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Social Impact Assessment of the Natural Forest Protection Program on the forest-dependent communities and households in Western China

- Case studies in Gansu Province and Chongqing Municipality

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LIST OF ACRONYMS

AAAS	American Association for the Advancement of Science
CAF	Chinese Academy of Forestry
CCG	Chinese Central Government
CEQ	Council on Environmental Quality (U.S.)
CIA	Cultural Impact Assessment
CNFEDRC	China National Forestry Economics and Development Research Centre
CPC	Communist Party of China
CPC	Communist Party Committee
CRS	Contract Responsibility System
EARP	Environmental Assessment and Review Process
EDRA	Environmental Design Research Associates
EEC	Europe Economic Community
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EU	European Union
FA	Farmer Association
FAO	Food and Agriculture Organization of the United Nations
FEMAT	Federal Ecosystem Management Assessment Team
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GIS	Geographical Information System
GTZ	German Technical Cooperation Company
Ha	Hectare
HH	Household
HRS	Household Responsibility System
IAIA	International Association for Impact Assessment
ICGP	Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment
IFC	International Finance Corporation
IIED	IIED's *Directory of Impact Assessment Guidelines*
KII	Key Informant Interview
NEPA	National Environmental Policy Act (U.S.)
NFPP	Natural Forest Protection Program

NGO	Non-Governmental Organization
NNFFR	North-Northwest Farm Forest Region
NSSFR	North-east Southwest State Forest Region
NTFPs	Non-Timber Forest Products
PCSLF/ SLP	Program of Conversion of Slope Land into Forest
POET Model	Population-Organization-Environment-Technology Model
SCFR	Southern Collective Forest Region
SEA	Strategic Environmental Assessment
SFA	State Forestry Administration
SIA	Social Impact Assessment
SSI	Semi-structured Interview
TVE	Township and Village Enterprise
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
VC	Village Committee
WCED	World Commission on Environment and Development

ABSTRACT

Social Impact Assessment (SIA) is the process of analyzing, monitoring and managing the social effects of planned or implemented development interventions. The primary purpose of SIA is to bring about a sustainable and equitable biophysical and social environment. SIA is a prerequisite in FAO and World Bank aided projects which cover sectors of mining, agriculture, fishery, dams and transportation. In forestry it has the great potential of enhancing sustainable forest management, taking into account rural development objectives and local needs. SIA can be applied before and after the implementation of projects and programs.

In the context of recent policy changes in China, the Natural Forest Protection Program (NFPP) has been implemented in a "top-down" process from 1998 to 2010. A large part of the forests on main river basins in Western regions are being conserved with severe restrictions for commercial use. The social effects of the NFPP are still debatable, indicating a need for conducting a SIA of the NFPP using a systematic conceptual approach.

Objectives of the research are: (1) To understand how and to what extent the NFPP affected the local forest-dependent communities and their households; (2) To identify the local strategies currently used to cope up with the impacts; and (3) To develop the optimal strategies likely supported for a better harmonization between livelihood and the NFPP implementation in different regional contexts.

The empirical research is approached through quantitative and qualitative social research methods for data collection and analysis. For the case studies, four villages with a total number of 175 respondents were selected for field surveys where questionnaires, interviews and group discussions were employed.

The research findings indicate that, the NFPP has significant impacts on the population characteristics, institutional arrangements and infrastructure and public services at the community level and at household level, the income derivation, expenditure, labour time distribution, perceptions on public health/safety and changing values of forests perceived by individuals.

The research reveals that, synthesizing *de facto* impacts of the NFPP makes potential negative social impacts predictable. The policy-makers and project teams implementing the NFPP should be aware that, the NFPP results in dynamic change processes which include the *de facto* and potential impacts as well as the influence factors; among these, contribution of strategies derived from local communities and households as the spontaneous reactions to cope with the NFPP impacts should be taken into consideration. Recommendations are given referring to a better implementation of the NFPP and the need for future researches concerning the SIA for sustainable forest management in different regional contexts.

ZUSAMMENFASSUNG

Social Impact Assessment (SIA) ist ein Prozess, der Analyse, Monitoring und Bewältigung der sozialen Effekte geplanter oder durchgeführter Entwicklungsinterventionen umfasst. Das Hauptanliegen von SIA ist, eine nachhaltige und gerechte biophysische und soziale Umwelt zu schaffen. SIA ist für Projekte der FAO und der Weltbank in den Sektoren Bergbau, Landwirtschaft, Fischerei, Talsperren und Transport eine Grundvoraussetzung. Für die Forstwirtschaft ergibt sich daraus das Potenzial, nachhaltige Waldbewirtschaftung zu stärken und dabei die Ziele ländlicher Entwicklung und lokale Erfordernisse zu berücksichtigen. SIA kann vor und nach der Durchführung von Projekten und Programmen angewendet werden.

Im Zusammenhang mit den aktuellen politischen Veränderungen in China wird das *Natural Forest Protection Program* (NFPP) im Zeitraum von 1998-2010 nach dem *top-down*-Verfahren durchgeführt. Die sozialen Auswirkungen des NFPP sind noch immer umstritten. Das unterstreicht die Notwendigkeit der SIA unter Anwendung einer systematischen konzeptionellen Herangehensweise. Ein besonders kritischer Faktor dabei ist, dass ein erheblicher Anteil der Wälder in den Wassereinzugsgebieten wichtiger Flussläufe in den westlichen Regionen durch strikte Einschränkungen der kommerziellen Nutzung geschützt wurden.

Die Ziele der Forschung sind: (1) Aufzeigen wie und in welchem Ausmaß das NFPP die örtlichen waldabhängigen Gemeinden und ihre Haushalte beeinflusst hat; (2) Identifizieren lokal entwickelter und angewandter Strategien, um die Auswirkungen des NFPP zu bewältigen; und (3) Entwickeln optimaler Strategien für eine bessere Harmonisierung der Lebensgrundlagen mit der Umsetzung des NFPP in unterschiedlichen regionalen Kontexten.

Die empirische soziale Forschung bedient sich quantitativer und qualitativer Methoden zur Datensammlung und Datenanalyse. Für die Fallstudie wurden vier Dörfer mit insgesamt 175 Befragten ausgewählt. Bei der Primärdatenerhebung kamen Fragebögen, Interviews und Gruppendiskussionen zur Anwendung.

Die Forschungsergebnisse zeigen, dass das NFPP signifikanten Einfluss ausübt auf Größe und Anteil armer Bevölkerung, auf institutionelle Rahmenbedingungen, die Infrastruktur und den öffentlichen Dienstleistungssektor auf Gemeindeebene. Auf Haushaltsebene wurde signifikanter einfluss nachgewiesen für die Generierung von Einkommen, die Ausgaben, die Arbeitszeitverteilung, die Vorstellungen über Gesundheitswesen und Sicherheit als auch auf die Wahrnehmung der sich verändernden Werte des Waldes.

Es wird ersichtlich, dass durch Zusammenführen der *de facto*-Auswirkungen des NFPP potenzielle negative soziale Einflüsse vorhersagbar werden. Entscheidungsträger und Projektteams sollten sich darüber bewusst werden, dass das NFPP zu dynamischen Veränderungsprozessen führt, welche die *de facto*- und potentiellen Auswirkungen sowie die Einflussfaktoren betreffen. Dies schließt den Beitrag der lokal entwickelten Strategien ein. Empfehlungen betreffen die bessere Umsetzung des NFPP sowie die Notwendigkeit weiterer Forschung hinsichtlich der SIA im Zusammenhang nachhaltiger Waldbewirtschaftung in

verschiedenen regionalen Kontexten.

1 INTRODUCTION

1.1 Background

Unlike human ecosystems[1], natural ecosystems such as lakes, wetlands, and forests are the basic life-support system on earth. Since the end of the 20th century, natural resource utilization sectors - agriculture, mining, energy, forestry, fisheries and tourism - are under increased global pressure due to diminishing available natural resources (Becker 2003).

Consequently, international and national policies have been instituted to guide and regulate utilization of the resources in order to facilitate resource development and regeneration. However, over the last several decades there are concerns that some of these policies may have negative social as well as environmental implications. For instance, most resource development efforts and policy interventions are geared to regulate the utilization of limited resources. This neglects the environmental and social consequences such policies as well as resource intervention programs and projects may bring with them. Although the effects of the pressure on natural resources are similar, the intervention strategies in the developed world differ from those of developing countries.

The developed world such as North America, Western Europe and Australia spend enormous amounts to restore and protect the environment in order to safeguard natural resources for future generations, but developing countries such as China and India are challenged with combining social and economic development with protection of the environment and preservation of their natural resources. When economic and social development integrates environmental protection and natural resource conservation concerns, the development is regarded as meeting some of the necessities for a "sustainable development" (Becker *et al*. 2003) for natural resource management, especially in the developing countries. To achieve this desired result, the impact assessment process should be a prerequisite for the following: resource development projects, technological changes, resource utilization conflicts and resource policy initiatives (Burningham 1995, IAIA 2003).

The past decade has seen a tremendously increased consciousness concerning cultural survival, indigenous rights and the anti-poverty mandate of development banks (Barrow 2000). This new awareness raises new challenges to projects development and intervention. At the same time, the expansion of democracy and global communications provide isolated and formerly politically powerless communities and people a voice to express their views and opinions when their rights are trampled (Burdge 1998).

The publication of the Brundtland Report (WCED 1987) and the United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit in Rio de Janeiro in 1992, led to the wide acceptance of the concept of sustainable development which advocates that Environmental Impact Assessment (EIA) should be a legal instrument conducted before any development project. Hence, it has been adopted and backed as a legal

[1] The definition of the human ecosystem is discussed in detail in Chapter 3.5.

framework in many countries. Since then the EIA has also been increasingly used to assess the social and economic impacts of most intervention strategies such as development policies and projects. The relationship among the EIA, Social Impact Assessment (SIA) and economic Cost-Benefit Analysis (CBA) is presented in Figure 1-1. The world of EIA, SIA and CBA has operated in their separate realms but with certain connections (Figure 1-1).

SIA emerged in the early 1970s as an applied social science field in response to the need for establishing the impacts of implementation of natural resource development and environmental policy on human populations (Burdge 1994; Joyce 2001). SIA was a significant component within EIA before the 1990s. Nowadays it is used equally and in parallel with the EIA in the decision-making process (Barrow 2000). It has been increasingly conducted as an independent activity and process. The change how the SIA is applied coincides with changes in how development is perceived and valued, taking into account society's concerns and the potential effects projects could have on individuals, family and communities. In natural resource sectors, the SIA focuses on the impacts on people who live and work at the interface between societies and their natural resource base (Burdge 1998).

When applied in the earliest stages of the decision-making process, EIA and SIA became important project planning instruments (Barrow 2000). These processes provide information on potential consequences of specific development activities. Thus, the potential consequences can be taken into account in a timely manner and incorporated in the processes that lead to a final decision and design mitigation measures. Therefore, a proper application of EIA and SIA can significantly improve the quality of project proposals and eventually lead to efficient and effective project implementation, because potential negative impacts are reduced and chances of acceptance of the project are considerably increased (Vanclay 1999).

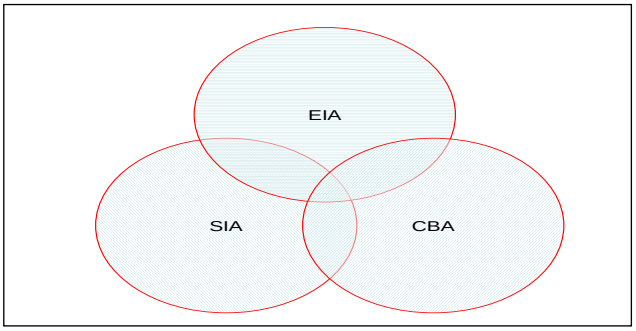

Figure 1-1: Relationship among the EIA, SIA and CBA in impact assessment processes

As a research field, SIA has been developed primarily within the discipline of sociology and related sub-fields such as rural sociology, environmental sociology and human geography (Little *et al*. 1988, Burdge *et al*. 1994, Machlis *et al*. 1997, Vanclay 1999, Barrow 2000, Becker 2003). In practice, practitioners from many sectors have conducted SIA in the areas of mining, fisheries, transportation, and dams. These SIA empirical application cases helped the decision-makers to visualise social implication of their management plans or projects before or after the (initial) decision-making.

Often the measurement unit for SIA focuses on the small community[2] because it is where the costs and benefits of change are felt strongly (Barrow 2000). Social benefits and consequences of project development, which always occur, are usually borne at the community and local level, while the rationale for projects and the decisions are justified and sold based on regional and national economic goals (Burdge 1999). Large-scale projects, which characterize natural resources development, are often conducted in areas previously less exposed to commercial activity (Barrow 2000). They can affect the local community in terms of community beliefs, values, attitudes, norms and practices (Burdge 1998). Consequently, these small communities are often of interest to SIA because their social dynamics make them vulnerable to impacts brought by change, and because some communities are isolated and may depend on one or a few natural resources for their livelihood (Bowles 1983).

The initial applications of SIA in forestry projects were advocated by some forestry scholars, economists and sociologists as far back as the 1960s when large scale forest development schemes occurred (Freeman *et al*. 1986). In the 1970s the initial applications were adopted as a prerequisite to the FAO and World Bank aided forestry development projects. After the 1980s SIA has been adopted in forestry projects, and later was formally recognized as a component of the forestry policy-making process in many developed countries and several developing countries (Vanclay 1999; Finsterbusch *et al*. 1990). It has been more widely used to establish how and why people use nature and resources (Rickson *et al*. 1995) such as forests. Meanwhile, the development schemes of large natural resources, especially forests, have been one of the driving forces behind the continued development of SIA (Barrow 2000).

Nevertheless, SIA as a research field has some limitations. For instance, there have been relatively few evaluations or ex-post audits of SIA, i.e. studies that look back to check whether the SIA was accurate, whether the procedures were cost-effective, and recommendations were acted upon and so on. Compared with EIA, the research results of SIA are not as precise and the units of measurement are less standardized. This makes it more difficult to review the performance of a given assessment through time, and also to compare one SIA with another (Barrow 2000).

The past and current problems in the contemporary application of SIA in natural resource management differ widely between its potential (currently realized in a small percentage of projects) and its general current use. On the one hand, the SIA is a dynamic and an ongoing process of integrating information on potential and real social impacts on decision-making and management practices. On the other hand, it is a static and a one-shot technocratic assessment undertaken to gain project approval or financing with little or no follow through. Such problems are often due to the poor conceptualization of the changes in resource

[2] A community can be defined in part by behavior patterns which individuals or groups of individuals hold in common. These behavior patters are expressed through daily social interactions, the use of local facilities, participation in local organizations, and involvement in activities that satisfy the population's economic and social needs. A community is also defined by shared perceptions or attitudes, typically expressed through individuals' identification with, commitment to, and attitude towards a particular identifiable area. In addition, there are other concepts of community, which are not based on spatial relationships. Communities may be based on a common characteristic or interest, such as religion, ethnicity, income strata, or concern for the economic viability of a region, which provides a psychological unity among members (Buchan and River 1990). Small communities may take a form of a village, townships or groups sharing culture or traditions (Bowles 1983; Barrow 2000).

communities for the purpose of SIA (Freudenburg 1986).

The ambiguity associated with impacts, the attribution gap[3] between the actual impacts of the project and social change process in the local community, the lack of operational definitions for many constructs, as well as an societal mentality (Burdge and Vanclay 1996) lead investigators to focus on common measurable variables (e.g., economic and demographic) and politically convenient indicators such as population changes, job creation or use of services (Gramling and Freudenburg 1992). "*Too many SIA studies have been inadequate, often presenting little more than demographic or economic predictions*" (Burdge and Vanclay 1996:66). In most of the contemporary applications of SIA the selection of the variables and indicators seems too random and too pragmatic because of the lack of a strong theoretical background and a systematic conceptual framework to support those indicators.

Leistritz and Murdock (1981) reviewing the available literature recognize a number of conceptual approaches to SIA including the "Function evaluation" and "Human ecology" approaches. The "human ecology" approach supports the opinion that humans adapt to an ever-changing environment which leads to constantly altering social institutions (Marten 2001). The view is that SIA should be used to analyse social institutions in an environmental framework (Barrow 2000). Those supporting a "Functionalist" approach see humans as coming together to form social groups in order to more effectively perform "essential" functions, such as survival, religion and community cohesion-building. Consequently, they feel that SIA should seek to analyse how these functions vary (de Groots 1992).

These mentioned conceptual approaches offer a theoretical basis and reference for a conceptualization of the "social impacts". However, there are very few empirical studies of SIA to test these conceptual approaches and to formulate a systematic conceptual framework that guides the indicator selection and clearly explains the quarry of the selected indicators.

Experience shows that the success and effectiveness of SIA in supporting the management planning and policy making process depends largely on the quality of its assessment methods *vis* the systematic conceptual framework of social impact indicators and clear application procedures (Barrow 2000; Vanclay 1999). These factors are relatively weakly recognised in the contemporary empirical research of SIA.

China is one of the countries with the most dramatic forest policy changes in the world (William *et al*. 2003). The frequent changes in forestry policy are attributed to the recognition of the different roles forestry has played in Chinese society from ancient to modern times. Forests are more important today than in ancient times, not just for their commercial value, but for the income and livelihood they provide to the millions of poor households in rural China. The environmental degradation associated with the population explosion and the income growth in the past several decades threatens the role of environmental values of forests such as habitats for biodiversity, the store of carbon to mitigate global climate change, catchment areas for reliable source of clean water, and soil protection against erosion and consequent loss of agricultural productivity downstream.

[3] A methodogocial discussion on the attribution gap is presented in Chapter 4.6, Methodology.

In view of this background, the following issues are of interest: the social impacts of the forestry policy changes in China, especially the social impacts of the current stringent utilization-prohibitive policies on the local forest-dependent communities and households (Li *et al*. 2000, Xu *et al*. 2003); the information on social and cultural factors that need to be considered in the implementation of the current forest policy strategies (Zhang 2000); and the mechanisms for incorporating local knowledge and values into the forestry policy decision-making process and thereby identifying the most socially beneficial course of the forestry development action for local, regional, and national interests (Hou 2004), and so on. These issues offer a great opportunity for SIA as a developmental tool applied to the forestry sector for sustainable forest management in China.

1.2 Problem statement and justification

China is a large country in terms of both its population of 1.4 billion and its land area of 9.6 million square kilometres (Anon. 2006). Seventeen percent of the area which counts for about 167 million ha (equally to 1.67 million square kilometres)[4], is forestland with a total growing stock of about 12.5 billion cubic meters (SFA 2005a). The forest area per capita is only 0.11 ha, which is approximately one-sixth of the worldwide average level (World Bank 2003).

Forestland is divided into two categories according to ownership structure: (1) collective forest area occupies 58% of the total, which include 38% (64.8 million ha) collectively owned and managed, and 20% (35.1 million ha) collectively owned but individually managed; and (2) the remaining 42% (about 72.9 million ha) is state-owned and managed (SFA 2005b).

Forestland is also categorized in terms of forest type *vis* natural forests[5] and plantation forests. Natural forests cover of about 113 million ha, which are located in isolated areas in the North-east, Northwest and Southwest of China. They account for between 68% of the total forest area and 82% of stocking volume. Plantation forests cover about 54 million ha, which account for only 18% of stocking volume, and most of them are newly established (SFA 2005a).

The forestry sector in China has played a critical role not only in protecting biodiversity and watersheds but also in the national economy, providing 40% of rural household energy. It supplies almost all of the lumber and panel products for the construction sector and raw material for the large domestic pulp and paper industries (World Bank 2003). Rural people depend on forest resources. Living in close relationship with the forests, they commonly utilized state-owned and collective forest areas for generations (Anon. 2002; Xu 2003) (Chapter 2 provides details).

The implementation of economic reforms and open market policy starting in 1978 accelerated economic growth and improved people's living conditions. The acceleration of

[4] Ha = Hectares, 1 ha is equal to 0.01 square kilometers (km^2).

[5] The accepted Chinese definition of "Natural forests" refers to forests established by nature without human interventions, which are either virgin forests without any human disturbance or secondary forests with natural regeneration. Most of natural forests in China now are secondary (Lu 1998).

economic growth has also pushed China into a "natural resource crisis", seriously depleting the natural forest resources during the past two decades due to the rapid population growth and socio-economic as well as infrastructure development (Hou 2004). Large-scale deforestation and over-harvesting of forest products greatly impacted the environment. Frequent floods, droughts and sandstorms became significant constraints for the further growth of the national economy and social development of China (Xu 2002). In recent years, the Chinese Central Government (CCG) has put huge monetary investments in certain ecologically-oriented forestry projects (programs) in order to improve the environmental condition of the country (Anon. 2002; David *et al*. 2002). This type of interventions characterizes the current forest development scheme in China.

Within the context of recent forest policy change in China, the Natural Forest Protection Program (NFPP) has been implemented under a top-down process by the Central Government since 1998. The current phase of the NFPP implementation will end in 2010. Under the NFPP, large parts of Chinese forests, both state- and collective-owned, have been put under conservation with severe restrictions for their commercial use. This counts for about 94 million ha of natural forests and plantations in main river basins. In total, the NFPP covers 18 provinces, contains 734 counties (districts) and 167 forestry enterprises in the North-east, North-west and South-west mountainous regions in China. However, the available research articles are unclear and without quantifiable measurements in regards to the social consequences of the NFPP and how it affects the local forest-dependent communities and households. Thus a systematic conceptual approach for the SIA component of the NFPP is required.

In China the research on SIA is in the early stages. It is not common to assess the social impacts of projects, including the forestry projects. There are few empirical cases of assessing the social consequences of the NFPP in certain specific areas (Chapter 2 has more details). These studies lacked a systematic conceptual framework and a clear definition of the indicator system (Li 2000). Thus, the results of the assessment seem to be too static and pragmatic. Such studies only describing the story of present impact are unable to predict what will happen in the future. They are too descriptive and qualitative, not precise enough to provide a concrete picture of the expected impacts (Xu 2003).

The need for the development of conceptual framework that fits to the specific local settings challenges the effective application of SIA in assessing the social impacts of the NFPP on the local forest-dependent communities and households. That presents a necessity for conducting an empirical study in this field.

1.3 Research objectives

1.3.1 General research objectives

The starting points of the research are that SIA as a research field has several limitations; there are few available research articles concerning the social impacts of the NFPP on local communities and households; and there is an ambiguity associated with social dimension of

the impacts resulting from the NFPP implementation.[6] Therefore, this empirical research has an exploratory character[7].

In an exploratory research, "*researcher explores a new topic or issue in order to learn about it; the issue is new or pervious researchers have written little on it and the researcher begin at the beginning* (Neuman 1994:19). The goals of an exploratory research are "*to become familiar with the basic facts, people, and concerns involved; to develop a well-grounded mental picture of what is occurring; to generate ideas and develop tentative theories and conjectures; to determine the feasibility of doing additional research; to formulate questions and refine issues for more systematic inquiry; and to develop techniques and a sense of direction for future research*" (Neuman 1994:19). An exploratory research needs to be conducted in order to know enough to design and execute a second, more systematic and extensive study (Neuman 1994). These statements provide a scientific background for formulating the following research objectives.

The general objectives of the empirical research are three-fold: (1) To understand how and to what extent the NFPP implementation affects the local forest-dependent communities and households; (2) To identify the strategies developed by local communities and households to cope with the negative impacts of the NFPP implementation; and (3) To suggest and develop the optimal strategies for a better harmonization between local livelihood and the NFPP implementation in a broader regional context. In addition, as an explorative study, this empirical research intends to formulate questions and refine issues for a more systematic and extensive SIA practice applied in forest management plans in China in the future. (Research questions are formulated based on the conceptual perspectives and are presented in detail in Chapter 3.)

1.3.2 Specific research objectives

- To identify the *de facto* impacts[8] of the NFPP implementation on local forest-dependent communities and households by measuring and analyzing selected research indicators;
- To recognize the contribution of local strategies initiated and developed by local communities and households to cope with negative social impacts of the NFPP implementation when *de facto* impacts are evaluated;
- To identify internal and external factors influencing the extent of social impacts of the NFPP implementation on local communities and households; and thereby,
- To predict the potential (*anti*)[9] social impacts of the NFPP implementation on local communities and households in the future;

[6] There are all presented in previous sections.

[7] According to Neuman (1994), there are three purposes (types) of research: exploratory, descriptive and explanatory. Each different type of research has different research objectives.

[8] *De facto* impacts mean the actual impacts which are already happened to the local people, Becker *et al*., 2003.

[9] Potential (*anti*., *anticipated*) impacts mean the impacts which can be predicted in the future based on the current information observed in the field. Ibid.

- To suggest and develop the optimal strategies for the harmonization between the NFPP implementation, local community development and livelihood improvement in a broader regional context;

- To apply and develop a conceptual framework that captures a right scale of social impacts based on the local settings; this framework should illustrate a systematic interaction among the social impacts, strategies and external-internal factors, so that the framework can guide future SIA practices applied in forestry field in a broader regional context.

1.4 Structure of the dissertation

The thesis has eight chapters, and the interrelation of each chapter is displayed in Figure 1-2. Chapter 1 introduces the research background and context, formulates research problems and outlines research objectives.

Chapter 2 provides detailed information on the NFPP and its various impacts known from the previous research. It reviews the Chinese forestry sector reforms undertaken since 1978, providing an understanding of the policy paradigms and the context of the NFPP initiation. It gives an overview of the SIA as a management tool and its contemporary application in previous case studies, serving as an empirical reference for the social indicator selection.

Chapter 3 presents a theoretical support for the conceptualization of social impacts in a local forest-dependent community assumed to be a small scale "human ecosystem". The chapter offers a theoretical background for the social indicator selection. Considering the unique local context, a conceptual framework is elaborated at the end of this chapter that integrates the research indicators and the pathways of yielding social impacts in a unit of a local forest-dependent community.

Chapter 4 details the methodology applied in the research as it defines and operationalizes the research indicators selected for measurements. It introduces quantitative and qualitative approaches for data collection and analysis, emphasizing the process of data collection during the field research where questionnaire surveys, interviews and group discussions were employed. It also introduces the strategies for facilitating the researcher's socialization in study areas.

Chapters 5 describes two selected case study areas where the NFPP is implemented. It compares and contrasts the scopes and profiles of the two local communities being investigated. The chapter explores the characteristics of the surveyed households, emphasizing differences in forest ownership structure, existing socio-economic settings and historical conditions as applied to the forest. The chapter specially addresses the household features, including size, the educational level of the head of household, and distance to the forests.

Chapter 6 assesses the four categories of social impacts of the NFPP implementation in two case study areas at both the community and the household level, based on the measurement

of the twelve selected indicators. The chapter delineates local strategies developed by local communities and households to offset negative impacts of the NFPP implementation and for their better survival. Causal relations between the NFPP implementation and the impact consequences are presented after the measurement of each indicator.

Chapter 7 features a discussion of the *de facto* and potential impacts of the NFPP on the local communities and households through a comparative analysis based on the two case study experiences. Each sub-chapter reflects corresponding research questions. External/internal factors that may influence the extent of social impacts of the NFPP are discussed. Dynamics of *de facto* and potential impacts, local strategies and influencing factors are illustrated in a refined conceptual framework which should be tested in the future.

Chapter 8 sums up the highlights of the main research findings and conclusions. Scope and limitations of the empirical research are pointed out; optimal mitigation strategies for a better implementation of the NFPP are recommended; relationships between theory and findings are discussed; the current methodology employed for SIA practice is critically reviewed; and implications for future SIA application in forest field for sustainable forest management in broader regional contexts are obtained and discussed.

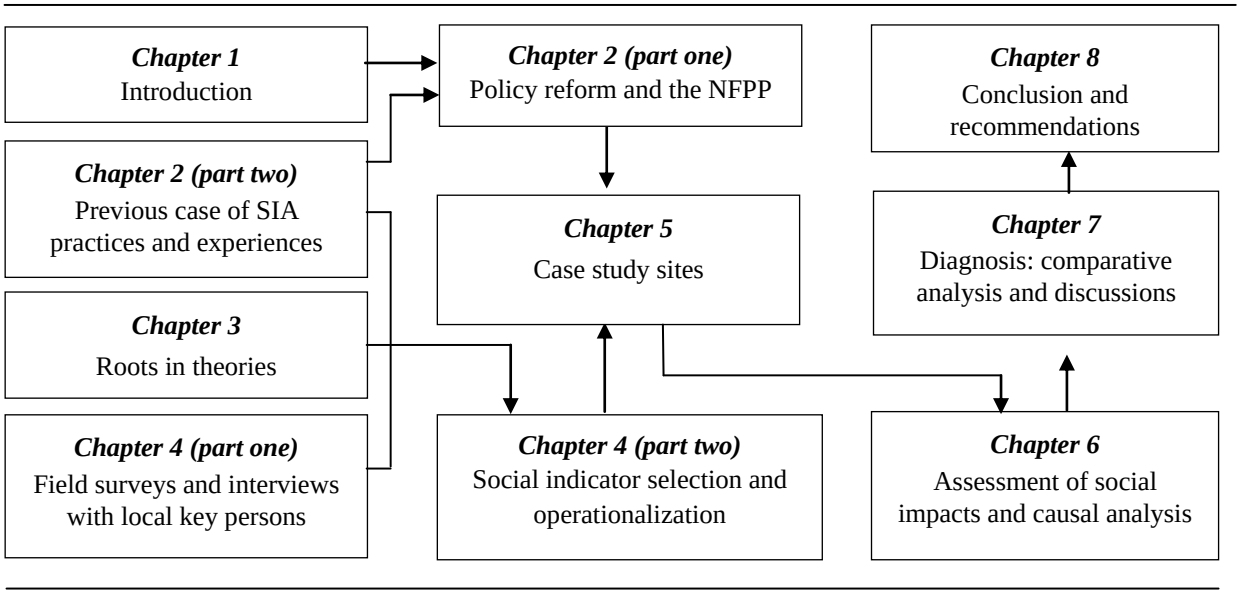

Figure 1-2: Structure of dissertation and interrelation of each chapter

2 CURRENT STATE OF KNOWLEDGE AND INFORMATION

2.1 General remark

Summarizing changes in the forestry sector in China since 1978, the first section of this chapter provides a synopsis of China's forest administration system and its geographic organization and a chronology of China's general reforms and their respective consequences. This summery provides the background to policy changes in China prior to the implementation of the NFPP. It is very relevant for the understanding of the socio-economic context and the forest development of the selected case study areas which are presented in Chapter 5. This section closes with a review of the specific forest-sector reforms and an introduction to the NFPP.

The last section of this chapter reviews the SIA to provide a greater understanding of the SIA in terms of its methodological attributes. It includes: The concepts that generally explain the aims of the SIA; a short history that illustrates the developmental process of the SIA; fundamental principles and guidelines which should be considered when a SIA is conducted; a basic model that depicts the comparative approach of SIA and guides the comparative case studies (presented in Chapter 5 and 6); a basic process that offers a useful base for empirical research procedures; and it integrates the example of three previous case studies that serve as a reference for the research indicator selection. Altogether, this section provides an insight to the further elaboration of the conceptual framework (which is presented in Chapter 3).

2.2 Forestry reforms in China

2.2.1 China's forestry sector since the economic reform in 1978[10]

Although China's forest management history extends over centuries, the major management changes occurred in the past 30 years. Beginning with the 1930s the forests have been heavily damaged and destroyed by the repetitive wars and continuous exploitation. The central government recognized the problem in the early 1950s and tried to address it with land rehabilitation projects. Later the economic adjustments promoted multi-purpose afforestation activities such as inter-cropping and shelter belts aimed at protecting the environment (controlling wind and water erosion and the salinity of soils) while improving agricultural productivity (Hyde *et al*. 2003). However, the limited forest resources were rapidly depleted during the period of collectivization and industrialization that began in 1958. Collectivization raised doubts about the ownership of forest resources, and thousands of backyard furnaces constructed for steel production consumed most of the small stock of farm trees that remained. During the Cultural Revolution (1966-1976), large areas of the remaining natural forest were cleared as part of the campaign to expand crop land. The state-owned

[10] Many have reviewed and assessed this experience. The author cross-checked the material in this section with reviews in Ho 1994, Chai 1997, Linge 1997, Chen 1999, Du 1999, Qian 2000, Zhang 2001, Zhang and Chen 2001, Wang and van Kooten 2001, and Hyde *et al*. 2003.

forests were depleted to support production and provide employment in state-owned sawmills. Many existing plantations were in their second or third rotations from the same basic stock. Forests covered 82.6 million ha in 1978, but this was only 8.6% of China's total land area or 0.10 ha per capita, among the lowest per capita shares in the world (*China Forestry Yearbook 1986*). The Cultural Revolution and the political struggles that dominated Chinese society for the decade that followed restricted any real opportunity for economic growth or environmental conservation in the broader economy. Agricultural and forest production stagnated. Per capita annual income in the communes was only 62.8 Yuan[11] (about 25 USD) in 1976; more than one-third of rural households were in debt; and most households had insufficient fuel, clothing, and housing; about 100 million people suffered from food shortages (Lu 1986).

Table 2-1 summarizes China's rapid growth and the more variable experience of its forestry sector since the introduction of economic reforms from 1978 to 1998[12]. Nevertheless, the 1978-1998 snapshots are imperfect for the purposes of this research because they do not reflect the more recent expansion in log imports that accompanied the NFPP and a logging ban on the upper watersheds of the Yangtze[13] and the Yellow Rivers[14]. The economic reforms increased China's real GDP fivefold and its per capita GDP almost fourfold; rural per capita GDP has increased a phenomenal six fold (Anon. 2000). The rural economy, including forest-based communities and many other households dependent on the forest for some or all of their livelihood, has shown the greatest increase (Hyde *et al*. 2003).

Growth in the forestry sector has been more variable. Log production has increased slightly (7%), whereas lumber production has increased by a moderate 60%. The paper industry has expanded to almost five times its former level. However, the expansion in paper production has brought serious environmental concerns. The pulp and paper industries have become the largest sources of rural environmental pollution (Xu 2003). As a result, the central government became so concerned about environmental protection that it announced in 1999 that any enterprise not in compliance with environmental regulations would be closed[15]. By 2000 more than 2,000 small papermaking enterprises had been shut down.

[11] Yuan is the Chinese currency. The current exchange rate to US dollar (USD): 1 USD is equivalent to 8.2 Yuan, 1 Euro to 10 Yuan, noted by the author, 2008.

[12] 1978 is also a year for which China has a complete inventory of forestland and standing forest volume; 1998 marks China's most recent complete forest survey (Hyde *et al*. 2003).

[13] The Yangtze River as the biggest river in the country arises in Tanggula, the main peak of the Mountain Range in Western China, traverses eastward 10 provinces, autonomous regions and municipalities before emptying into the East China Sea. It's 6,300 km long with a basin covering 1.8 million square kilometers, 19% of China's total area, and holding nearly half the country's population and similar shares of the GDP and fixed assets. The annual average runoff stands at about 951.3 billion cubic meters (Anon 2002).

[14] Yellow River as the second largest river in the country originates from the foot of Bayan Har Mountain in Qinghai Province in Western China, and flows 5,464 km easterly across 9 provinces and autonomous regions, has more than 40 tributaries, make up a total drainage area of 750,000 square kilometers. The annual average runoff is 66.1 billion cubic meters. The middle section of the river traverses the Loess Plateau with loose soils, making it the river with the highest silt content in the world (Anon 2002).

[15] President Jiang Zemin's address to the annual workshop on Population, Resource, and Environment on March 13.

Table 2-1: China's economic growth (1978-1998) and variable experiences in forestry sector

Growth	*1978**	*1998*	*Change (%)*
GDP (1978 monetary value)	-	-	-
Aggregate	362	2,312	538
GDP per capita	379	1,869	390
Rural GDP per capita	133	945	610
Forest products ($\times 1,000$ m^3)	-	-	-
Production	-	-	-
Logs	51,673	55,557	7
Lumber	11,055	17,876	62
Wood-based panels	1,017	10,563	939
Paper and paperboard	4,390	21,256	385
Imports	-	-	-
Logs	1,870	4,820	158
Lumber	75	1,679	2,139
Wood-based panels	258	1,977**	666
Paper and paperboard	767	5,760	651
Exports	-	-	-
Logs	28	63**	125
Lumber	13	255	1,862
Wood-based panels	10	598	5,980
Paper and paperboard	229	250	9
Forest cover	-	-	-
Area (million ha)	115	154	35
Standing volume (million m^3)	8,801	10,086	15

* Data for imports are from 1981 and data for exports are from 1983.
** Data from 1997.

Source: China Statistic Yearbook 2000; China Forestry Development Report 2005

It is estimated that demands decrease on the consumption of forest products as China continues to implement the protective forest polices, while increase on the ecological services related to forests as household incomes increase and overall human welfare improves[16] (Hyde *et al*. 2003). Observations of China's mountain or lake resorts reveal a rapid increase in outdoor recreation over the past few years. The central government's decisions to enforce environmental compliance and establish sustainable development demonstrate the raising of importance of environmental values among the government development policies and strategies[17].

The economic reforms have been experimental, pragmatic and gradual (Xu 2003). As a result, China has experienced at least three economic cycles, reforms in various sectors and significant regional variation in the applications of the reforms, and also differing results between broad institutional categories of management. The regional differences in forest organization and the chronology of the sectional reforms are summarized in the next sections.

[16] The information on non-market forest products and services during the time cannot be summarized as easily. Aggregate data on products such as fuel wood, bamboo products, mushrooms and the many herbs collected from natural forests, forest-based environmental services such as erosion control, protection of biodiversity and forest recreation are not completely available. Nevertheless, the available evidence is instructive.

[17] Primary Zhu Rongji, in the Government Report to the National People's Congress on March 5, 1999.

2.2.2 Forest tenure and administration

In China, official forest statistics is organized according to six administrative regions[18]. The forest land area and its classification (as either state-owned or collective) were defined during the national forest surveys which are provided in details in following Table 2-2.

Table 2-2: Forestland area in China

Region and administration	*Forest stands (million ha)*			*Change (%)*
	1977-1981	*1984-1988*	*1994-1998*	
North-east				
State-owned	21.37	20.55	23.50	9.97
Collective	2.33	3.96	4.20	80.26
Total	23.70	24.51	27.70	16.88
Northwest				
State-owned	2.48	5.30	5.78	133.06
Collective	1.96	2.80	3.19	62.76
Total	4.44	8.10	8.97	102.03
Southwest				
State-owned	NA	8.15	9.42	
Collective	NA	12.24	17.39	
Total	23.53	20.39	26.81	13.94
South-east				
State-owned	1.32	1.73	2.49	88.64
Collective	10.84	12.01	16.55	52.68
Total	12.16	13.47	91.04	56.58
South Central				
State-owned	1.78	2.18	2.55	43.26
Collective	10.32	14.92	22.44	117.44
Total	12.10	17.10	24.99	106.53
North China Plains				
State-owned	13.26	13.11	14.18	6.94
Collective	1.55	2.13	3.43	121.29
Total	14.81	15.23	17.61	18.91
All China				
State-owned	NA	51.01	57.93	
Collective	NA	48.06	67.19	
Total	98.81	99.07	125.12	26.63

Note: NA, data not available.

Source: China Forestry Yearbook 2005

The state-owned forests are managed by approximately 3,000 independent forest farms (enterprises) and about 135 state forest bureaus. Many of these forest farms were originally established to manage plantations. The bureaus have their own forest farms, and most of the forest farms have own wood processing facilities. The bureaus were originally established for logging operations in natural forests. The reporting hierarchy for both forest farms and wood processing facilities has changed several times. They currently report to local or provincial governments for personnel and planning but both are subject to the forest management guidelines set by the State Forest Administration (SFA).

[18] The six forest regions and the provinces and autonomous regions within each are: the North region, the North-east region, the North-west region, the South Central region, the South-east region and the South-west region. Hyde, 2003.

Collective forests were managed by local forest and agricultural collectives before 1978. Since 1978, individual households have gradually assumed long-term contractual responsibility for increased collective lands. Nowadays about 60% of the total forest land belongs to the collectives, and individual households manage about 80% of it.

Both the state-owned and collective forest areas have expanded gradually. There have been several changes in the regional organization of forest management and responsibilities. The North-east and Southwest are sometimes combined and managed as North-east Southwest State Forest Region. They are regions with predominantly state-owned forest and are China's major sources of industrial wood (*China Forestry Yearbook* 1986). The state forests provide employment, especially in the local mills. But the standing inventory of the forests has been declining because the saw mills procure the logs at prices too low to support reforestation. The Southern Collective Forest Region, which includes the South-east, South Central, and some of the Southwest, is the most productive region. It has also been affected by the procurement prices that are too low to encourage reforestation without external financial assistance. The North-Northwest Farm Forest Region covers the remainder of the country, and it is dominated by the government-supported shelter belts (Hyde *et al*. 2003).

2.2.3 Chronology of sectional reforms in China and their consequences

The reforms began in 1978 within the agricultural sector and eventually spread to other sectors of the rural and then urban economic development. The impacts of the reforms on the forestry sector occurred largely in response to reforms in other sectors. The reasons were two-folds: incentives pressured people in the forestry sector to change their behavior as incentives did for people in other sectors; rapid growth in other sectors increased the pressure of demands on forest products thereby had a negative affect on the forest. The following presents the chronology of reforms in all sectors in general, and in the forestry sector in particular. The sectional reforms occurred in three cycles between 1978 and 1998[19]. Table 2-3 provides an overview of the chronology of sectional reforms and their consequences in China before the initiation of the NFPP in 1998.

Period 1978-1984

During this period, agricultural reforms had two fundamental elements: the decentralization of property rights from the prior system of centrally administered to collectives and production teams; and upward adjustments in the prices for agricultural outputs. The two elements provided the incentives for households to agriculture farming. The original sanction approved in 1980 targeted only the poor and those in remote and hilly regions. Nevertheless, the reforms spread rapidly as they appealed to farmers and local government officials. The advantages were the diminished transaction costs and risks of government organizations that accompanied reforms, as well as in the increased agricultural production that rapidly followed.

[19] Reforms were followed initially by visible economic growth before recessing into inflation and budgetary deficits in the central government. This led to retrenchments before another round of reforms that led again to growths (Xu 2003).

Table 2-3: Historical development and sectional reforms in China

Period	Sectional reforms in China and impacts/consequences
1930s	• Repetitive wars and continuous resource depletion.
1949	• Foundation of the P.R.China.
Early 1950	• Land rehabilitation and multi-purpose afforestation/land reform and economic recovery; primary collectivization.
1958	• Advanced collectivization & industrialization; forest seriously depleted.
1966-1976	• Cultural Revolution; large areas of remaining forests were cleared to expand cropland.
1978-1984	• Introduction of economic reform; • Began within agricultural sector, and gradually spread to forestry sector after 1981; • Institutional change in property right – Household Responsible System (HRS), as a result: - Both land and agricultural productivity increased. • 1981-1985 the HRS in forestry sector.
1985-1990	• Reforms in non-agricultural enterprises – Contract Responsibility System (CRS); • Establishment of Market Economy; • Increased household income and saving stimulated local investment in local enterprises, especially the township and village enterprises (TVEs), and as a result: - Forest based TVEs such as wood products/pulp/paper benefited, wood/paper production increased, but also environmental problems were brought; - Growth in TVEs created income disparity in regions. • Government decreased its budgetary role in state-owned enterprises (SOEs).
1991-1998	• Reforms on SOEs: - 70% of SOEs privatised by 1997; 7 million employees relieved duties by 1998; • Advanced liberalized trade market, as a result: - Household income/saving continuously increased; environmental problems became worse. • Government began to take a strong view towards environmental protection.
1998- 2010	**The initiative of the NFPP (the focus of the empirical study)**

Source: Adopted from Zhang et al. 1999, Xu 2000, Hyde et al. 2003

The institutional change in property rights began in Fengyang County, Anhui Province in 1978. There were different forms in different counties. The most popular system was known as the "Household Responsibility System", where the community contracted the responsibilities (i.e., land, animals, implementation procedures, output quotas, and taxes) to its member households. The distribution of land and animals occurred on a largely egalitarian (per capita) basis. The contracts required the households to sell their production quotas at centrally determined procurement prices but permitted them to sell production in excess of these quotas at market prices. This contract system developed slowly until 1981, and then expanded rapidly to 70% of all rural communities by the end of 1982.

The market opportunity stimulated production. Farmers met their quotas with low quality products but sold their high quality products in excess of quotas at market prices. Government surpluses accumulated, even as the government raised its procurement prices to levels that were closer to market prices.

Sharp increases in procurement prices continued, and at the same time, the central government suffered budget and trade deficits in 1979 and 1984. Inflation reached a record of 6% in 1980. The aggregate economic conditions caused some rethinking, and the authorities withdrew "Household Responsibility System" rights from some households. Nevertheless, these rights extended to almost all agricultural production units by the end of 1984. Compulsory production quotas and the two-price system for outputs were finally abandoned in 1985. Households saved and invested in durable consumer goods, but agricultural investment lagged particularly in irrigation. The general suspicion is that this lag was due to the uncertainty regarding policy and administration in general and the uncertainty with respect to the durability of the "Household Responsibility System" contracts for land in particular. These uncertainties became the critical issue for forestry as well. Nevertheless, the overall effect of the initial agricultural reforms was positive and impressive. Land productivity increased 225% between 1978 and 1984, and the productivity of agricultural labour increased by 172% (Chai 1997).

Period 1985-1990

A second round of reforms began in 1985. This round of reforms supporting the development of non-agricultural enterprises in rural areas was known as the "Contract Responsibility System". This system targeted the industrial and financial sectors in urban areas. China experienced another cycle of inflation and tighter central controls on expenditures in 1986 before a period of easier credit and expansion in 1987. Establishment of a market economy was in discussion during this period. Meanwhile, improvements in agricultural wealth led to an increase in household savings – which were already among the highest in the world. The high level of accumulated household savings stimulated local investment. It financed the new opportunities for local enterprises, known as Township and Village Enterprises (TVEs), which emerged under contract with the local administrative authorities.

The contracts that developed between TVE managers and local authorities were similar to those developed under the "Household Responsibility System" for agriculture. Individual enterprise managers were contracted for fixed responsibilities, and their remuneration was tied to performance. Profits from performance greater than contracted quotas were usually shared with the local government, giving local governments incentives to ensure continued growth of the enterprises. However, local governments insisted on tighter budget because they did not receive extra support from the central government. Within the administrative discretion of the local authorities, the Township and Village Enterprises (TVEs) became almost entirely market-oriented by the mid of 1980s.

Two forest-based industries that benefited from TVEs were wood products and pulp and paper, which are generally located in rural areas. By the late 1980s, TVEs accounted for 90% of the enterprises in the paper industry. Though the TVEs firms were small, production output grew more rapidly in the TVEs than in the large state-owned enterprises for both industries. Consequently, the production of wood and paper under TVEs initiative more than doubled between 1978 and 1989. Problems emerged in the TVEs because some enterprises expanded more rapidly than market demand. Further, some local governments became very protective of the revenue flows from the enterprises by introducing barriers to interregional trade. This

led to excess use of some production inputs, including the excess conversion of agricultural land and forestland to other land use forms. Moreover, like most other examples of early industrial growth, air and water quality suffered (Hyde *et al*. 2003).

The first signs of change in the previously egalitarian distribution of income appeared during this period. Generally, agricultural income is less variable than the income from some non-agricultural activities, including income from the wood products and paper industries. Growth in the TVEs increased the income disparity within the regions. Furthermore, the success of the TVEs was distributed unevenly across the regions, creating regional income disparities. For instance, regions with better infrastructure, more capital, better education, and better access to major urban areas and outlets for foreign trade grew faster. As a result, household incomes and local government revenues and budgets for social services became more uneven.

Finally, the reforms in industrial- and financial-sectors in this second period emphasized also the transfer of the successful Contract Responsibility System in agriculture to the larger scale of urban state-owned industrial and financial sectors. The central government allowed the managers of state-owned enterprises to have discretion on variable inputs and output levels as well as mixes. The government decreased its budgetary role in most state-owned enterprises but continued to control most capital investment decisions.

Period 1991-1998

A third period of reforms continued the focus on state-owned enterprises as the role of the central government continued to decline. Beginning in 1991, the government allowed some state-owned enterprises but forced others to go out of business. About 70% of small state-owned enterprises were privatized by 1997. Between 1995 and 1998 one-fifth of all state-owned enterprise employees, about seven million, relieved their duties as redundant labour. Some found employment in TVEs while other lived on their severance allowance. Meanwhile, the central government downsized its budgetary role in most state-owned enterprises, simplified the tax system, and halved the number of civil servants from eight million to four million. Prices became mostly market-determined. As a result, productivity continued to increase. The industrial sector grew at an annual rate of 6% in the early 1990s but declined slightly in the late 1990s due to the effects of economic decline in East Asia and the rest of the world (*China Statistical Yearbook* 2000). Furthermore, the government liberalized the markets, allowing the retention of earnings from foreign trade in 1984, removing direct export subsidies in 1991, and eliminating centrally regulated exchange rates in 1994. It officially allowed joint ventures with foreign capital as early as 1979, but this opportunity did not materialize until the late 1980s and early 1990s when the government approved the location of joint ventures in some coastal counties.

Household incomes continued to increase, as did savings. Accumulated saving were 6% of GDP in 1978 and a phenomenal 62% of GDP in 1998. The reservoir of savings may reflect current investment opportunity, or it may reflect household decisions to protect against a future that many still perceive as uncertain. Most of “Household Responsibility System” contracts expired during the mid to late 1990s. The policies were not changed after the

contracts expiry. As a result, agricultural households had greater confidence in the stability of the policy.

Despite the reforms, the central government remains a major actor in the economy. Most of the largest firms are still state-owned, and many unprofitable state-owned enterprises remain in operation. The government in its active role continues to restrict labour mobility between regions and to the cities. It seeks the international acceptance of its trade policies. In addition, it has recently taken a stronger view toward environmental protection, charging fees for emissions, discussing degradable permits, and even closing many firms that are not in environmental compliance. Among closed firms are several small paper mills.

2.2.4 Policy reforms in the forestry sector

A number of specific policy reforms applied to the forest sector either in response to or to complement other economic reforms. The chronology of important central government forest policy decisions is provided in following Table 2-4. These include several reforestation programs and restrictive regulation on the use of forest resources. Meanwhile, the successes of agricultural policy provided the earliest incentives for forest policy reform and development. Forest-dependent households had seen the success of Household Responsibility System rights in the agriculture-dependent households, and they demanded similar rights for themselves. As a result, a comparable system known as the "Contract Responsibility System" was introduced in 1981 for forest cooperatives and forest-dependent households. The "Contract Responsibility System" became the main component of the "Three-Fix" policy for forestry[20] that was implemented between 1981 and 1985.

The households participating in the "Contract Responsible System" grew to 55% by 1983. By 1984, approximately 30 million ha had been designated for private management by about 57 million households. As part of the reforms, markets were liberalized in the collective forest areas in 1985 by abolishing the state monopoly on the purchase, sale, and distribution of logs. It resulted, for instance, in the increase of real timber prices by 43% in the Southern Collective Forest Region.

The pace and extent of these forest reforms were not uniform, even among counties. Many local forest authorities doubted the willingness of individual households to make the long-term commitment necessary to grow trees. Due to the inflation of 1986 and the retrenchment that followed, some local authorities withdrew "Contract Responsibility System" rights from some households so that only 52% of households in collective forests still held the rights by 1988. The state monopoly was repudiated and an open market policy was reconfirmed once more in 1993.

[20] The "Three-Fix" policy for forestry means: stabilizing the rights to and ownership of forests and mountains, identifying boundaries of household plots, and establishing a forest production responsibility system.

Table 2-4: Policy reform in forestry sector in China

Date	Title	Issued by	Principal objectives/impacts/Consequences	Influenced area
3/1980	Introduction of Vigorous Development of Afforestation	Central Committee of CPC, State Council	Accelerates the greening of China, promotes national afforestation and greening.	State-owned/ collective
3/1981	Decision on Several Issues Related to Forest Protection and Development (the "Three-Fix" policy	Central Committee of CPC, State Council	Sets rules and policies for forest protection and development. For forestry reform: Determines the ownership of mountains and forests, designates mountain slopes for household use, and defines a forestry responsibility system. Ownership certificates were issued for 97 million ha of mountain forests (of which 3 million ha were designated as privately managed mountains) for about 57 million rural households.	Collective
10/1984	Decision on Reform of the Economic System	The 3rd Plenary Session of the 12th Central Committee of CPC	Shifts the priority of reforms from rural to urban and the emphasis to state-owned enterprises, market development, and price reform.	State-owned
1/1985	The Forest Law of the People's Republic of China (China's first forest law)	People's Congress	Formally recognizes the division of forests between the state and collectives. States general objectives for forest management, establishes timber harvest quotas, and requires shipping permits.	State-owned/ collective
1/1985	Ten Reforms To Further Stimulate the Rural Economy	Central Committee of CPC and State Council	Abolishes the state monopoly (the Unified Procurement System) for timber purchase, sale, and distribution in collective forest regions, and open the markets for wood.	Collective
5/1986	Implementation Rules for the Forest Law of China	State Council	Implements the forest law; protects forest resources and develops the forest industry.	State-owned/ collective
1987	Enhancement of Forest Resource Management and interdiction of Ruinous Cutting in the Southern Collective Forest Region	Central Committee of CPC and State Council	Halts clear-cutting; implements the responsibility system of government leadership at all levels in the protection and development of forest resources. Resumes the state monopoly on timber purchased in the Southern Collective Forest Region.	Collective
1988	The Provisional Regulation of State-owned Enterprise Management Responsible Contracting System	State Council	Improves control over the consumption of forest resources and improves the financial operation of state-owned forests. These enterprises were requested to adhere to annual timber cutting quotas, promote reforestation, diversify management and the comprehensive use of resources, and enhance production safety, forest protection, and fire prevention.	State-owned
5/1989	Notice of Strengthening the Management of Logging with Certificates	Forestry Ministry	Reinforces the logging quota system and requires that forest growth had to exceed timber harvest levels.	State-owned/ collective
1993	Decision on Several Issues on Establishment of Socialist Market Economic System	The 3rd Plenary Session of the 14th Central Committee of CPC	Accelerates introduction of the market system and reform of taxation, finance, prices, and rules for foreign investment.	Mainly collective

Notes: CPC, Communist Party of China; ha= hectares

(Table to be continued)

(Table continued)

Date	Title	Issued by	Principal objectives/impacts/Consequences	Influenced area
1995	China's Agenda for Forestry Action Plan in the 21st Century (first environmental objectives for forest management)	Forestry Ministry	Presents, in a general way, the development plan for different elements of China's forest sector.	State-owned/ collective
1/1995	Notice of Implementing the System of Using Forest Land with Certificates	Forestry Ministry	Requires certificates for all forest lands. Differentiates forestland from other land uses. Effectively restricts conversion to other land use and ensures that this land will be regulated in accordance with forest law.	State-owned/ collective
8/1995	General Outline for Restructuring the Forestry Economic System	Forestry Ministry	Pushes forest enterprises toward the market, mobilizes and enhances financial support to forestry through tax policy, strengthen infrastructure development, reduces the role of government, and reinforces administrative support for forestry.	State-owned
10/1995	Instructions on the Decision about Accelerating Progress by the Central Committee of CPC and State Council	Forestry Ministry	Establishes guidelines of reform for science and technology education, set forth science and technology as the guiding ideology for promoting forest development and set the major mission for the near future through 2010.	State-owned/ collective
5/1996	Experiment on the Reform of the Development of Classified Management of Forestry	Forestry Ministry	Promotes the reforms of classified management and operation. Classified forests according to commercial, environmental (public interest), and mixed objectives.	State-owned/ collective
9/1996	Decision on Several Issues Related to Deepening the Reform in the State-Owned Forest Farms	Forestry Ministry	Emphasizes two points: (1) Classified management reform must differentiate between commercial and environmental forests and should be appropriate for local economic and social development conditions; and, (2) Industry structure of forest farm must be optimized.	State-owned
1998	National Ecological Environment Establishment Program	State Council	Continues the shift toward environmental justifications for state forest management.	State-owned
4/1998	Amended "Forestry Law of the People's Republic of China"	People's Congress	Legalizes transfer rights for family plots and extends the period of user rights, essentially stabilizing forest tenures in collective forest; emphasizes that the principal role of forestry is to provide environmental services.	State-owned/ collective
8/1998	Notice on "Protecting Forest Resources, Interdicting Ruinous Deforestation, and Occupation of Forest Land"	State Council	Protects forest resources by preventing the conversion of forestland for agriculture and other development purpose.	Collective
8/1998	**National Forest Protection Program (NFPP)** **(Research focus)**	**State Council**	**Bans logging in natural forests at upper reaches of Yangtze River and upper/middle reaches of Yellow River; reduces timber production of state-owned forest farms in the North-east, West and inner Mongolia by 19.91 million m^3, establishes 12.7 million ha of plantations and redirects as well as resettles 740,000 excess workers. Later, the logging ban was also implemented in collective forest areas.**	**State-owned/ collective**

Notes: CPC, Communist Party of China; ha= hectares *Source: SFA, 2005*

Most household incomes in China have risen substantially since 1978, but the disparity between households also has increased, within provinces and even more greatly across broad regions[21] (Chai *et al*. 1994, Chen *et al*. 1995). Many rural households remain poor. There are a total of 1,580 counties of which 592 counties are officially designated as poor (Anon. 2006). Among the poor counties, 496 are in mountainous areas where various forestry activities are a major source of household's welfare. So far, there is little information available on how these reforms (introduced in Table 2-4) have impacts on those local forest-dependent communities and households.

2.3 The Natural Forest Protection Program[22]

2.3.1 Background and objective

The Natural Forest Protection Program (NFPP) was triggered by the devastating floods of 1998 in the river basins of the Yangtze and the Yellow Rivers, which were blamed on high levels of deforestation (Zuo 2002). Thus, immediate policy changes to combat deforestation were announced in August 1998. The major changes included ban on logging in natural forests, ban on opening up of lands at the expense of forests, freezing of all construction projects in forestland, and the introduction of a new requirement for direct cabinet approval for any occupation of forest land (World Bank 2003). In response to the policy changes, the central government launched the NFPP to rehabilitate and conserve the forest and ecological environment. The program came with an investment of more than 200 billion Yuan (equivalent to 25 billion USD) implemented in 18 provinces geographically located in Northern, Western and South-Western parts of China as indicated in Figure 2-1 (SFA 1999, World Bank 2003).

2.3.2 Scale and main contents

The central government divided strategies into three main components during the NFPP implementation period from 1998 to 2010: First, it called for a complete ban on logging in the natural forests of the upper and middle river basins in Western China and reduced logging in state-owned forests in the Northeast and Southwest State Forest Regions. Specifically, the first NFPP strategies covered (a) protection of 61.2 million ha of forests along the upper basin of the Yangtze River and upper-middle basins of the Yellow River by banning commercial logging in natural forests and establishing plantations; (b) protection of 39.4 million ha of forests (of which 34.4 million are natural forests) in state-owned forest enterprises by reducing annual timber production of 7.5 million cubic meters and restructuring enterprises; and (c) protection of natural forests outside of the key program areas by the provincial governments. Second, in addition to these logging bans and reductions, the program encompassed reforestation and silvicultural treatment of designated forestlands. Third, the

[21] China's Gini coefficient, a measure of its household income inequality, rose sharply from approximately 0.20 in the late 1970s to 0.30-0.35 in 1990 (Chai and Chai 1994, Chen et al 1995). It may be around 0.40 today. Demographers often consider a coefficient that is much greater than 0.40 as indicative of serious maldistribution and potential social unrest.

[22] The information used here were according to the previous design editions of the NFPP, mainly were translated and summarized on the base of Regulations and Reports of NFPP, from the China's NFPP Center, some articles of foresters, and several websites.

program called for providing alternative employment to state forestry workers made redundant because of the ban and payment of pensions for retired staff of state-owned forest enterprises (SFA 2004). The program provided new jobs for the 1.2 million laid-off workers in forestry economy. Further, the program is relevant for the subsistence and livelihood of about 5 million people in forest areas (World Bank 2003).

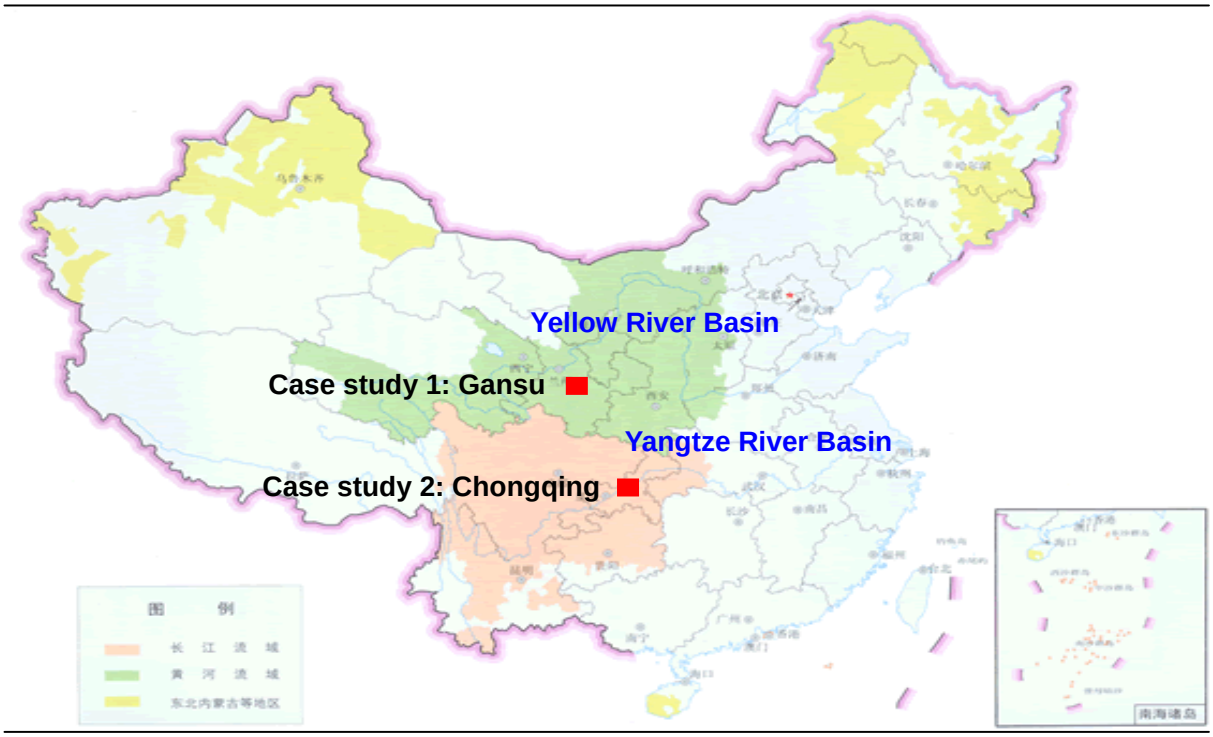

Figure 2-1: The NFPP covered areas (coloured as light green, red and yellow) in map of P. R. China
Source: The NFPP Information Centre on line, www. Tianbao. org. cn, 2005

As the program expanded to the big areas of collective forests in the upper and middle reaches of Yangtze and Yellow River in Western China, it covered a total of 126 million ha of natural forest (accounting for more than 90% of natural forestland in the country) in main river basins, with 42% being state-owned and 58% collective forests and involving 18 provinces, 734 counties, 167 state forest enterprises, 21 local key logging firms, and 8 provincial and 662 county-level forest bureaus (SFA 2004). In terms of forest function the NFPP covered with 98 million ha of ecological protection areas (77.4% of total protected area) and 28.5 million ha of commercial forest (22.6% of total protected area). The ecological protected area was further divided into two zones: areas that prohibited logging (49.7%) and areas that restricted logging (27.7%).

2.3.3 Implementation process

The NFPP followed a “top-down” implementation process. The central government identified the general implementation areas, the provinces, and forestry bureaus and enterprises, but it proposed implementation plans that were based on the proposals of lower-level governments or jurisdictions. The SFA reviewed the provincial plans and formulated a national implementation plan. Local governments prepared annual implementation plans according to

the national planning and implementation situation. In turn, the SFA reviewed and approved these local implementation plans, making financial appropriations accordingly. Local governments carried out implementation according to the final plans and budget. Various forms of monitoring and auditing were carried out on an on-going basis. At the end of each year, implementation was evaluated based on the performance of forest bureaus and enterprises as, for example, the number of trees protected and planted, whether funds were handled properly and so on. On the basis of the evaluations, recommendations were made for the implementation plan in the following year.

2.3.4 Budget

In the initial design the budget was 204 billion Yuan (equivalent to 25.5 billion USD) for the entire 10 year program. However, since the costs of resettling forest workers were higher than anticipated, the budget was increased[23]. Central government is responsible for 80% and local governments for 20%.

2.3.5 Legal basis

The NFPP has its roots in the 1950s when China's first national forest conference adopted the guiding principle of "*protecting the forest comprehensively, afforestation in key areas, rational felling and rational utilization of timber*" (SFA 1999). In the 1970s, SFA revised the *Management Measures of Felling and Regeneration* to prevent clear-cutting around the large reservoirs, lakes and the banks of major rivers. Later, in 1979, China promulgated the *Forest Law* that brought forest protection into the legal system, which remained in new editions of *Forest Law* in 1984 and 1998, respectively.

2.3.6 Current implementation status and main achievements

Reports indicate that the most salient implementation achievement is the enforcement of the logging ban which has been strictly implemented in the Northeast, Northwest and Southwest China since 1998. The financial resources allocation, the task allocation, and the employment re-allocation achieved in the NFPP are shown in following Table 2-5.

2.3.7 Various impacts of the NFPP derived from previous researches

The NFPP has various impacts (Xu 2003). Many studies show that the NFPP has had a positive impact on environment conservation and biodiversity, but there is much evidence that NFPP does not always have a positive impact on the various sectors and stakeholders in the whole society (Lu 1998; Sun 1999; Tian 1999; Anon. 2000b; Zhang 2000; Zheng 2002; Jeffrey 2003; Zhang 2003; Li 2004; Dai 2005 etc.). These studies were conducted by those representing the various fields of the social sciences, economics, environmental science and forestry (see Table 2-6).

[23] Before the completion of the dissertation, the NFPP is still implementing in China. So, there is not very much information available on the increased budget for the continous implementation of the NFPP, author, 2008.

Table 2-5: Allocation of fund, task and employment for the NFPP implementation in 1998

	Sub-total	North-east	Southwest	Northwest	Hainan
Fund allocation (million Yuan)					
Central financial resources	1,618.58	1,073.95	500.63	39.00	5.00
Local financial resources	1,500.00	516.00	720.00	210.00	54.00
Total	3,118.58	1,589.95	1,220.63	249.00	59.00
Tasks allocation					
Timber output reduction (m^3)	2,913,500	1,444,600	1,364,300	104,600	0
Plantation area for public welfare forests (ha)	512,884	13,633	306,122	50,959	21,170
Closing the mountain for reforestation (ha)	2,261,924	1,441,455	8,882,225	298,000	0
Area for forest tending (ha)	1,135,782	632,988	426,495	62,899	13,400
Natural regeneration/enrichment planting (ha)	307,600	90,800	207,800	9,000	0
Employment re-allocation (number)					
For protecting forests	63,409	29,532	27,721	5,072	1,084
For developing public welfare forests	116,521	87,283	23,098	5,600	540
For developing commercial forests	580	180	0	0	400
For transitional projects	10,536	6,500	2,400	0	324
For other works	15,689	12,000	980	580	1,130
Total	206,735	135,495	54,199	13,563	3,478

Sources: Anon., CNFEDRC, 1999b

Table 2-6: Various impacts of the NFPP mentioned by previous research

Main findings/research titles	Researcher/year
As result of the NFPP, there has been 5% increase in forest cover rate and 50% reduction of river sediment erosion in the Yangtze Basin and 30% of that in the Yellow River Basin from 1998 to 2003.	Zhi 2004:56
The NFPP has great influence to the forestry sector in China.	Lu 1998
The NFPP is challenged with the China's increasing purchasing power and willingness to pay for services.	Sun 1999:33
"Protection and development: research on the NFPP and socio-economic development in state-owned forest areas".	Tian 1999:85-88
The NFPP has brought ecological and economic impacts on the forest and environmental sectors, governments, and general ecological environment.	Guo *et al*. 2003
The NFPP has resulted in the complete stop of the commercial loggings of natural forests in the upper regions of the Yangtze and upper-middle regions of the Yellow River by 2000.	Huang 2002:14
The NFPP has resulted in the decrease of the planned harvesting volumes from 18.53 million m^3 in 1997 to 11.02 million m^3 in 2000 in Northern China.	Zhuang 2005:36
The NFPP has resulted in the decrease of the planned harvesting volumes from 13.51 million m^3 in 1997 to 1.02 million m^3 in 2001 in Western China.	David *et al*. 2002:19
After the implementation of NFPP, about 200 counties in China lost more than one-half of their fiscal revenues as a result of lower tax payment from the forestry sector, the major impacts of which will not be felt until 2010 and beyond. As a result, prices of domestic and imported raw materials are likely to increase, which will result in higher prices for building materials, furniture, and other products, adding further stress on the relatively inefficient wood processing sector.	World Bank 2003
… The expected increase of timber imports will draw down foreign exchange reserves, consequently shocking the international wood trade market, and rapidly creating new pressures for (illegal) harvesting of forest elsewhere, particularly in Russia, Southeast Asia and Africa.	David *et al*. 2002; World Bank 2003
The strict protection of forests has directly resulted in shutting down of 65 large state-owned harvesting enterprises/logging companies with another 70 scaling back operations.	Katsigris 2002:21
… Approximately one million forest loggers were shifted to other activities or became unemployed by 2001.	World Bank 2003

Source: Collected and concluded by author, 2007

Because of the strong role of the State Forestry Administration in developing the NFPP, the scope of compensation is limited only to forest bureaus and enterprises; the policy omits assistance to many farmers living in the forest who are highly dependent on the forest resources (Xu 2000). This could decrease the effectiveness of the NFPP as well as exacerbate poverty and decrease social stability in rural regions, thus reducing support and participation by local households (Sun 1999). However, there are very few studies that explore the affect of the NFPP on the life of the local communities and households and there have been few policies additionally developed to mitigate the impact of the NFPP on community livelihood, especially for the farmers relying on logging and the use of forest resources for their livelihood (Xu 2000).

2.4 Social Impact Assessment as a development tool

2.4.1 Concept of Social Impact Assessment

There is no agreed single precise definition of SIA, or a universally agreed upon list of its aims (some definitions are provided in Appendix 1). The Inter-organizational Committee on Guidelines and Principles for Social Impact Assessment (later known as the International Association for Impact Assessment, IAIA) defines it as "*assessing all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet theirs needs, and generally cope as members of society*" (1994:107). The definition is later redefined to mean "*a process of analysing any social change processes invoked by those interventions effecting on individuals, groups and communities*" (Vanclay 1999, Becker 2003:66, IAIA 2003:5). Its primary purpose is to bring about "*a more sustainable and equitable biophysical and human environment*" (IAIA 1998:5, 2003:6).

Barrow (2000:4) generally defines the SIA as "*the process of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned intervention or development (policies, programs, plans, projects) on people*". Buchan and Rivers (1990:97) define the SIA as "*a process examining proposed projects, programs and policies for their possible effects on individuals, groups and communities*".

These definitions reveal that the SIA is a management process which "*follows a certain procedure that includes at least eight steps or stages*" (Barrow 2000:29)[24]. Social change processes indicate the "direct" or "primary" social impacts and "secondary" or "tertiary" social impacts which are invoked by the primary social impacts (Barrow 2000, Slootweg *et al*. 2001)[25].

"S*ocial impacts*" is defined as "*the consequences to human population of any public or private actions that alter the way in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society*" (IAIA 2003:6). The term also includes "*the cultural impacts involving changes to the norms, values and beliefs of*

[24] The eight septs of SIA research procedure is presented in detail in Chapter 2.4.5, page 31.

[25] More discussions on social change process and social impacts are presented in Chapter 3, Conceptual framework.

individuals that guide and rationalize their cognition of themselves and their society" (IAIA 2003).

The many debates on the categories of social impacts indicate different understanding of the term. For instance, Barrow (2000:31) declares in his model of SIA that "*the economic (income, employment, taxes, etc.), demographic, institutional, displacement and relocation, community cohesion, lifestyle or well-being, beliefs and health*" are the important category of "social impacts"[26]. As defined by Berker (2003:35) "*social impacts are implicitly context-dependent*". This raises extensive debates as to the various indicators needed to understand social impacts under differing socio-economic context of the project[27]. Since the indicators for SIA are not only quantitative, but also qualitative (Barrow 2000, Burdge 1998, Berker 2003), the SIA of a project will use both quantitative and qualitative data collecting methods[28]. By collecting quantitative and qualitative data, the SIA identifies and compares the actual impacts with community perceptions of those impacts. It also ascertains the local community's and household's priorities.

The main purpose of SIA is to answer the following question: "*Will there be a measurable difference in the quality of life in the community as a result of the proposed action?*" (Barrow 2000:7). The value of the SIA is to better understand and clarify the community's expectations, values, perceptions and practices regarding the project's impacts so that the negative impacts of a proposed project can be avoided or mitigated, and positive impacts, such as benefits and opportunities, can be ensured, making a positive contribution to the community possible. The SIA reviews impacts of previous developments so that applicable information can be selected and fed into future planning, or used to assist current conflict mediation (Burdge 2004). By identifying impacts in advance, better decisions can be made about which interventions should proceed and how they should proceed; mitigation measure can be implemented to minimize the harm and maximize the benefits from a specific planned intervention or related activities (IAIA 2004). If used appropriately, "*SIA can work as a research tool that discovers how and why social change takes place and what the future pattern might be*" (Barrow 2000:25).

Ideally, SIA is a development tool that provides information to agencies and developmental organizations as well as local communities concerning social and cultural factors that need to be considered in any policy actions. It provides a mechanism for incorporating local knowledge and values into the decision. It helps a decision-maker identify the most socially beneficial course of action for local, regional, and national interests (Burdge 1999). "*SIA is best understood as an umbrella or overarching framework that embodies the evaluation of all impacts on human activity and on all the ways in which people and communities interact with their socio-cultural, economic and biophysical surroundings*" (Barrow 2000, Berker 2003).

Some scholars also argue that SIA should not be understood only as a tool for predicting social impacts in the impact assessment process. Most SIA professionals consider SIA as a

[26] This definition from Barrow (2000) is discussed in Chapter 3.4, page 46.

[27] SIA indicators are additionally discussed in Chapter 2.4.6, page 31, and Chapter 3.

[28] In Chapter 4, Methodology, it provides more details.

philosophy about development and democracy rather than a methodology since the SIA considers pathologies of development (i.e. impacts), goals of development (such as poverty alleviation), and processes of development (e.g. participation, capacity building) (Barrow 2000). The SIA in this research however is considered as a new research approach with a conceptual framework, clear definitions of operationalized indicators, presenting proper methodologies as well as research procedures[29].

2.4.2 A brief history of Social Impact Assessment

Prior to the social and environmental impact assessment begun in North America, project and policy evaluation relied solely on cost-benefit analysis. For instance, if the benefits of building a reservoir could be shown to outweigh the construction costs, project approval was generally given. However, increased failures led legislators and policy makers to seek something other than narrow economic criteria for project and policy evaluation. Of particular interest was how new projects and sometimes the abandonment of older ones impacted both the bio-physical environment and human communities (Vanclay 1999; Burdge 2004).

Since the early 1960s, planners and decision-makers increasingly accept that "social impacts" need to be considered along with the environmental and economic ones in response to the ideal of "growth" with "social responsibility" for improved environmental management and sustainable development (Barrow 2000).

The origins of SIA as a distinct field are usually traced to the United States (U.S.), becoming formalized with the passage of the National Environmental Policy Act (NEPA) in 1969 by the U.S. Congress (IAIA 1994). The NEPA required that "major federal actions significantly affecting the quality of the human environment," must first prepare a balanced, and publicly available assessment of the likely impacts of actions (now known as an EIA). However, there existed considerable ambiguity as to what NEPA required with regard to social impacts (MacFarlane 2001).

Impelled by the passing of the NEPA, the first meeting of practitioners and academics on SIA was convened by C.P. Wolf, in the fall of 1973, at the annual meeting of Environmental Design Research Associates (EDRA) held in Milwaukee, Wisconsin. Burdge[30] and Sue Johnson presented the paper: "*Social Impact Assessment: A tentative Approach*" at the first meeting.

A landmark event in the establishment of SIA was the **Inquiry**[31] in 1974 by Chief Justice Thomas Berger of the Province of British Columbia (Canada) into the proposed Mackenzie Valley gas pipeline that would extend from the Beaufort Sea, Yukon Territory, to Edmonton,

[29] Chapter 3 and 4 extend the discussions.

[30].Burdge, R.J, the senior researcher in SIA field; more information about him is presented in footnote on page 62.

[31] The Inquiry by chief Justice Thomas Berger of the Province of British Columbia (Canada) into the proposed Mackenzie Valley Pipeline, from the Beaufort Sea in the Yukon Territory to Edmonton, Alberta, was the first case where social impact were considered in project decision making (Berger 1977,1983; Gamble 1978; Gray and Gray 1977). Social impacts on indigenous populations were considered in depth, native populations were provided with funding to present their views and hearings were conducted in the native village in the local dialects (Berger *et al*, 1977, 1983).

Alberta. This was the first time that social impacts had been formally considered in project decision-making (Gray *et al*. 1977; Gamble 1978; Berger 1983), and led to the recommendation that the project be postponed for at least ten years to allow sufficient time for land claims to be settled, and for new programs and new institutions to be established to support the native population. At the time, the finding was unprecedented and marked the start of a huge growth in SIA. Prior to the inquiry a study identified just 12 Canadian SIAs. Three years later a study identified over 3,000 Canadian SIAs (D'amore 1981).

SIA was legislated into the NEPA in the USA in 1969 and the Environmental Assessment and Review Process (EARP) in Canada in 1973 formally became a part of the EIA (Barrow 2000). With the founding of IAIA in 1980, the first international conference on SIA was held in Vancouver, British Colombia, in 1982 and the publication of important state-of-the-art SIA papers in the mid-1980s (see MacFarlane 2001), both gave academic and political credibility to the new field (Vanclay *et al*. 1996; IAIA 1998).

By 1983, most US federal agencies had formalized environmental and social assessment procedures in agency regulations. The European Economic Community (EEC; nowadays as European Union, EU) began to recommend Environmental Impact Statements (EISs) for their member countries in 1985, and they became a requirement for project planning by 1989 (Vanclay 1999).

In 1985 the first major EIA case was overturned in the U.S. on the grounds that it failed to consider the social impacts on residents[32] (Freudenburg 1986:56).

Also in 1985 the EEC established a directive requiring EIAs from their members (although Europe continues to lack specifically accorded SIA legislation). By the early 1990's, many of the U.S. federal agencies and the U.S. Council on Environmental Quality (CEQ) had incorporated SIA into their EIA reviews or regulations.

Since 1986, the World Bank has decided to include both environmental and social assessment in their project evaluation procedures as social liabilities were increasing for projects evaluated strictly on economic and financial criteria.

By the mid-1990's, the World Bank issued social safeguard policies, established a Social Development Department at the World Bank and a social review unit at the International Finance Corporation (IFC), promoting the adoption of SIA principles for both public and private sector projects (Francis & Jacobs 1999). Since then, SIA has become an important requirement (although to varying degrees) around the world as nations have adopted and modified the original NEPA model (Burdge 1998).

Other Development Banks, some private sector corporations, regional donor organizations and Non-Government Organizations (NGOs) have incorporated similar procedures of SIA into their project appraisal procedures, and many national governments have made SIA a mandatory activity for project proposals (MacFarlane 2001).

SIA reached its highest legitimacy in U.S. at the conclusion of the 1993 "Forest Summit" in

[32] See the case of Northern Cheyenne Tribe, Freudenburg 1986.

Portland, Oregon. The social assessment team of the Federal Ecosystem Management Assessment Team (FEMAT) used much of the literature on community change and culture history (particularly for indigenous populations) as a basis for making assessments of community response to forest management alternatives (Clark *et al*. 1994; Stone 1993). The summit formally recognized SIA as a component of the policy making process.

In 1994, the first version of "*Guidelines and Principals for Social Impact Assessment*" was published by IAIA to shape and guide the SIA research within the context of the U.S NEPA of 1969.

Today, SIA increasingly carries equal weight with economic and environmental impact assessments as decisions are made to change policy or approve ecosystem alteration (Vanclay 1999). The social impacts of tourism, mining, forest management, and development projects such as relocation of dams, construction of nuclear power plants and new roads (highways) have been the major fields of study. A brief history of SIA is presented in Appendix 1.

2.4.3 Principles and guidelines for Social Impact Assessment

There was little uniformity in approach or methodology of SIA from the early 1970s to 1995 (Barrow 2000). The many different models and methodologies of the SIA were set out in a number of texts, and referenced in the IIED's *Directory of Impact Assessment Guidelines* (Roe *et al*. 1999). The models were presented in the following sources: *Guide to Social Assessment* (Branch *et al*. 1984), *Methods for Social Analysis in Developing Countries* (Finsterbusch *et al*. 1990), *Community Guide to SIA* (Burdge 1999), and *Environmental Assessment Source book* (World Bank 1991). Seebohm (1997) provided a précis of those principles in 1997 (see Appendix 1).

A real watershed in the development of SIA procedures was the publication of *Guidelines and Principles for Social Impact Assessment* by the IAIA in 1994, a new version of which was adopted by the government of the USA in 2003, providing guidance for the conduct of SIA within the context of the U.S. NEPA of 1969. This document, also published on the internet, might be consulted by anyone seriously interested in SIA worldwide (IAIA 2003) (see Box 2-1).

2.4.4 Basic model of Social Impact Assessment

There are many different models of the SIA process, but all of them have roughly the same elements in varying numbers of steps and stages (IAIA 1998). The basic SIA model is comparative and based on studying the course of events in communities where planned environmental changes have occurred and extrapolating from that analysis to predict what is likely to happen in another community where a similar development event or policy change is planned (Little *et al*. 1988, Burdge 1998).

The model illustrated in Figure 2-2 depicts the approach utilized in uncovering the major social impacts of developmental projects. The assessment team firstly identifies similar projects that are presently operational and attempts to locate the impacts resulting from the planned change (*comparative study*). Ideally, information about the community or area of

study would be available both before and after the event to help in measurement. Social impacts are indicated by the changes taking place between *T1a* and *T2a* (*comparative study (a)*). The *impact study (b)* attempts to predict the change between *T2b* and *T3b* based on the research and information accumulated from comparative studies of similar impact settings. If available, a *control study (c)* where no event took place would help demonstrate the normal effects of social change (the difference between *T1c T2c T3c*).

Box 2-1: Principles and guidelines for SIA

1. *Achieve extensive understanding of local and regional settings to be affected by the action or policy*
   - Identify and describe interested and affected stakeholders and other parties
   - Develop baseline information (profiles) of local and regional communities
2. *Focus on key elements of the human environment*
   - Identify the key social and cultural issues related to the action or policy from the community and stakeholder profiles
   - Select social and cultural variables which measure and explain the issues identified
3. *Identify research methods, assumptions and significance*
   - Research methods should be holistic in scope, i.e. they should describe all aspects of social impacts related to the action or policy
   - Research methods must describe cumulative social effects related to the action or policy
   - Ensure that methods and assumptions are transparent and replicable
   - Select forms and levels of data collection analysis which are appropriate to the significance of the action or policy
4. *Provide quality information for use in decision-making*
   - Collect qualitative and quantitative social, economic and cultural data sufficient to usefully describe and analyse all reasonable alternatives to the action
   - Ensure that the data collection methods and forms of analysis are scientifically robust
   - Ensure the integrity of collected data
5. *Ensure that any environmental justice issues are fully described and analysed*
   - Ensure that research methods, data, and analysis consider under-represented and vulnerable stakeholders and populations
   - Consider the distribution of all impacts (whether social, economic, air quality, noise, or potential health effects) on different social groups (including ethnic/racial and income groups)
6. *Undertake evaluation/monitoring and mitigation*
   - Establish mechanisms for evaluation and monitoring of the action, policy or program
   - Where mitigation of impacts may be required, provide a mechanism and plan for assuring that effective mitigation takes place
   - Identify data gaps and plan for filling these data needs

Source: IAIA 2003

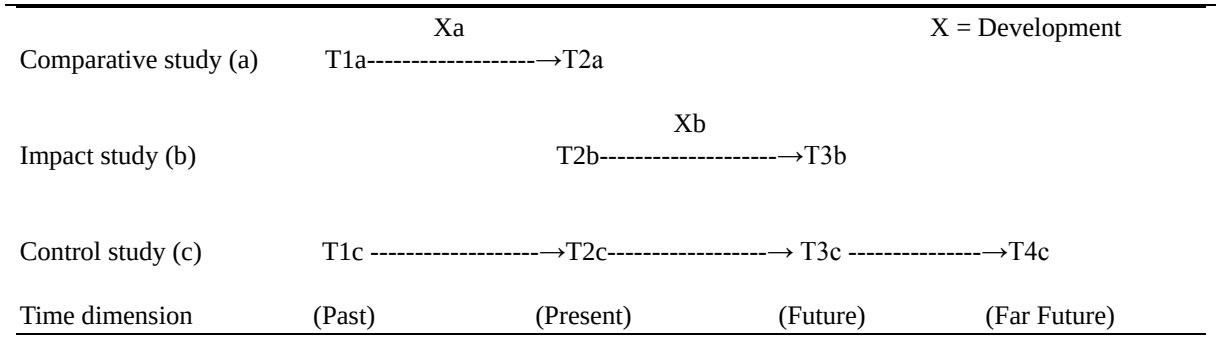

Figure 2-2: Basic model of the SIA

Source: Burdge, 1998

2.4.5 Process of Social Impact Assessment

SIA as a research approach has a common, widely-used process (Burdge 1999). The SIA process brings local knowledge to the decision-making process by employing the full scope of the public involvement processes, which are key requirements of sustainable development. With the use of local knowledge, SIA saves both time and money as affected populations are identified and involved in the process. It also ensures that the key stakeholders are identified and consulted (Burdge *et al*. 1996).

Ideally, SIA process is divided into at least eight steps or stages (Figure 2-3) which should be repeated in each phase of project and program development[33] (Barrow 2000). Defined methodologies and techniques[34] are used in different steps or stages of the SIA process. This general process of SIA is important to conducting research, offering a base from which to elaborate feasible field research procedures that can be followed in the targeted case study area[35]

2.4.6 SIA case study examples and matrix of common social indicators

2.4.6.1 The case of Skagway community, Alaska

In the Skagway case the social and cultural history of the community was examined to meet the objective of how the community might adjust to future environmental and social impacts due to the implementation of a new national park project so called Klondike Gold Rush International National Historical Park (Burdge and Field *et al*. 1989). Using the SIA approach to predict how the Skagway resource-dependent community would adjust, the authors asked the following questions: What are the key social impact variables that could be used to predict community response to social change? What had been the history of change in those variables and the relationship among them? What historical forces or factors, either external or internal, could be associated with those changes? Answers to these questions were derived from archival research, content analysis of newspapers and public documents, open-ended interviews, and participant observation of the Skagway community done at intervals since 1974. Community theory used for analysis emphasized the definitions of the community, its structure and function. Early theories on human ecology from the Chicago school[36] as well as the descriptive analysis represented the major research approach (Wade 1964). Data was obtained from field observations and comparisons among different rural communities. The conceptual and empirical task in SIA was to understand the key elements for study within the community, and the process of community adaptation to external forces of change. The following seven social impact variables used to guide the historical social assessment of the Skagway community were:

[33] Project and program development has phases which typically are as follows: (a) initiation or construction; (b) stable, ongoing management; (c) adjustment (s); (d) closedown; (e) replacement or rehabilitation (Barrow, 2000).

[34] The definitions of methods and techniques are presented by Statz (2000:101) as the footnote on page 71.

[35] Chapter 4, Methodology, presents in detail the research procedure, which is derived from the general process of SIA.

[36] Detailed information on concepts of human ecology from the Chicago school is presented in Chapter 3.5, page 47.

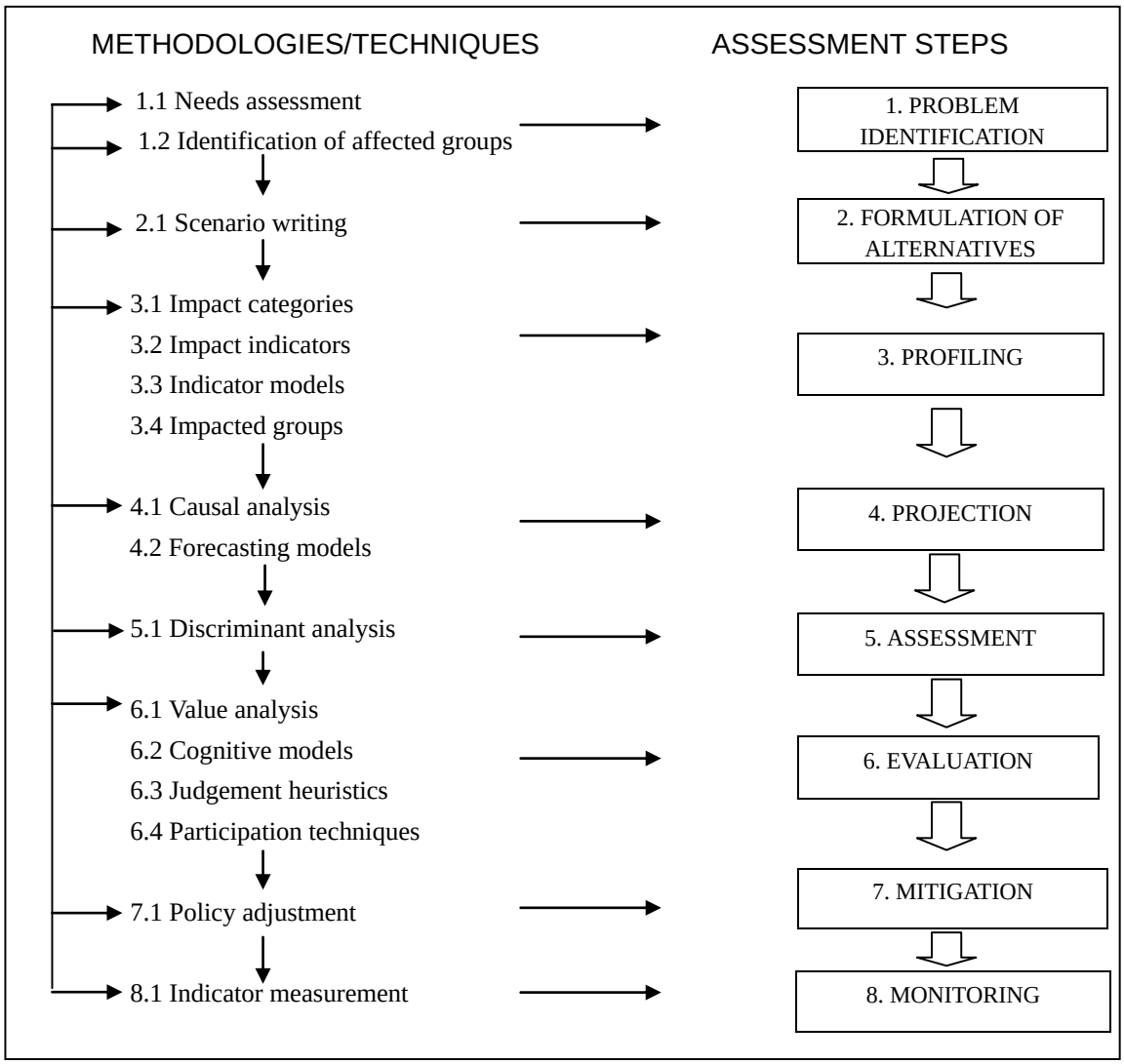

Figure 2-3: Process of SIA in stage of project implementation

Source: Barrow, 2000

"*Population influx-out flux*[37]; *Community involvement*[38]; *Previous impact Events*[39]; *Occupational composition*[40]; *Local benefits*[41]; *Presence of outside agency*[42];

[37] Population influx-out flux – Will the development involve significant influx of new people and has the community experienced significant population influx-out flux in the past?

[38] Community involvement – Will the project or policy be known in advance, and to what degree will the community be involved in the planning decision process?

[39] Previous impact events – Does the community have a history of the same or similar social impacts?

[40] Occupational composition – What is the occupational composition of the persons who will be involved in the project and to what degree does it match with that of the host community?

[41] Local benefits – Will the benefits of the project accrue to private-sector or public sector agencies of the larger society or will they accrue to the local community?

[42] Presence of outside agency – Will the proposed project bring to the community a new neighbor in the form of a temporary or permanent government agency or private-sector organization? Does the "new neighbor" have a history of attempting to mitigate the social impacts it creates? Has the community experiences occupation by an outside agency in the past?

and *mitigation measures*[43]" (Burdge 1987). The study showed that the presence of the new park altered the flow of visitors through the community only by increasing the rate of that flow, but that the length of the visitor season was not significantly affected. The Park posed no threat to that flow, nor was there a major need to mitigate or supplement the social implications of the Park's creation. The occupational composition of the park employees, differed from the skilled persons required to operate the rail road, fit the service and administrative categories that catered to the tourist industry. Benefits seemed to exist more for the community at large rather than for any segment of the local power structure. Skagway residents have a good idea what mitigation measures are necessary and appear to have collective consensus as to how they might be achieved in the case of the National Park Service. However, this case study also has some limitations. For instance, the social history of the community uncovered the roots of how Skagway has been adapting to social change all along; some significant social changes associated by people in the Skagway community with the Park were also associated with other projects such as opening of the Car Cross Road over White Pass (connection to the Alaska Highway). These changes produced fears of the loss of peace, security, and frontier autonomy. If such losses do in fact occur, it will not be possible to attribute them separately to one cause or another[44].

2.4.6.2 An ex-post facto analysis case of the socio-economic impacts of reservoir development, Illinois

In the Lake Shelbyville case[45], the SIA study used ex-post facto analysis to report the economic and social impacts of construction, operation and maintenance ten years after the reservoir project was completed (Burdge *et al*. 1987). Prior to construction of the reservoir and at selected time during operation and maintenance, the following data was obtained: *agricultural land use patterns, private sector expenditures, community infrastructure development, perceptions and attitudes towards the project* as well as *community organization*. The major conclusions of the economic and sociological components were reviewed under over-all questions: *What has been the impact of the reservoir*? And *Were the expectations raised by a major water impoundments project realized*? Each question considered the standpoint of the individuals, families, organizations and the communities that were impacted. A conclusion, drawn on the *de facto* impacts of the reservoir based on the observations and interviews, predicted the future economic and social impacts and suggested important recommendations for state agencies and local governments asked to support the water projects in the future. The study employed the following socio-economic indicators to assess the economic and social impacts of the reservoir: *Changes in agricultural income; Changes in tax base of the two counties affected by the reservoir; Changes in employment and income; Changes in business and government expenditures; Changes in business and*

[43] Mitigation measures – To what degree has the community acted as a unified decision making body in past dealing with outsiders? Does the community make decision in response to a crisis or was some advanced planning involved? (Dixon 1978:300).

[44] This important issue is related to the attribution gap of the project's impact between the real impact and the impact coursed by other project(s). More discussions on attribution gap is presented in the later chapters.

[45] Lake Shelbyville is a multi-purpose impoundments planned, built and operated by the U.S. Army Corps of Engineers in East Central Illinois.

industrial development; Changes in land use and zoning; Adjustment of residents relocated due to the reservoir; Social effects of land acquisition; Recreational visitation patterns at Lake Shelbyville; Local economic impact of recreation expenditure; and the attitudes of visitors (weekend residents: taking without caring). The limitation of the study was that, it was conducted somehow in a qualitative way. The study seemed to be too subjective without enough quantitative evidence.

2.4.6.3 Experiences in China: SIA in forestry and the NFPP evaluation

There are very few applications of SIA in China, especially in the forestry sector. Prior to the 1980s, cost-benefit analysis was the most common way to evaluate the success of a forestry development project. Since the 1990s China, recognizing the failure of traditional cost-benefit economic analysis in project evaluations and opening up to foreign countries, introduced the social evaluation methodology and social impact approach as applied in World Bank aided forestry projects and multi-donor-countries aided projects in China (Zhi 2004). Research now involves groups of experts from different disciplines covering social, economic, environmental, political and cultural aspects (Zhi 2004).

Based on the general definition of SIA presented by IAIA (1994), the SIA of forestry projects in China is defined as: "*The evaluation of the contribution and impact of forestry projects to the national or local social development, including the inter-impacts between the projects and local natural and social environment*" (Li *et al*. 2000). Meanwhile, certain social indicators and the evaluation methodology for research on SIA of forestry projects were developed by scholars and finally published by China National Forestry Economics and Development Research Centre (CNFEDRC) in 1992 (the list of indicators is provided in Box 2-3 in appendix 1). The selection of these indicators was based on the forestry development characteristics and the socio-economic conditions in China (Li *et al*. 2003). However, the list of the social impact indicators is rather general and some of the indictors have not taken consideration of the specific local contexts. There are very few field and case study samples that have tested and verified the rationality of these indicators and they are failed to explain the representativeness of the indicators derived from their case study experiences (Zhi 2004, Li *et al*. 2003).

After the flood disaster and the wide implementation of NFPP in 1998, NFPP became the main focus for SIA practitioners in the forestry field, conducting several empirical studies in different areas of China where the NFPP was implemented. These case studies include: "*Research on social appraisal of investment project of NFPP*" (Zhu *et al*. 1999); "*Socio-economic impact appraisal of NFPP and PCSLF*[46] *- Case study in Zheng'an County, Shaanxi Province*" (Yu 2002); "*The social impact evaluation of the NFPP in collective forest*

[46] PCSLF means the Program of Conversion of Slope Land into Forest. In some documentation it also abbreviated as "SLP" (UNDP 2004). It was another big forestry project launched by Chinese Central Government in 1999, main focusing on the conversion of unsuitable cultivation of sloping land to forest. It is usually seen as a project that is associated with the NFPP implementation, and some project areas are over lapping with the NFPP's. The NFPP supports reforestation and logging ban on forests enterprises, while the targets for the PCSLF are the individual households and farmers, e.g., farmers are paid to convert agricultural land to forest ("Grain-to-Green") and are given the right to use the trees. About 3.8 million ha of land have been converted to forest due to PCSLF till 2003. State Forestry Administration is responsible for overseeing the implementation of the two programs, author, 2007.

areas in Yunnan Province[47] *in South western China*" (Li *et al*. 2003); and, most typically, "*The SIA for forestry investment projects – case study of the NFPP in Qiandongnan Prefecture, Guizhou Province*" (Li *et al*. 2000, Li *et al*. 2003). However, these case study samples are unilateral because they are mostly conducted in collective forest areas where the ownership and traditional use rights of forest resources are claimed or easily recognized (Wang 2005). There are very few studies conducted in state-owned forest areas where the traditional use rights of the forests are usually neglected, and the NFPP has very negative impacts on the local farmers as some regulations associated with the NFPP conflict with traditional use rights (Xu 2003, Wang 2005). Some of the empirical studies are superficial and too descriptive; and, all of these studies contribute very little to the theoretical building and conceptual framework. Thus, results from these empirical studies are fractional, pragmatic, and not comprehensive enough to understand the impacts of the NFPP on the local people as a whole; and the results could not be compared with another.

Nevertheless, these case studies contribute to the further development of the social indicator and evaluation methodology of SIA in the NFPP as well as in other forestry projects. These case studies have common features. They are based on the case study design and rural households' questionnaire survey, combine qualitative and quantitative approaches and data analysis methods, employ a number of social variables and indicators related to the local community development, public participation, capacity building and benefit sharing in the project covered areas (see Appendix 1). These case studies represent the first time that the concept of SIA was ever introduced into the evaluation of the NFPP implementation in collective forest areas, and the first time that the SIA was employed as an independent evaluation method in the NFPP evaluation in China (Zhi 2004, Huang 2002).

2.4.6.4 Learning from previous SIA case studies and list of common social indicators

In the contemporary SIA forum, there are no commonly agreed social indicators. The setting of social indicators is context-dependent[48] (Slootweg *et al*. 2001). In the light of the case study samples stated above, whether in America or in China, the employed social indicators for SIA are various, but some of them are also overlapping. The employed indicators are diverse due to dissimilar project contexts and different understanding of social impacts.

Table 2-7 presents a matrix of common social indicators employed in the case studies in Skagway Community, Shelbyville Reservoir in U.S. and the NFPP in China. The matrix also considers the lists of social indicators advocated by IAIA (2003), senior experts such as Barrow (2000) and Burdge (1999, 2004). These SIA practitioners and agencies consider all issues pertinent to SIA that affect people, directly or indirectly.

IAIA (2003) states that a convenient way of conceptualizing social impacts is to observe and consider changes to one or more of the following: social-economics, ecological environment and other social factors. They suggest the following indicators for SIA listed in Box 2-5.

[47] One of the 18 provinces in which NFPP was implemented in October, 1998; a total of 8.5 million ha forestland in the province, 1/3 of the forest land has been covered by the NFPP, consisting mostly of state-owned and collective forest areas.

[48] Chapter 3 has more details about the "context-dependent" characteristics of social indicators.

According to Burdge (1999) and Cernea (1995) the SIA indicators point to measurable changes in human populations, communities, and social relationships resulting from a development project or policy change. Drawing from previous research on local community change, rural industrialization, reservoir and highway development, natural resource development and social change in general, Burdge (2004) delineated a list of 28 social indicators under the general heading of population impacts, community/institutional arrangements, communities in transition, individual and family level impacts, and community infrastructure needs, all representing the types of effects arising from planned changes in local communities (see Appendix 1).

The matrix in Table 2-7 serves as an integration of previous case studies of SIA as stated above, and offers a reference for the selection of social indicators in the empirical research, which Chapter 4 presents in greater detail.

Table 2-7: Common social indicators employed in previous SIA case studies

Source: Collected and compiled by the author, 2007

Variables	Indicators	Skagway Case[49]	Shelbyville Case[50]	Barrow (2000)	Li (2000)	Li *et al.* (2003)	IAIA (2003)	Burdge (2004)
Population	Population influx-out flux/demographic change	×		×	×	×		×
	Residents relocated		×					×
	Previous impact events	×						
	Population composition							×
Economic development/ income	Business/industrial development/Regional economic development		×		×	×		×
	Local economic benefits/income level	×	×	×	×	×	×	×
	Marketing competition capability				×			
	Income distribution				×	×		×
	Energy saving				×	×		
Employment	Occupational composition/Social employment	×	×	×	×	×		×
Community institutional arrangement /local government	Business/government expenditure/Tax base		×					
	Governmental support				×			
	Size/structure of government							×
	Community cohesion						×	
	Community involvement	×						
	Public participation				×		×	
	Local political system/social network						×	×
	Presence of outside agency	×						×
Infrastructure	Infrastructure/public services				×	×	×	×
Land use	Land use/zoning/Land acquisition		×					×
Recreation	Recreational visitation patterns		×		×	×		
	Recreation expenditure		×					
	Weekend residents/Tourism		×					×
	Time saving				×			
	Leisure/entertainment				×			×
Technology	Technological development/dissemination			×	×	×		
Health/safety	Medical treatment/sanitation			×	×	×	×	×
	Security/safety for future				×		×	×
Culture and other social factors	Culture/education/beliefs/values			×	×	×	×	×
	Attitudes towards projects			×				×
	Social welfare				×	×	×	
	Minority ethnic groups				×			×
	Social order				×	×		×
	Religion practise							×
Life style	People's way of life/daily living/movement pattern						×	×

[49] Social impact assessment case of Skagway community, Alaska, presented by Burdge and Field *et al*. 1989.

[50] Case of Shelbyville reservoir development, presented by Burdge *et al.* 1987.

3 CONCEPTUAL FRAMEWORK AND THEORETICAL PERSPECTIVES

3.1 General remark

There is no formulated theory that supports the SIA application from available literature. As pointed out by Barrow (2000:67) that "*there are difficulties with finding a theoretical base from the social sciences, and the complexity and holistic nature of SIA makes it daunting…*". Little and Krannich (1988:24) concluded that "*rather than pursue a futile hunt for a single unifying theory for SIA, effort should be made to use available theories as guides for the SIA process. As a model for this, they advocated the use of local communities as the primary unit of analysis and called for a conceptual framework to order this*".

This chapter attempts to construct a conceptual framework with supportive theoretical perspectives guiding for the SIA practice applied to empirical context. It is important to determine the scale of possible social impacts, in order to measure a specific project such as the NFPP in the context of local forest-dependent communities. This chapter presents different understandings of social impacts as it reviews in detail the literature that addresses the systematic conceptual approaches in SIA and the relevant theoretical bases supporting conceptualization of SIA. The chapter searches for a well-organized conceptual framework for assessing the social impact of a planned intervention, such as a forestry program/project (i.e. the NFPP) on local communities and households as well as individuals. Proper indicators for evaluating the social impacts are selected and included in the operational framework presented in the conclusion of this chapter.

Leistritz and Murdock (1981) generally recognize a number of conceptual approaches to SIA including the "Function evaluation" and the "Human ecology" approaches. The "Function evaluation" approach (R.S de Groot 1992)[51] provides an insight to relations between human society and the biophysical environment, with focuses on the characterization and classification of functions provided by the biophysical environment, on the assessment of their value for supporting human activities and on the identification of needs for an intervention. The integration framework (Slootweg *et al*. 2001) based on this approach presents an integrated way of thinking of the complex cause-effect chains that may lead to desired or undesired effects as a result of a planned intervention, so that the indirect human impacts resulted from the biophysical change and the direct human impacts resulted from the social system change can be identified. The integration framework also demonstrates the social change processes and human impacts, which are altogether the social impacts and their interrelations. Another conceptual framework of SIA, developed by Barrow (2000), concentrates more on the changes in social setting, resulting from a policy intervention, providing greater details on elements of the social system, meanwhile being highly consistent with the integration framework of Slootweg *et al*. (2001). These two frameworks support the

[51] See de Groot, R.S 1992. *Functions of nature: Evaluation of nature in environmental planning, management and decision making*, Groningen: Wolters-Noordhoff, and de Groot, W.T. 1992. *Environmental science theory: Concepts and methods in a one-world, problem-oriented paradigm*, New York: Elsevier. The approach translates nature and natural resources into functions for human society, and this bears some similarity to the discussion of environmental goods and services that is going on in some countries, Slootweg, *et al*. 2001 in Becker *et al*. 2003.

concept that the social impacts include the primary and secondary social change processes, and consequently the tertiary impacts perceived by people in general and individually in particular. These two frameworks are also referential for conceptualization of a full range of possible social indicators for the SIA application.

The conceptual models of "Human ecosystem" supported by Marten (2000) and Machlis *et al*. (1997) illustrate the dynamics and institutional (elements) change between nature and human society, providing a holistic view of the human ecosystem as composed of interrelated biophysical and social subsystems, corresponding to the insight into a framework based on the "Function evaluation". The models support an important concept that a local community can be considered as a small scale human ecosystem, providing a conceptual background for the integration framework of Slootweg *et al*. (2001) and the framework of Barrow (2000) applied into the context of a local forest-dependent community. Through defining the elements of biophysical and social settings in the human ecosystem, the models aim to guide the selection of measurable social indicators, and serve as an organizing concept for SIA application in the local village community, in order to sustain the forest resources and local livelihood.

Table 3-1 summarizes the relevant theories and concepts as presented in this chapter; connections and interrelations are also displayed between the concepts and the operational framework elaborated for this empirical study.

Table 3-1: Theories and concepts related to conceptual framework for this empirical study

Theory & concept	Author /year	Content		Connection to operational model
Function evaluation	de Groots (1992)	Characterizes/classifies functions provided by biophysical environment, assessment of their value for supporting human activities, and need for an intervention Complex cause-effect chain		Conceptualization of social impacts
Integration Framework	Slootweg *et al*. (2001)	Framework integrating environmental and social impacts derived from a planned intervention: Intervention causes biophysical changes and impacts (EIA) and social change processes and human impacts (SIA) Pathways deriving direct and indirect human impacts Social impacts are context-dependent		Conceptualization of social impacts/ full range of social indicators
Conceptual framework of SIA	Barrow (2000)	Concentrates more on the changes in social setting as a result of intervention		Conceptualization of social impacts/detailed social indicators
System model of human ecology	Marten (2001)	Holistic thinking of human ecosystem as composed of interrelated biophysical and social subsystems	A rural community is a small-scale human ecosystem	Conceptual background for SIA framework applied to a local community/ Organizing concept/ Defining indicators
Human ecosystems model	Machlis *et al*. (1997)	Human ecosystem as a coherent system of critical resources and human social system		

3.2 Basic settings in the "Function evaluation" approach

The EIA as the most developed instrument, backed by a legal framework in many countries, is increasingly used to assess the social and economic impacts of planned intervention (Becker 2003). The conceptual framework presented here attempts to provide a harmonized and integrated way of thinking of the relations between human society and the biophysical environment, and aims to assist in the identification of potential environmental, social and economic impacts of a planned intervention. It is a framework that integrates environmental (EIA) and social impact assessment (SIA). The framework is based on the so-called "Function evaluation of nature". Leading authors in this field are R.S. de Groot (1992) and W.T. de Groot (1992).

The starting point in this approach is that society utilizes products and services, which are provided by the physical environment. In economic terms, society constitutes the demand side, and the biophysical environment constitutes the supply side (see Figure 3-1). Sustainability deals with the equilibrium in supply and demand, *now* and *in the future*. Perceived imbalances in this equilibrium trigger institutions to act by managing either the supply from nature or the demand from society. In this sense, institutions can be represented by national, regional or local authorities with their formal instruments and regulations, examples being forest laws and policy/programs determined on the national level and the concrete regulations on local forest use at the local level. Traditional chieftains or village elders with their traditional techniques and customary laws (soft laws) may be involved into this mix. In a globalized world, international agencies that exert effective control over human activities could also be included[52].

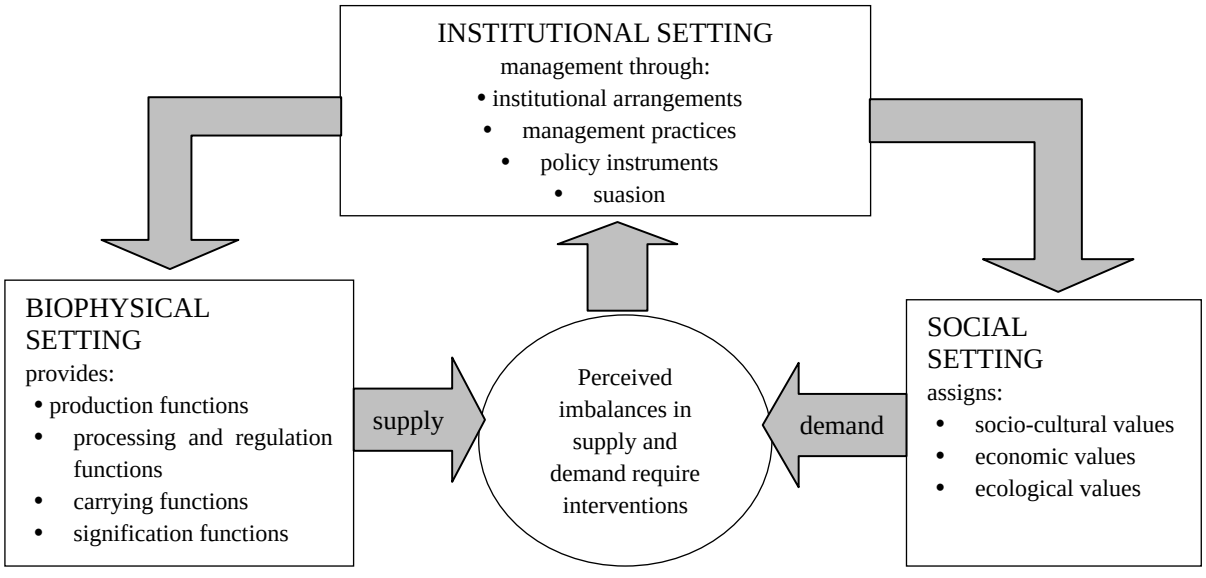

Figure 3-1: Main settings in function evaluation approach

Source: de Groots, 1992 in Slootweg et al., 2001

[52] Example as the Framework Convention on Climate Change, the Biodiversity Convention or the Montreal Protocol on Substances that Deplete the Ozone Layer, World Commission on Environment and Development 1987. (Becker *et al*. 2003).

Three main settings can be identified as shown in Figure 3-1. The natural environment (*biophysical setting*)[53] comprises a combination of living and non-living resources and their interactions. Human society (*social setting*)[54] encompasses all human activities, knowledge, beliefs and values. The *institutional setting* consists of the institutional arrangements (authorities, legal framework, traditional laws and regulations), management practices (such as physical structure – dykes, roads), policy instruments (permits, subsidies, quotas), and the use of suasion by governments or agencies in an attempt to change people's beliefs or behaviour. *Perceived imbalances* between the supply of goods and services provided by the biophysical environment and the demand for these goods and services from society may lead to the identification of an actual or a perceived (current or future) problem (e.g., overexploitation) or a development opportunity. The problem or development opportunity will put pressure on the institutional setting (to trigger an initiative from the policy- or decision-makers through their institutional arrangements, policy instruments, management practices and advices) to undertake interventions (activities, policies, projects and programs) and to address the issue (trying to solve the problem or benefit from the development opportunity). This intervention either works via the biophysical setting by managing the supply of environmental goods and services (such as provision of agriculture, forestry or hydraulic engineering), or via the social setting by managing the demand for goods and services (through tax incentives, setting of quota, opening or restricting of the access to the forests, trade negotiations and so on). In this case, Figure 3-1 also explains why the NFPP

[53] Biophysical system comprises many environmental functions that provide goods and services that can be utilized by human society. Four categories of environmental functions are distinguished: *production*, *processing and regulation*, *carrying*, and *significant function.*

Production functions relate to ability of natural environment to generate useful products for people and society. A distinction is made between natural production functions and nature-based human production functions.

Processing and regulation functions (or maintenance functions or resilience capability of nature) relate to the maintenance of ecosystem support systems. They refer to ability of ecosystem to maintain or restore dynamic equilibrium within the system, or in other linked ecosystems through physical, biological and chemical processes and interactions.

Carrying functions are related to space or to a substrate that is suitable for certain activities and for which there may be a demand. Examples include suitability of an area for human habitation and settlement, nature conservation areas, areas for nature-based recreation, waterways for navigation and sites for energy conversion.

Signification functions involve the social values that are ascribed to nature itself (natural heritage values) and to other features of the landscape, including human constructed landscape (cultural heritage values).

[54] *Social setting* creates demand for environmental goods and services. The existence of goods and services derived from environmental functions is what determines the perceived value of those functions for humanity. This perceived value is also related to what is socially valued in that society, which in turn, is related to the culture of that society, the level of technology and so on. Three broad categories of values can be distinguished: *social values*, *economic values* and *ecological values*.

Social values refer to quality of life in general and can be expressed in many different units, depending on social context and cultural background of the situation/society (corresponding to processing of regulation function and significant function). Examples are health and safety, housing and living conditions, religious and cultural values of environment function.

Economic values of an environmental production function refer to monetary value of goods and services that are provided and assigned to individual economic activities (agriculture, industries, fisheries, construction), to household income (as an overall indicator of the financial conditions of the population) or to per capita gross regional or domestic products, as an overall indicator for the income of the society as a whole.

Ecological values refer to value that society places on or derives from the maintenance of the earth's life support systems (particularly the processing and regulation functions). They come in two forms: Temporal ecological values are the potential future benefits that can be derived from biological diversity (genetic, species and ecosystem diversity) and key ecological processes that maintain the world's life support systems for future generations.

was initiated and how it has yielded impacts on local forest-dependent communities and households.

3.3 Integration framework: indirect and direct human impacts

The basic settings in "Function evaluation" approach provide a way of understanding how impacts are developed from triggered interventions. It distinguishes the concepts of a change in the biophysical setting from the impact on the environmental functions (environmental impacts), and the impact experienced by people as a result of those biophysical impacts (social impacts).

Enlightened from this approach and supported by Slootweg *et al*. 2001, Figure 3-2shows how a physical intervention (A), creates changes to the characteristics of the natural resources in the biophysical setting (B) (*biophysical change*), and in turn, results in changes in the social setting and causes social impacts (F)[55].

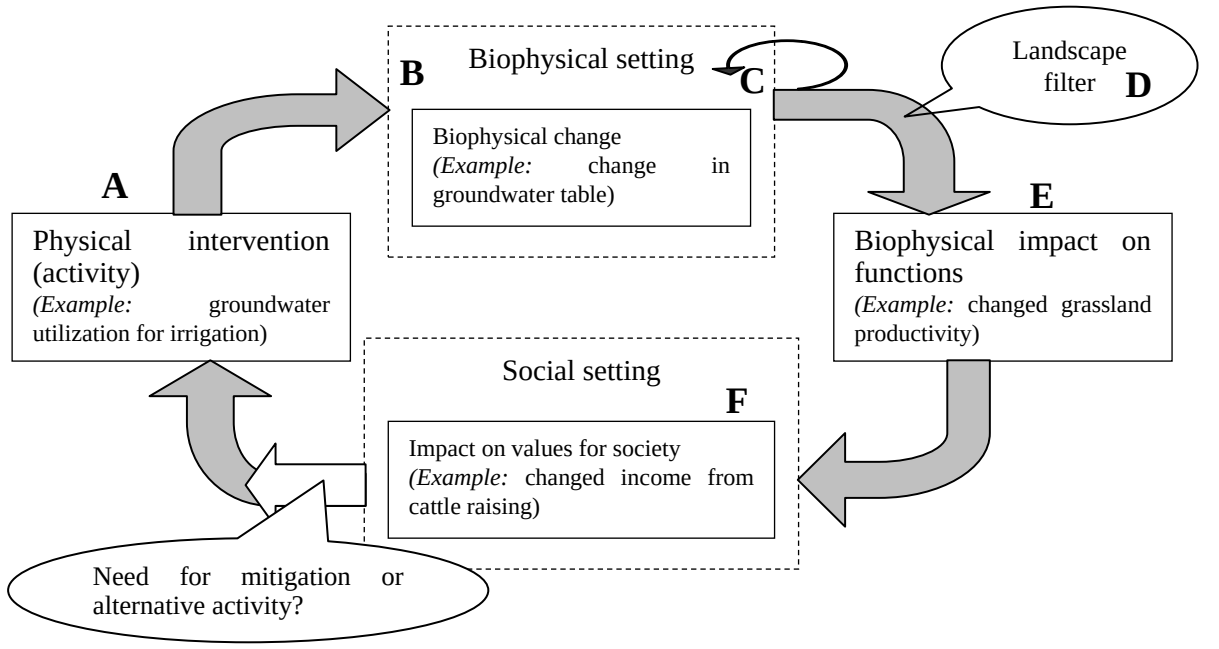

Figure 3-2: Impacts resulting from physical intervention (indirect human impacts)

Source: Slootweg et al., 2001, in Becker et al., 2003

The *biophysical change* that directly results from an intervention is a *first-order change*. This

[55] A change in the characteristics of a natural resource will occur under all circumstances, irrespective of the type of ecosystem or land-use type in which the intervention is carried out. The referred *biophysical changes* can be measured and quantified. Magnitude and direction of change are determined by combined characteristics of intervention and natural resource involved. The framework in Figure 3-2 only allows for the identification of *likely* biophysical changes. Field observations and detailed information on the proposed interventions are needed to determine the actual magnitude and the direction of the change (Slootweg *et al*. 2001).

change may cause *second-* and *higher-order* biophysical changes (*C*)[56]. Changes in the physical and biological properties of natural resources will change the functions of the natural environment (*E*), i.e. the goods and services provided by nature. These changes are referred to as the *biophysical impacts*. The type and quality of the biophysical environment determine the functions affected[57]. From this framework, a long list of potential impacts can be derived from all imaginable environmental conditions[58].

The long list of potential impacts can be narrowed down considerably by introducing a so-called "*landscape filter*" (*D*)[59]. This landscape filter "filters" the relevant impacts from the long list of potential impacts. *Biophysical impacts on functions* (*E*) are expressed in terms of changes in products and services provided by the environment and will consequently affect the values of these functions for human society (*F*). Changes in *functions* of nature will lead to changes in *values* assigned to nature[60]. These impacts on society are considered to be *indirect human impacts*[61]. Decision-making in relation to a proposed project has to be based on the assessment of all these values, and on possibilities of defining alternatives or mitigation measures in the case of undesirable impacts. Changes to the proposed intervention, or the implementation of mitigation measures, are a new intervention making the process circular. Over time, the type of new projects proposed (*A*) is dependent on the experience of the past intervention (*F*).

The framework presented above in Figure 3-2 identifies *indirect human impacts* that result from physical interventions (changes to the biophysical setting). Accordingly, a further framework as shown in Figure 3-3 is elaborated to address the *direct human impacts* that result from social interventions (changes in social setting).

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[56] As in the example above, a river diversion is likely to result in a change in river hydrology (first-order change); the change in hydrology may lead to a change in the flooding regime in downstream floodplains, or change the salt and other pollutant concentration along the river (second-order changes). Ibid.

[57] For example, a change in groundwater level in forested upland areas will affect functions such as wood production, and the provision of water for lowland areas. In coastal lowlands, the same biophysical change in groundwater level will affect functions such as the prevention of underground seawater intrusion, and productivity of meadowland. Ibid.

[58] With some knowledge of the specific location, it would be possible to improve the identification of potential impacts by using the concepts of ecosystem and land-use type. By knowing the ecosystem or land-use type in which a biophysical change occurs, it would be possible to indicate the functions that potentially will be affected. Ibid.

[59] For practical reasons, the combined term "landscape" is used and defined as a biologically and/or geographically recognizable unit representing either a natural ecosystem (for example a lowland rainforest), a semi-natural ecosystem (such as managed forest) or a human land-use type (irrigated crop land). Ibid.

[60] For example, due to construction of a dam, surface area of floodplains downstream changes (physical changes), downstream fish productivity change (biophysical impact), and this in turn influences society through transformation in economic livelihoods of downstream fisher folk, Slootweg *et al*., 2001.

[61] The word "*indirect*", in this case, refers to the fact that the impacts on humans take place through biophysical changes and impacts; in contrast to the *direct human impacts* where the proposed intervention is directed at society itself (discussion on *direct human impacts* is presented in the following section). The word "*human*" instead of "*social*" is introduced to avoid semantic discussions on what should be considered "*social*" impacts. The term *human impact* is defined as the real and perceived impacts experienced by human beings (at individual and higher aggregation levels) as a result of *biophysical* (*indirect*) and/or *social change processes* (*direct*) caused by planned *interventions*. It is assumed that human impacts encompass all final impact variables/indicators that are studied in EIAs, SIAs, health impact assessments and even biodiversity impact assessments, given that the maintenance of biological diversity (a function of nature) is currently valued by society (as an ecological value) to guarantee the livelihoods of future generations. Ibid.

In contrast to biophysical (environmental) impacts, human impacts occur as soon as there are changes in social conditions, even from the time when a project is anticipated. People in the local community do not simply experience social changes; they react to them and are able to anticipate them. This makes the assessment of social changes and human impacts difficult and situation-specific. In this context, human impacts should be evaluated in the broadest sense. They should refer to not only the quantifiable variables/indicators, such as economic or demographic issues, but also the alterations in people's values, beliefs and perceptions about the society in which they live, the gendered differentiation of impacts and all other aspects of life.

Considering the distinction between biophysical changes and biophysical impacts, Slootweg *et al*. (2001) argue that a distinction between *social change processes* and *human impacts* should be identified in the social setting since policies or project interventions cause social change processes which are intended (such as conversion of economic activities) or unintended (such as job loss). Social change processes are set in motion by project activities or policies, and they take place regardless of the social context of society (groups, nations or religions)[62]. Social change processes can be measured objectively, independent of the local context. Under certain conditions, depending on the characteristics of the existing community (the local social setting) and mitigation measures that are put in place, the social change processes can lead to human impacts. Conceptually, an "impact" has to be experienced or felt in a corporeal (physical) or cognitive (perceptual) sense, whether at the level of individuals, households, communities and the society[63]. The ways in which social change processes are perceived or valued, depend on the social context in which various societal groups act. Some sectors or groups in society are able to adapt quickly and make use of the opportunities of a new situation; however, others, especially vulnerable groups, are less able to adapt and will bear most of the negative consequences of change. Therefore, social impacts are implicitly context-dependent.

Figure 3-3 below presented by Slootweg *et al*. (2001) provides a revised version of the framework combining all elements: the biophysical setting, the social setting and inter-linkages. It particularly shows that the social setting can be influenced by interventions through two pathways: *indirect* and *direct*. *Indirect human impacts* result from changes in the natural resource base and its derived functions (*biophysical impacts*). *Direct human impacts* originate directly from social interventions via the social change processes and are either especially designed to influence the social setting (objectives) or an unintended consequence of the intervention. Change has a way of creating other direct or indirect changes. *Social change processes* that are resulted directly from the intervention, the so-called "first-order changes", can lead to (several) other social change processes, e.g., the second- and

[62] For example, the resettlement or relocation of local people owing to the building of a dam, or the influx of new residents, whether permanent, seasonal or weekender's, are all social change processes and are not in themselves social impacts. Thus, the many impact variables/indicators commonly measured in SIA studies (change in population size, relocation of individuals and families) are actually social change processes. Ibid.

[63] An increase in population, or the presence of strangers, is a social change process and not the experienced impact: the experienced impact is likely to be the changed perception of the nature of the community (communalness, community cohesion), of the individual's personal attachment to the community and possible annoyance and personal disturbance as a result of the project. Ibid.

higher-order change processes[64]. The social experience of change (*human impacts*) can also prompt people to undertake other behaviour or cause further social change processes[65].

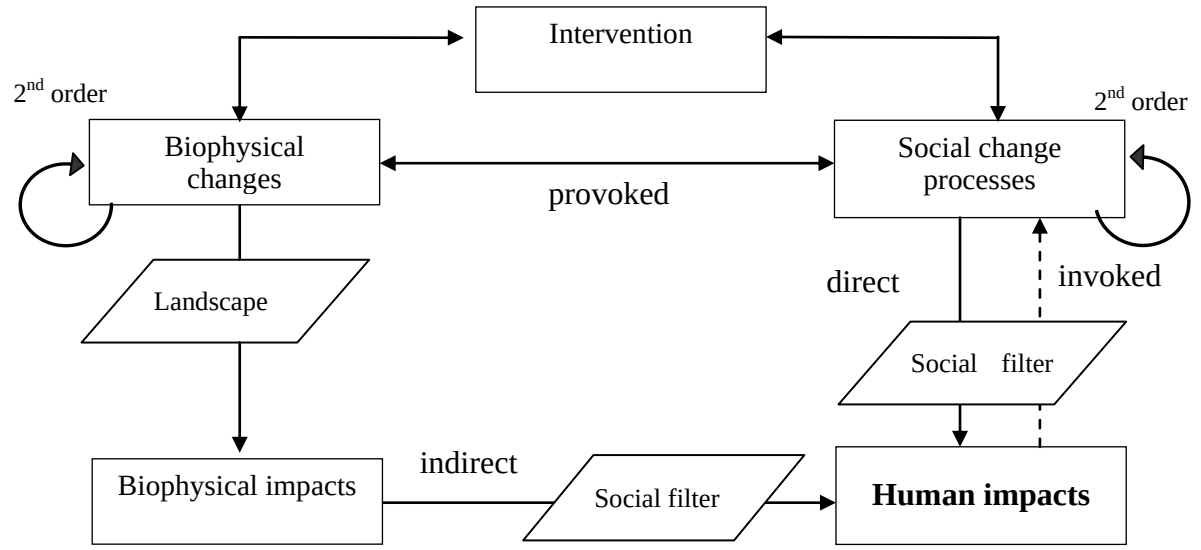

Figure 3-3: Pathways yielding biophysical and human impacts (indirect and direct)

Source: Slootweg, Vanclay and van Schooten, 2001 in Becker et al. 2003

Social change processes can also provoke *biophysical changes*[66]. Biophysical changes may affect the functions/opportunities which the environment provides for the people[67]. Analogous to the landscape filter in the biophysical setting, a *social group filter*[68] is conceived which aims to narrow down the long list of potential human impacts and to

[64] Example as resettlement can lead to processes of rural to urban migration and changes in food production, Slootweg 2001.

[65] Example as the negative human impacts (experiences) associated with unemployment can activate the social changes process of rural to urban migration in search of work. Ibid.

[66] Economic developments which increase number of tourists in a particular area can have a serious influence on land use and water quality, which in turn have indirect human impacts through a reduction in agricultural production and subsequently on income level of smallholder farmers. Ibid.

[67] For example, if an activity causes land degradation, one of the biophysical impacts may be that the productive capacity of the land will decrease. The resulting reduction of income from farming activities is an indirect human impact. Biophysical changes can also have effects on disease organisms or disease vectors that can lead to health impacts. The introduction of irrigation agriculture leads to social change processes such as the creation of jobs and an increase in food supply. These social change processes may result in the raising of social wellbeing as the direct human impact, create breeding sites for mosquitoes and snails as the biophysical changes, resulting in *biophysical impacts* such as the increased transmission of malaria and schistosomiasis impairing health (an indirect human impact).

[68] The construction of such a social filter in any practical application of this framework appears to be very complicated, and there is resistance amongst SIA professionals to consider the possibility. In biophysical setting, biophysical impacts are related to ecosystems and landscape types. The classification of ecosystems or landscapes into meaningful units is reasonably established and accepted amongst EIA professionals and within the discipline of ecology. In contrast, there is not a generally accepted classification of social groupings for which sufficient knowledge exists to make predictions about the likely experience of human impacts. Further, landscape or ecosystem units have common elements around the world, but cultural grouping tends to be unique in many respects. The concept of a social filter still needs further thinking. Some experienced social scientists suggest that the social filters might mean the intrinsic social filter mechanisms that exist in the community. Ibid.

identify the relevant impacts for that group by using information about the types of social groups present. The filter would be placed between the social change processes and the human impacts and between the biophysical impacts and the human impacts.

The integration framework in Figure 3-3 is an attempt to provide a means to structure social and biophysical knowledge in impact assessment. The framework not only identifies the pathways (causal chains) by which environmental (indirect) and social impacts (direct human impacts) may result from proposed projects, but also assists in thinking about a full range of social impacts (which are composed of social change processes and human impacts) that are likely to occur from a given intervention.

3.4 Conceptual framework of SIA: focusing on changes in social setting

Another conceptual framework of SIA, depicted in Figure 3-4, focuses more on the changes in social setting as the result of a specific development intervention, providing even more details as to elements in the social change process and human impacts, which altogether are social impacts. This framework developed by Barrow (2000) is highly consistent with the integration framework of Slootweg *et al*. (2001), and is especially referential for conceptualization of the social impacts in the empirical context.

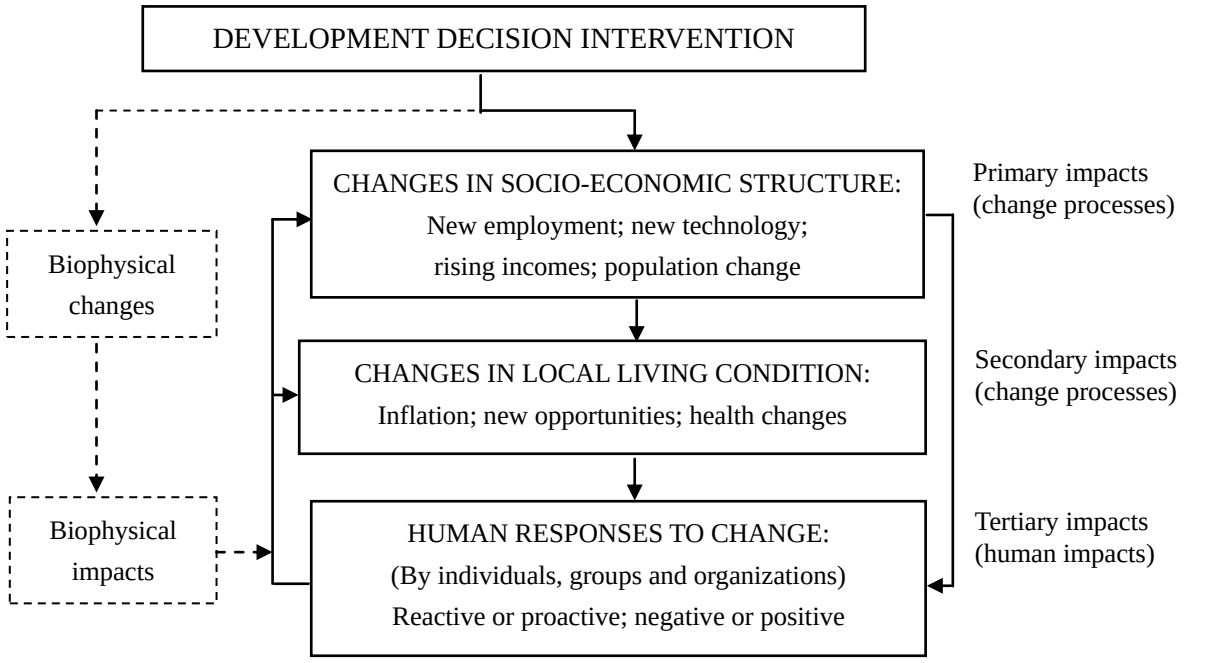

Figure 3-4: Social change processes and human impacts in social setting resulting from an intervention

Source: Adapted from Barrow, 2000; refined by the author, 2007

Barrow (2000) points out that SIA framework should focus on society and the individual, showing "who gets what", and in this way promote sustainable development, human rights, social justice, and overall development. He holds that *development decision intervention*

leads to the *primary social change* processes such as transformations in the *socio-economic structure* (*employment*, *technology*, *income*, *population* and so on) and other social change processes also include *alterations in local living conditions* (*change in inflation*, *opportunities*, *health situation* etc.). These social change processes directly influence *responses of individuals, groups and organizations*, some *reactive*, some *proactive*, some *negative* and some *positive*. This is the so-called "*tertiary impacts*" or "*human impacts*", the impacts felt or experienced by the people who are the intervention's terminal objectives.

Since Barrow's framework for SIA focuses mainly on the society and the individual (the social system), the changes and impacts of the biophysical system and their indirect influence on social impacts have not been clearly delineated (shown with broken lines in Figure 3-7).

Ideally, a number of different conceptual frameworks shape the conceptual approach for SIA, but efforts have to be made to select the most appropriate combination to create a framework for each situation, because "*each situation is unique and SIA studies are by definition context specific*" (Barrow 2000).

3.5 Human ecosystem as an organizing concept for SIA

3.5.1 Concept of human ecology and human ecosystem[69] models

Human ecology[70] is the science of the coherence and interactions between society, human

[69] The term "ecosystem" was holistically defined by Tansley (1935:65) as "the whole system (in the sense of physics), including organism-complex and the whole complex of physical factors forming all the environment of the biome – the habitat factors in the widest sense". The term achieved common application by E. P. Odum, the use of the "ecosystem" as an organizing concept in his 1953 text, "The Fundamentals of Ecology".

The "human ecosystem" was then defined in the POET Model of Duncan in 1964, as the interaction between *population*, *organization*, and *technology* in response to the *environment* (Catton 1982; Duncan 1964). These were to be human ecology's "master variables" and became the human ecologist's central concern.

Anthropologists Steward (1955) and Bennett (1976) employed the ecosystem as a tool for organizing fieldwork and research in 1950s and 1970s. In the 1980s and early 1990s, anthropologists such as Moran (1990), sociologists such as Burch (Burch and DeLuca 1984) and ecologists such as Odum (1983) and Odum (1993) employed the concept of human ecosystem as a theoretical framework. It was applied to archaeological research (Butzer 1990), energy policy (Burch and DeLuca 1984), threats to national parks (Machlis and Tichnell 1985), and anthropogenic impacts on biodiversity (Machlis 1992).

[70] The roots of the human ecology lie primarily in general ecology, sociology, and anthropology (Field and Burch 1988; Micklin 1977; Hawley 1950, 1986). Haeckel states that human ecology uses the relation of organisms and environment for its research of social environment of human societies. Sociologists at the University of Chicago in 1920s and 1930s initiated the application of general ecological principles to human activity. Sociologists Park and Burgess (1921) drew analogies between human and non-human communities, describing society's symbiotic and competitive relationships as an organic web (Faris 1967). They treated the community (for them, that meant the city) as a key unit of small scale human ecosystem for analysis. The limited focus on spatial relationships and urban life eventually led to a search for a more holistic framework.

Ernst Haeckel, German zoologist and nature philosopher, advocate of Darwin's "Theory of evolution" and founder of the ecology. "Unter Ökologie verstehen wir die gesamte Wissenschaft von den Beziehungen des Organismus zur umgebenden Aussenwelt, wohin wir im weiteren Sinne alle ‚Existenz-Bedingungen' rechnen können. Diese sind theils organischer, theils anorganischer Natur [...] Als organische Existenz-Bedingungen betrachten Wir die sämmtlichen Verhältnesse des Organismus zu allen übrigen Organismen, mit denen er in Berührung kommt, und von denen die meisten entweder zu seinem Nutzen oder seinem Schaden beitragen" (Haeckel 1866).

The research of R .E. Park was on the urban development process (put the urban community as a key unit of analysis). The

being and environment. It focuses on a holistic reflection of the ecological, social, cultural, economical and political aspects (Glaeser 2003).

Studies in human ecology have employed a number of very different conceptual approaches, each one presenting a specific conceptual model (Rambo 1983)[71]. This section reviews only two contemporary conceptual models which are very relevant to conceptualization of SIA applied to this empirical context. They provide a theoretical support for the conceptualization of social impacts in a scale of local small forest-dependent communities. These two models are: Systems model of human ecology (Marten 2001) and Human ecosystem model (Machlis 1997). In the following paragraph both models are discussed in relation to the integration framework of Slootweg (2001), but only within the context of a local small community.

3.5.2 Systems model of human ecology

"*Although humans are part of the ecosystem, it is useful to think of human-environment interaction as interaction between the human social system and the rest of the ecosystem*" (Marten 2001:3). A simplified diagram of the basic structure and functional relationship involved in Marten's Systems model of human ecology is illustrated in Figure 3-5.

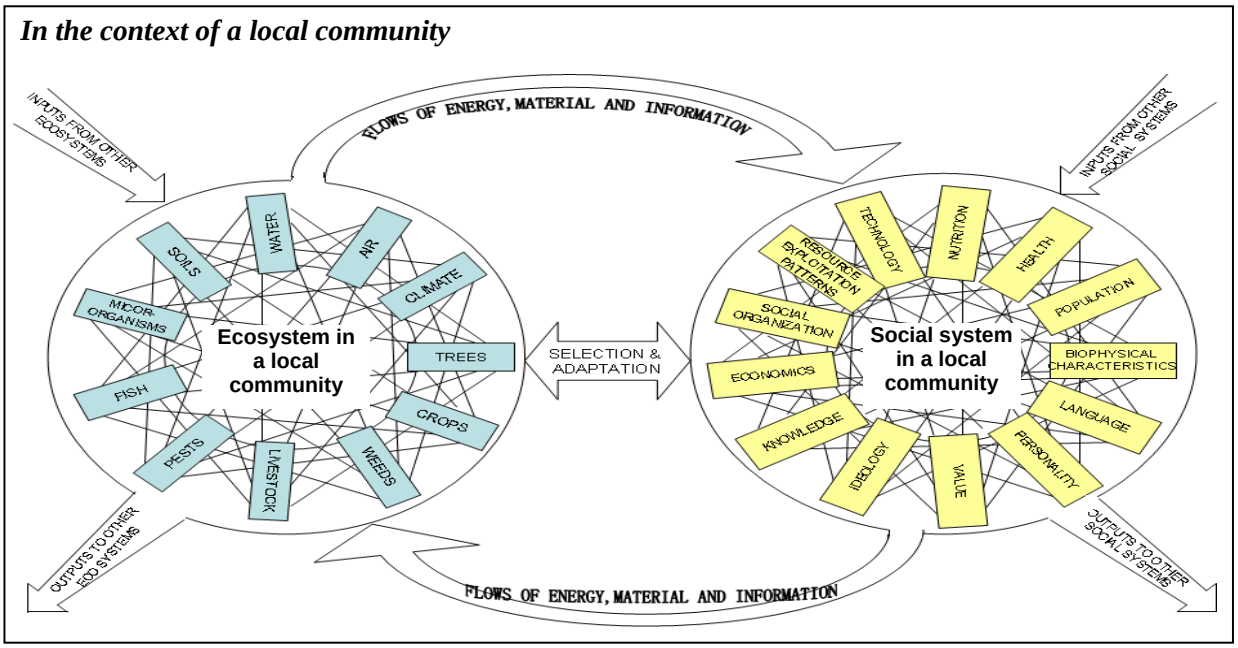

Figure 3-5: Interaction between social system and ecosystem in a scale of local small community

Source: Adapted from Marten, 2001; fine-tuned by the author, 2007

Marten's model views human ecosystems as composed of two interrelated and interacting

center of attention was the urban way of living as relationships of neighborhoods, forms of interaction and communication, competition and social strata (Haberl 2003, Teherani-Kroenner 1992a, 1992b).

[71] Park's Human Ecological Pyramid; Duncan's Ecological Complex – POET Model; Steiner's Triangle of Human Ecology – Attempt of a Common Human Ecology; and Fischer-Kowalski's Social Ecology - The Concept of Social Metabolism as well as the Approach of the Colonization of Natural Systems (Marina Fischer-Kowalski).

subsystems – the *biophysical system (ecosystem)*[72] which includes the natural world and the biophysical context of human existence, providing services to the social system; and the *social system*[73] which includes the socio-economic and cultural components of human life and shapes their behaviour (Marten 2001:5). The *social system* is the central concept in human ecosystems, since human activities, exerting an impact on ecosystems, are strongly influenced by society in which people live (Marten 2001).

Marten's model describes social systems as they interact with ecological systems. *Adaptation* is assumed to occur at the level of the total social system. Both the social system and the ecosystem with which it interacts retain their integrity as systems, with each changing its structural configuration according to its internal dynamics. Each system receives inputs (energy, material and information) from the other, and these inputs also influence its structure and functioning. Each system is open to influences from other systems of the same kind, so that a social system may be altered by inputs received from a neighbouring social system, and an ecosystem may be changed by inputs from another ecosystem as well. Change occurs in the institutions making up the social system in response to inputs from the ecosystems, either primary (indirect impact) or secondary (direct impact)[74]. Social system changes in response to inputs from the ecosystem may be and often are *adaptive*, which means they contribute to the continuing survival of the social system under changed environmental conditions. However, they need not result in a better or happier way of life for individual human participants. It is the social system itself (that is, social change processes), rather than the people who are involved in it (human impacts), that is the unit of natural *selection* and *adaptation.* Adaptation and selection are assumed to occur at the level of the total social system and the rest of the ecosystem (Marten 2001).

From the discussion above, it can be seen that a high consistence lies between this model and the integration framework of Slootweg *et al*. (2001) in terms of the dynamic mechanism of changes and impacts in the social system as a result of interventions.

Meanwhile, Marten supports the concept that the human ecosystem can be on any scale: villages, towns, and large cities or even the whole planet that can represent different scales of

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[72] The *biophysical system* provides services to social system by moving *materials*, *energy* and *information* to social system to meet people's needs (e.g., the *water*, *fuel*, *food*, *materials* for clothing, construction materials and recreation etc). Every material object contains energy, most conspicuously food and fuels, and every object contains information in the way it is structured or organized. For example, a farmer's observation of his field prior to planting, a city dweller's assessment of traffic when crossing the street, and a refreshing walk in the woods are all transfers of information from ecosystem to social system. In the opposite direction, the material, energy and information also move from social system to ecosystem as a consequence of human activities that impact the ecosystem (Marten 2001).

[73] The *social system* is everything about people, their *population* and the *psychology* and *social organization* that shape their behaviour. *Values* and *knowledge*, which together form the world view of human beings as individuals and as a society, shape the way that people process and interpret information and translate it into action. *Technology* defines the repertoire of possible actions. *Social organization*, and the *social institution* specify socially acceptable behaviour, shape the possibilities as to what people actually do (Marten 2001:3-4).

[74] Such change may be either *primary* (the in*direct* impact), as when an increase in the death rate due to environmentally transmitted diseases changes the population structure of a society, or *secondary* (the *direct* impact) as other social system institutions change in response to environmentally generated primary change in one institution. Ibid.

human ecosystems[75]. He points out that a local community can be seen as a combination of the social system (e.g., its population, social organizations such as farm associations, the value and perceptions of individual farmers, etc.) and the rest of the ecosystem (natural resources such as trees, crops, soil, water, etc.). This point of view provides a potent basis for application of the integration framework (Slootweg *et al*. 2001) on the scale of a local community. The elements constituting human ecosystems defined in Marten's model (2001) provide the possible social indicators which are referential for conceptualization of social impacts on the scale of the local forest-dependent community. This is thought to be the most important contribution of the model to this empirical study.

3.5.3 Concept model of human ecosystems

Similar to Marten's model, Machlis *et al*. (1997) define the "human ecosystem" as a coherent system of *critical resources*[76] which provide the system with necessary supplies and keep human ecosystem functioning, and *human social system*[77], the set of general social structures and factors that guide much of people's behaviour, and are capable of regulation, adaptation and sustainability over time. Figure 3-6 displays the Machlis's Human ecosystem model, outlining the elements of a general human ecosystem and their interrelations. More explanations of these key components and variables/indicators in the Model are provided in Appendix 1, and they serve as a guide for defining the measurable social indicators for this empirical study.

Adaptation process between the human social system and resource systems is also regarded as continuous in Machlis' model of human ecosystems[78]. This is corresponding to Marten's model and the integration framework of Slootweg *et al*. (2001) with regard to discussions on interaction between changes of social setting and biophysical setting.

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[75] This concept was also developed enlightened from views of Park *et al*. (1921), see the footnote on page 47.

[76] *Critical resources* are of three kinds: *natural resources* include *energy*, *land*, *water*, *materials*, *nutrients*, *flora* and *fauna*; the *socio-economic resources* include *information*, *population*, *labour*, *capital*; *cultural resources* include *organization*, *beliefs* and *myths*.

[77] *Human social system* in this model is composed of three subsystems: *social institutions*, *social cycles* and *social orders*.

Social institutions are defined as a set of collective solutions to universal social changes or needs. For instance, the collective challenge of maintaining people's health leads to *medical institutions*, which can range from traditional shamans to modern hospital systems, rural health cooperatives, and preventive care. Other social institutions deal with universal challenges such as *justice (law)*, *faith (religious)*, and *sustenance (agriculture and resource management)*.

Social cycles are defined as the series of temporal patterns for allocating people's activity. The important categories are *physiological* (such as *diurnal patterns*), *institutional* (permitted hunting seasons) or *individual* (graveyard shifts) or *environmental* (climate change). Social cycles significantly influence the distribution of critical resources. An example of this is the set of collective rhythms in which a community or culture organizes its calendar, festivals, harvests, fishing seasons, business days, and so forth.

Social orders are defined as a set of cultural patterns for organizing interaction among people and groups. It includes three key mechanisms for ordering behaviour: *personal identities* (such as *age* or *gender*), *norms* (rules for behaving), and *hierarchies* (e.g., of wealth or power). The *social order* (individually, collectively, and in relationship to social institutions and social cycles) provides high predictability in much of people's behaviour (Machlis *et al*. 1997: 347-367).

[78] Social institutions adapt to changes in resource flows, and in turn, alter such flows. The result is a perpetually dynamic system (Bennett 1976). Hence, the model explains how the forest policy should be applied. For example, political institutions may adapt to the increased demands on forest resources by altering decision-making processes (such as increased public participation) and the resource flow (as when the legal system issues injunctions against timber cutting). Adaptation is used here in a non-valued sense; what is adaptive (or advantageous) for one institution or social group may be maladaptive (or harmful) for another (Bennett 1976, 1993).

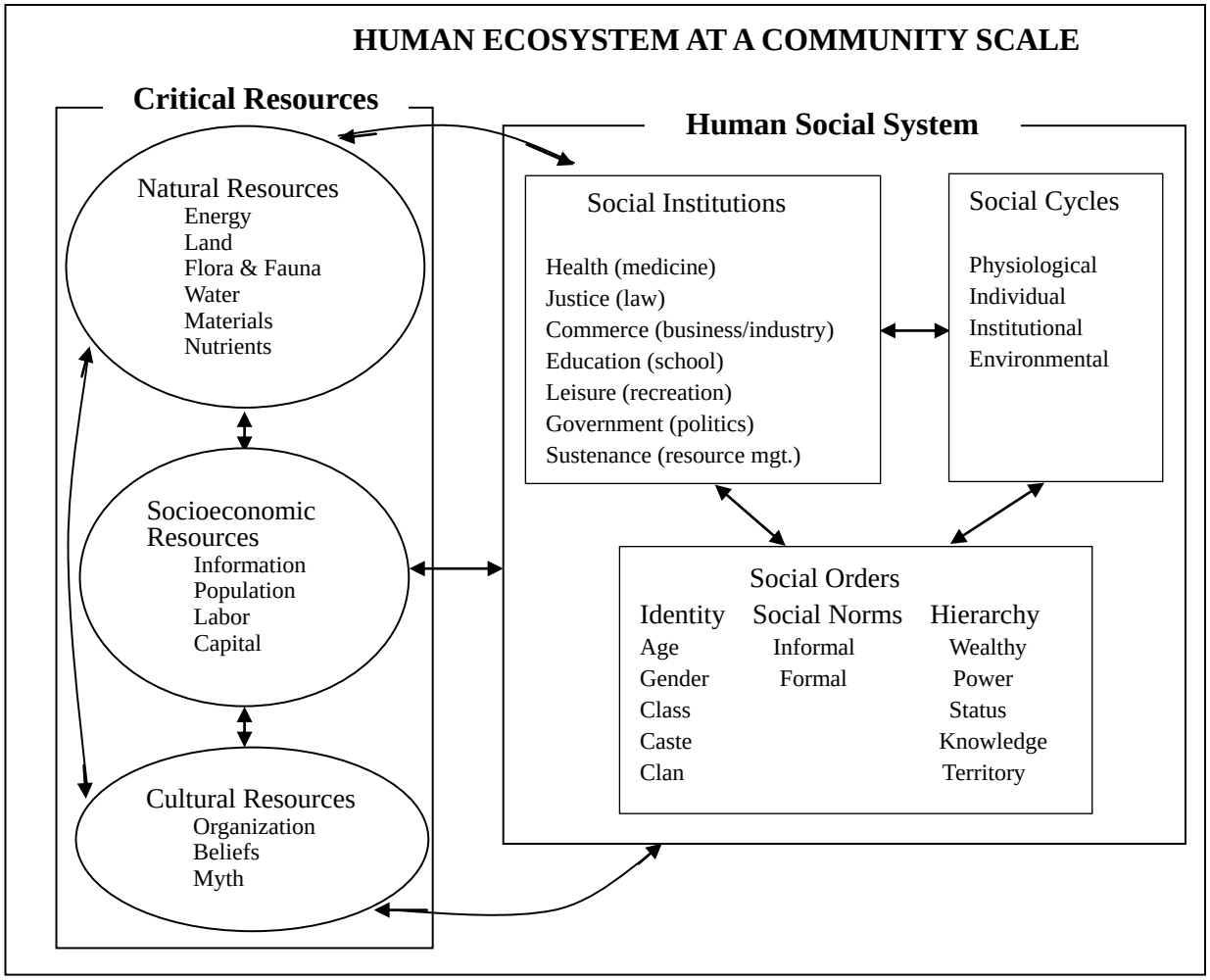


Figure 3-6: A rural community can be considered as a small scale human ecosystem

Source: Adapted and modified from Machlis et al., 1997

Machlis *et al*. (1997) also hold that the scale of human ecosystems can vary. Human ecosystems can be described at several spatial scales, and these scales are hierarchically linked. "*A rural community can be considered a human ecosystem if it exhibits boundaries, resource flows, social structures, and dynamic continuity*" (1997:5). Since a particular human ecosystem may be hierarchically nested with human ecosystems at different scales, the rural community as a small scale of human ecosystem may be linked to larger human ecosystems such as counties, regions and states, and to smaller human ecosystems such as clans or households. Changes in a human ecosystem at one scale may have effects on human ecosystems at larger and smaller scales.

3.5.4 Learning from the two conceptual models of human ecosystem

The two conceptual models have common characteristics. Both models describe the inter-connections between social system and ecosystem. The elements in each system are dynamic and open, inter-connecting with each other at higher or lower levels. Both models agree to the existence of "adaptation" between the social system and ecosystem, but some elements such as cultures and myths may be defined differently in the models. Marten (2001) regards the cultural resources as elements in the social system while the model of Marchlis *et al*. (1997) considers myths together with cultures as belonging to one of the critical natural

resources. Nevertheless, both models offer holistic thinking concerning the interrelations between the people and their surrounding natural resources such as forests.

There are several potential applications of these two models: First, both models can be employed as organizing frameworks for SIAs associated with ecosystem management plans[79]. Such ecosystem management concepts can be applied to various levels, from forest area to local forest-dependent community (village) and higher levels. Models may serve as a guide in capturing the appropriate scale of potential social impacts of a management style. For example, changes in land use or change in forest use policy (such as a shift from timbering to recreation) may impact a range of social institutions.

Second, both models can be served as guides for the development of social indicators for SIAs in a small scale of forest-dependent local communities. Social indicators have been used traditionally in policy decision-making for a long time. At present, they are experimentally used in natural resource (forest) management. There is the potential to develop a set of social indicators for small local communities. Forest managers have already employed biophysical indicators for assessing stream quality, tree growth, and soil erosion. Forest managers also need the social indicators to guide forest policy decision-making and to monitor the effects of on-the-ground forest management actions on local communities. A systematical application of social indicators may be resulted in an "adaptive management" [80] of the local forests (Force & Machlis 1997).

Third, the models can be used as a basis for monitoring other programs directly tied into the activities of natural resource agencies. By collecting and learning from data related to the Model's variables and indicators, management alternatives that meet local needs for sustenance and long-term requirements for sustainability may be devised[81]. Predicting such variation is an important ecosystem management skill.

Fourth, the Models offer an intellectual crossroad for multi-disciplinary scientists working on issues related to a local forest-dependent community. Because the models are derived from numerous disciplines and explicitly multi-scaled, there are opportunities for economists, anthropologists, geographers, political scientists, sociologists, and others to link their work and findings, in order to contribute to the models' overall improvement.

[79] There are numerous definitions of ecosystem management, as well as vigorous debates (see the August 1994 issue of The Journal of Forestry). Moote *et al*., synthesizing the literature, provide a serviceable, if generalized, working definition. "Ecosystem management is a management philosophy which focuses on desired status, rather than system outputs, and which recognizes the need to protect or restore critical ecological components, functions, and structures in order to sustain resources in perpetuity" (Moote *et al*. 1994:1). Definitions describe five principles central to ecosystem management: (1) socially defined goals and management objectives, (2) integrated holistic science, (3) broad spatial and temporal scales, (4) adaptable institutions, and (5) collaborative decision making. The actual practice of ecosystem management may be considerably less inclusive.

[80] Based on the recognition of adaptation process, both conceptual models of human ecosystem were used to select a set of social indicators for monitoring ecosystem management in the Upper Columbia River Basin. Similar efforts have utility for other critical regions, from South Florida to Chesapeake Bay to the Mississippi Delta to Puget Sound, presented in the article "The human ecosystem part Π: Social indicators in ecosystem management. Society and Natural Resources 10:369-382, Machlis *et al*. 1997.

[81] For example, the emphasized role of social institutions in ecosystem order (from health to business to faith) suggest that the inclusion of local leaders beyond the typical political and special interest representatives may be of significant benefits for public planning. Human ecosystems with weak or sound institutions may respond very differently to a manager's plan for altered timber harvests, special management zones, wilderness areas, and other forms of ecosystem manipulations.

Golley (1993) notes the possibilities of this shared approach:

> *"It is not clear to me where ecology ends and the study of the ethics of nature begins, nor is it clear to me where biological ecology ends and human ecology begins. These divisions become less and less useful. Clearly, the ecosystem, for some at least, has provided a basis for moving beyond strictly scientific questions to deeper questions of how humans should live with each other and the environment. In that sense, the ecosystem concept continues to grow and develop as it serves a larger purpose."* (Golley 1993:205)

In summery, both concept models from Martin (2000) and Marchlis *et al*. (1997) have great potential as an organizing concept for SIAs and ecosystem management, particularly when SIAs are applied into natural resource-dependent local communities. However, the models of human ecosystem, the selection of variables/indicators and the importance which has been placed on them are preliminary. The models must be tested, applied and revised. Also they must go through the same "adaptive management" cycles requiring ecosystem management techniques that are applied to forests, grasslands, parks, and reserves (Machlis *et. al*.1997).

3.5.5 A local forest-dependent community as a small scale human ecosystem

The conceptual models from Martin (2000) and Marchlis *et al*. (1997) both support a concept that a rural community, such as a forest-dependent community, can be considered as a small scale human ecosystem if it exhibits boundaries, resource flows, social structures and dynamic continuity. Based on this concept, it is accepted that a local forest-dependent community can be treated as a human ecosystem with similar social structures, resource flows which may be dominated by forests and is part of the dynamic continuity interrelating and interacting with other human ecosystems in either higher scales such as towns, counties, regions and states or lower scales as clans and households.

A simplified diagram of the basic structure and functional relationship between the social system and biophysical system involved in a local forest-dependent community is illustrated in Figure 3-7. It is assumed that the local forest-dependent community is a small scale human ecosystem consisting of two interrelated and interacting subsystems – the *ecosystem system* which includes the natural world (dominated by forests) and the *social system* that emphasizes the context of people's existence and reliance on the natural resources. Forest resources like trees, timber, fuel wood and Non-Timber Forest Products (NTFPs) may dominate as the main natural resources used for the sustenance and income generation, but in addition, crops (agriculture), livestock and water also might be important resources for local needs. The social system in the local forest-dependent community may include the socio-economic and cultural components of the local life dependent on local forest use. The social system contains the components in a local community, for instance, the *population*, *health*, *education*, *social organization*, *institution*, *economics*, the (forest) *resource use patterns, knowledge*, *technology*, *values/beliefs* and *perceptions* concerning nature and forests. However, compared with a general local community, whether there are unique components or characteristics in a forest-dependent community, remain still questions and need to be further researched.

Although each subsystem is internally dynamic and in large part autonomous in this conceptual model, it is nevertheless clear that many of the elements within each subsystem frequently interact with and systemically affect elements and patterns of the other subsystem. For example, decrease in the forest resources in the local forest community may heavily influence the patterns of local economic activities which tie to local forest use, which in turn affects other socio-cultural components such as forest related technology and social organization (farmer associations and forestry extension services) which further influence people's values and beliefs, concerning forests and these perceptual changes, in turn shape people's behaviour and change the local conditions of the forest.

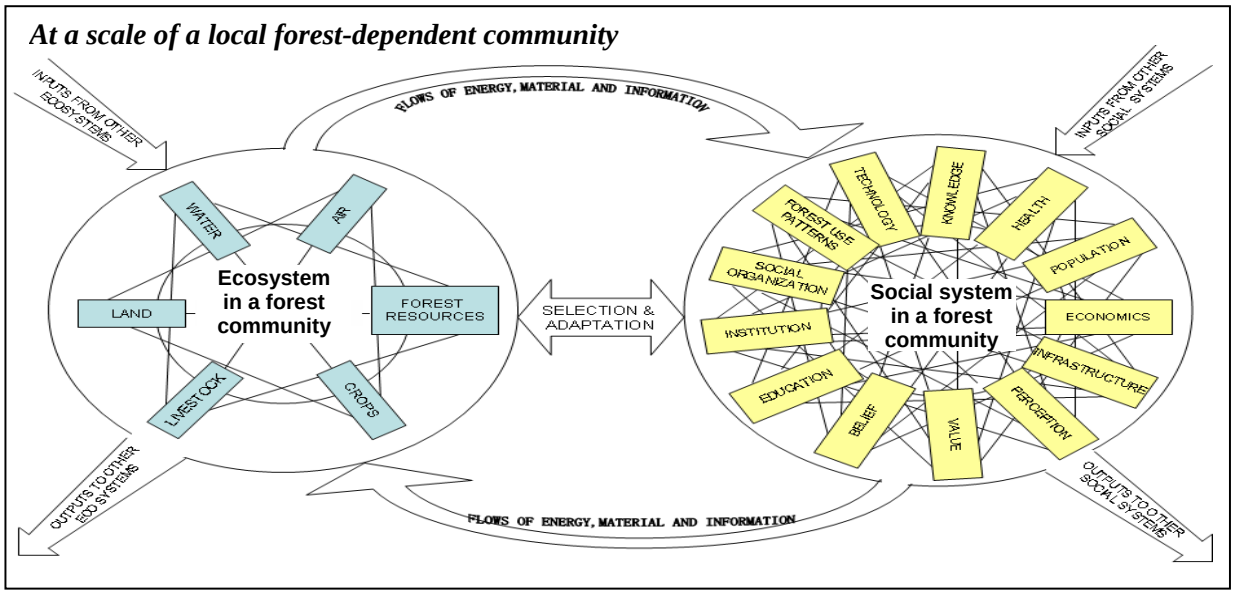


Figure 3-7: Characteristics of a local forest-dependent community as a small scale human ecosystem

Source: Adopted from Marten, 2001, refined by the author, 2007

"Adaptation" is also continuous in this conceptual model: social institutions adapt to changes in resource flows and alter such flows in turn, creating a perpetually dynamic system. The conceptual model of a local forest-dependent community shows how forest policy can work. For example, political institutions may adapt to the increased demands on forest resources by altering decision-making processes such as increased public participation and the resource flow, when the legal system issues injunctions against the timber cutting.

A local forest-dependent community as a small scale human ecosystem is an open system that impacts and is affected by larger scales as towns, counties and states, and smaller scales as clans and households. For example, a rise in rural unemployment may impact family health condition, increase demands on community doctors and deplete state medical funds; while an increased demand on the forest resource may give rise to a forest resource crisis, trigger a national forest policy change, alter the ways of local people's using or preserving the forests, negatively affect the local forest-based economy, increase the rural unemployment, and decrease household income. Hence, this section provides a conceptual background for the

application of the integration framework (Slootweg *et al*. 2001) to the empirical context of a local forest-dependent community.

3.6 Framework conceptualizing social impacts in the empirical context

The objective of the empirical study is to understand the social impacts of the NFPP on the local forest-dependent communities and households. Enlightened from the above-mentioned conceptual frameworks and models, Figure 3-8 illustrates a conceptual framework/operational model[82] especially designed for this empirical study. The model presents the interplay between the selected research indicators, and how they are employed to capture and measure the social impacts (the *de facto* impacts) on local forest-dependent communities and households as the result of the NFPP implementation. The empirical study concentrates on more detailed social change processes and human impacts in the local social system rather than biophysical changes as the result of the NFPP (which means, the impacts in the biophysical system, e.g., changes in forest quality and area, are not analysed in the study).

As shown in Figure 3-8, the NFPP implementation is characterized as a "top-down" process which follows from higher levels (province, county and town) to the local village community and household level. At the level of the local forest-dependent community considered as a small-scale human ecosystem, the implementation of the NFPP is assumed to affect the following four categories of social change processes and the human impacts:

Category A: *Community population characteristics*; Category B: *Community/institutional arrangements*; Category C: *Community infrastructure/public services*; and Category D: *Individual/family impacts*.

Twelve indicators are selected for measuring change within the four categories. Under Category A, *Community population characteristics*, the measurable indicators are *population size* and *percentage of people living under the poverty line*. Category B, *Community/institutional arrangements* considers as indicators *Size/structure of local government*, *regulations regarding access to forests (formal/informal)* and *economy/industrial diversification*. Category C, *Community infrastructure/public services*, measures *Infrastructure (transport, education, health care)* and *land use patterns*. These seven social indicators measure the three categories of social change processes at the level of local community, and these three categories of social changes integrate and influence each other, directly resulting in the changes at the level of households.

The following five social indicators measure the changes/human impacts within the household, i.e. Category D, *Individual/family impacts*: *household income derivation*, *household expenditure (alternative energy costs)*, *household labour time distribution*, *perceptions on public health/safety* and *forest values as perceived by people* (see Figure 3-9).

[82] Even though the local community as a small scale "human ecosystem" includes the biophysical system and the social system, the model also indicates that the biophysical change process/impacts result from the NFPP (such as change in natural forests) will indirectly influence the human impacts, the model emphasizes the change processes and impacts in the social system in the local community, author, 2008.

These four social change categories (A, B, C, and D) are closely related to each other, interacting and influencing each other as a whole. The change in one category could result in change in another. For instance, the increase in population size in the local community may result in the stricter regulation on access to forests, and may consequently impact the use of infrastructure and public services. As a result, less income of household derived from forestry may be compensated by income derived from other economic sources, such as business and migration work[83]. The households then spend less labour time on forest activities and more time on farming, business or even recreation. Finally the local household may place a different value on the forest, regarding it less as a source of income and more as environmentally important.

The model also indicates the possibility of the influence from external/internal factors on the extent of aggregate social impacts. The study assumes that the extents of social impacts of the NFPP differ in local communities of the state-owned forest area and the collective forest area. Thereby, different strategies and mitigation measures are required for a better implementation of the NFPP in local communities of forest areas with different kinds of ownership structures.

The selection of appropriate indicators used for this empirical study is based on the following four principles:

- The selection of research indicators is based on the applicable scientific literature, referring to theories and concepts as well as to the social indicators applied in previous SIA research (as presented in Chapter 2);
- The selection of research indicators should reveal the unique socio-economic context in case study areas in China, especially considering the characteristics of the NFPP as applied to local forest-dependent communities and households (Chapter 5 presents more details);
- The selection of research indicators integrates the quantitative and qualitative indicators as this empirical research employs the quantitative and qualitative combined approach (more discussions are presented in Chapter 4 and 7);
- Chapter 4 presents the definition and operationalization of each indicator selected for this study, the obtained evaluation results attributed to the NFPP implementation, and how to collect and measure data in the field.

[83] In the dissertation there are more evidences showing these relationships among the four categories of changes in the local communities in the case study areas. It is presented and discussed in more detail in later chapters, author, 2008

3.7 Research questions

In an exploratory research, the researcher's goal is to formulate more precise questions that future research can answer. Exploratory research rarely yields definitive answers; it addresses the "what" questions (Neuman 1994).

The conceptual framework and theoretical perspectives presented in previous sections[84] provide a scientific background for formulation of research questions which are as follows:

Q.1 What kinds of changes in local population characteristics have been introduced by the NFPP implementation in local forest-dependent communities?

Q.2 What have been brought as changes to the institutional arrangements in local forest-dependent communities because of the NFPP implementation?

Q.3 What have been changed in conditions of local infrastructure and public services by the NFPP implementation in local forest-dependent communities?

Q.4 What kinds of impacts have been introduced to the individuals and families in local forest-dependent communities because of the NFPP implementation?

Q.5 What are external factors at the local community level that influence the extent of social impacts of the NFPP implementation?

Q.6 What are internal factors at the local household level that influence the extent of social impacts of the NFPP implementation?

Q.7 What are the roles of strategies which are initiated and developed by local communities and households to cope with the negative social impacts of the NFPP and for their better survival?

Q.8 As the NFPP is continuously implemented, what are the optimal strategies likely supported and developed for a harmonization between the livelihood and the NFPP implementation?

Q.9 What are the interactions among the changes, strategies, internal and external factors in a model of a local forest-dependent community along with the NFPP implementation?

Among the above nine research questions, the first four research questions are investigated and answered by measuring and analyzing twelve selected social indicators and their respective verifiers (see Table 3-2). These four research questions also refer to the four categories of social impacts illustrated in conceptual framework, respectively (see Figure 3-8). Even though, an exploratory research frequently uses qualitative data (Neuman 1994); this empirical study employs a quantitative and qualitative combined approach[85]. Defining and

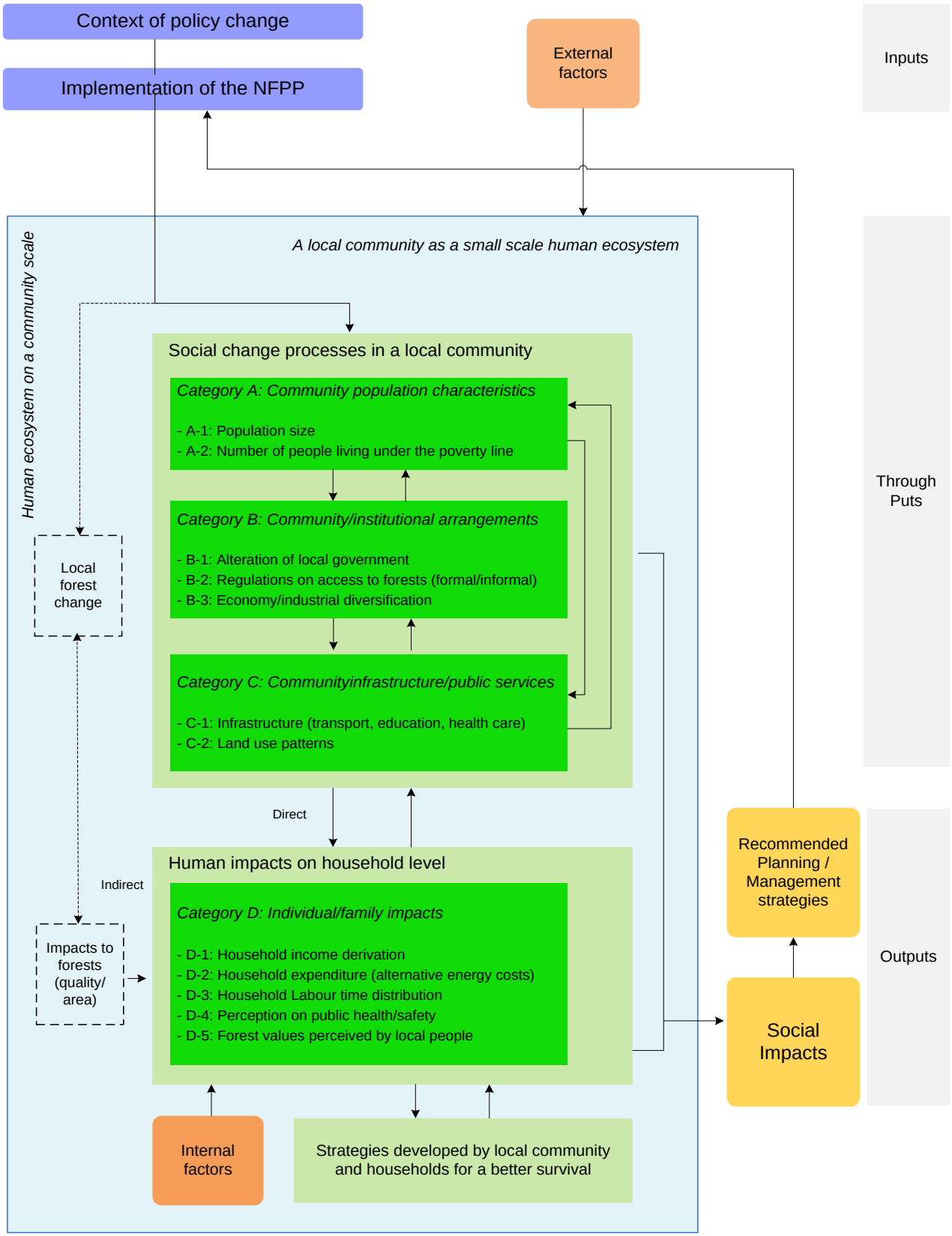
[84] See previous sections on pages of 38-52.

[85] As it measures not only the households' income and expenditure, but also the values, perceptions of local farmers. More discussions on quantitative and qualitative approaches are presented in later chapters.

operationalizing the research indicators are presented in the following Chapter 4, Methodology.

Table 3-2: Research questions and corresponding research indicators

Research questions	Categories of impacts	Corresponding research indicators and verifiers
Q.1	A. Impacts on the community population characteristics	A-1. Population size A-2. Percentage of population living under the poverty line
Q.2	B. Impacts on the community and institutional arrangements	B-1. Size/structure of local government/rule systems B-2. Regulations on access to forests (formal/informal) B-3. Economy/industrial diversification
Q.3	C. Impacts on the community infrastructure and public services	C-1. Infrastructure and public services ➢ Transport (number/quality of roads) ➢ Education (No./quality of schools, enrolment rate) ➢ Health care (number/quality of hospitals) C-2. Land use patterns
Q.4	D. Impacts on the individuals and families	D-1. Household income derivation D-2. Household expenditure (alternative energy costs) D-3. Household labour time distribution D-4. Local perceptions on the public health/safety ➢ Opinions of natural environmental condition ➢ Perceptions on public health ➢ Perceptions on future security D-5. Local forest values perceived by individuals



*Note: the broken lines mean that the part of the biophysical change and impacts will not be the main focus for this research.

Figure 3-8: Conceptual framework/operational model for the empirical study

Source: from the field research, 2007

4 RESEARCH METHDOLOGY

4.1 Defining and operationalizing the research indicators

4.1.1 Foundation of the definition

Since defining variables and indicators was not common in previous SIA research, current attempts to define social indicators in this empirical research are exploratory. The definition of each indicator is made according to the following bases:

- The discussions on theories and concepts (de Groots 1992, Machlis *et al*. 1997, Burdge *et al*. 1998, Barrow 2000, Marten 2001, Slootweg *et al*. 2001) in general, and the definitions by Burdge *et al*. (2004) in particular.
- Previous SIA practices and experiences in various sectors (Vanclay *et al*. 1996, Burdge *et al*. 1998), and especially the forestry sector in China (Li *et al*. 2003, Xu *et al*. 2003), considering the characteristics of the NFPP (of which have been presented in Chapter 2).
- Pre-testing and discussion of the indicators with local key informants interviewed in case study areas, to make sure that the selected indicators are feasible, measurable and fit to the context (Chapter 5 provides more details).

Table 4-1 provides an overview on the twelve selected indicators and their verifiers dealing with the four categories of social impacts in the local communities[86]. The table also discloses the unit, scale and level of measurement, data collection methods for each of the indicators, as well as its attribution to the NFPP implementation. In the table, the attribution to NFPP means, the attribution of individual indicator to the impact result of the NFPP implementation, i.e., how much or how significance the indicator attributes to the impact result of the NFPP implementation on local communities and households. As there might be also other projects/policies influencing the case study areas, one of the most difficulties of this research is how to exclude the impact results from other influence factors, and to understand which of impact results measured in the field research are really from the NFPP implementation.[87]

[86] More information about selected research indicators are presented in Appendix 4, including their names, labels, coded values, measurement level and detailed static data obtained in the field.

[87] A methodological discussion on the "attribution gap" is presented in Chapter 4.6 on page 76; it is also discussed in the context of case studies in Chapter 6 and concluded in a synthetical way in Chapter 7.

Table 4-1: Selected research indicators/verifiers, measurement units and data collection tools

Indicator/verifier		Unit of measurement	Scale	Data collection/ analytical level	Attribution to NFPP[88]
A-1: Population size		Capita	Quantitative (scale) &Qualitative	Key informant interview & focus group discussion at community level; Participatory village mapping; Household questionnaire survey /interview; Household questionnaire survey /interview & focus group discussion at household level	**
A-2: Percentage of people under the poverty line		%			**
B-1: Size/structure of local government		Number of staff; structure illustration			**
B-2: Regulations on access to forests (formal/informal)		Description of content of rules, and status of rules (formal/informal); indication of the change status of the rules	Qualitative& Quantitative (nominal &ordinal)		***
	Membership rule				
	Access rule to timber, NTFPs, fuel wood, bamboo shoots and grazing				
	Forest protection				
	Forest fire				
	Penalty of - illegal harvest, forest fire				
	Reward rule				
	Conflict resolution				
	Benefit sharing				
B-3: Local economy/industrial diversification		Yuan/village; proportion to total income	Quantitative (scale& nominal)		***
	Industrial income				
	Agricultural income				
	Forestry Income				
	Pastoral income				
	Construction income				
	Transportation income				
	Restaurant/hotel/other services				
C-1: Infrastructure/public services		Number /quality (good, adequate, bad)	Qualitative& Quantitative (scale& ordinal)		**
	Transport (road)				
	Education (school, enrolment rate)				
	Health care (clinic)				
C-2: Land use change		Ha/village; proportion to total land area (in percentage)	Quantitative (scale& nominal)		*
	Agricultural land				
	Forest land				
	Pastoral land				
	Homestead (mean)				
	Public land				
D-1: Household income structure		Yuan/HH; proportion to total income and expenditure			***
	Crops farming				
	Joint harvesting/transportation				
	NTFPs collection/cultivation				
	Vegetable/medicine plants				
	Livestock raising				
	Fuel wood collection				
	Migration work/business				
	Handcraft/sale				
	Remittance				
D-2: Household expenditure on alternative energy use					***
D-3: Household labor time distribution		Days/year			***
D-4: Local perceptions on public health/safety		Score from +3 to -3 according to opinions	Qualitative& Quantitative (ordinal)		*
	Opinion of ecological condition				
	Perception on public health				
	Perception on future security				
D-5: Forest values perceived by people		Percentage of the HHs agree the value	Quantitative (ordinal& nominal)		**
	Economic values (timber, fuel wood, NTFPs, medicine plants and job opportunities)				
	Ecological values (soil conservation, water supply, flood prevention, climate change and carbon storage)				
	Cultural values (recreation, tourism, feeling of belonging, religious and aesthetic values)				

[88] Here presents only the assumption from the author based on evidences obtained during the pre-testing phase of the field research as well as the secondary information from the literature review. In the table, "***" represents tat the measurement result from the indicator is highly related/attributed to the NFPP. "*" means that the result of the indicator is not very much related/attributed to the NFPP; there might be also other influence factors/projects contributing to the change in this indicator values. "**" is in the middle. More discussions on the attribution of each indicator are presented in Chapter 7, author, 2009.

4.1.2 Defining and operationalizing the selected research indicators

Category A: Community population characteristics

This social change process refers to the changes in number, density or distribution of people in the local communities affected by the NFPP, and focuses on the increase or decrease in the percentage of people living under the poverty line[89]. The magnitude and rate of population changes have important implications for community infrastructure and service requirements. It is a major determinant of other financial and social impacts on the effected community.

A-1: Population size. This indicator is used to determine the change in the number of the people living in the local community before and after the NFPP implementation. The general movements of local people either into or out of a specific geopolitical area in the light of pre- and post- implementation of the NFPP were taken into consideration in the survey by including specific immigration-emigration related questions in the questionnaire. If the increase or decrease of population from 1998 to 2007 is greater than plus or minus five percent[90], the area under analysis may experience significant population impacts (Burdge *et al*. 2004). The difference in population size and the percentages of changes from 1998 to 2007 are entered into sample table 1 (Appendix 2 presents the detailed formulation of sample tables from 1 to 12).

A-2: Percentage of people living under the poverty line. This indicator is used to determine the increase or decrease in the proportion of population receiving the lowest income in the study areas before and after the NFPP implementation. It is an indicator which reflects the extent of equality in the community and household economy, the adequacy of technology, and the sufficiency of transportation and communication infrastructure (Burdge *et al*. 2004). If increase or decrease in the percentage is greater than plus or minus five percent from 1998 to 2007, the impact could be considered as significant (see sample table 2 in Appendix 2).

Category B: Community/institutional arrangements

This social change process refers to the size, hierarchical structure and bureaucratic level of organizations such as local government agencies, NGOs[91], local rule systems[92] and the

[89] UNDP defines the population living under 1 USD per day as the population under the poverty line (UNDP 2002a). In China, the lowest standard of income poverty (absolute poverty, *pinkun xian*) was annually about 637 Yuan (80 USD) per capita (Anon. 2002). In 2003, about 29 million of the rural population in Western China received net annual income less than this poverty line (Anon. 2006). This empirical study defines the people receiving the annual income less than 637 Yuan as the people living under the poverty line, author, 2008.

[90] The standard of plus or minus five percent is referred from *A Community Guide to Social Impact Assessment*, Burdge *et.al*., 2004. "*If the increase or decrease is greater than 5% or 500 persons (if the total community/municipal area is larger than 10,000 persons) the area under analysis may experience significant population impacts and the difference and the percent change should be entered…*" (Burdge *et.al*. 2004:63).

Burdge, R.J is a senior researcher in the field of rural sociology and social impact assessment, and he has worked in this field for over 40 years. He has written over 300 articles, books and papers on social change in rural communities, natural resource and environmental issues, needs assessment surveys, the use of public involvement in the resource decision making process, the social and economic impacts of development projects, the sitting of hazardous and conventional waste facilities as well as natural resource recreation management. He was elected the President of the International Association for Impact Assessment (IAIA) in 1990, and in 1994 received from IAIA the Rose-Hulman Institute of Technology Award for outstanding contributions to the field of impact assessment. In 1996, he was named *Distinguished Rural Sociologist*, the highest honor given by the Rural Sociological Society.

[91] It means the non-government organizations in the local communities such as Farmer Associations at the village level.

commercial sectors in the local community as well as their linkages to the larger political systems. This includes the historical and present patterns of local economy and industrial diversification, occupation opportunities, size and level of activity of voluntary associations, interest groups, organizations, and related regulations and activities regarding local forest resources use. It also includes the institutional and legal processes affecting the efficiency and effectiveness of various organizations that are responsible for the supply (and security of supply) of the goods and services on which people depend. The three indicators under this category are:

B-1: Size/structure of local government. Since changes in the size and complexity of local government generally occur if the NFPP results in an increase or decrease in government related activity, the study must focus on possible changes in the number of staff members and the types of positions necessary to operate the local government[93]. The current funding and staffing levels may prove inadequate to meet demands for rapid infrastructure and service expansion, tax collection, and other types of government support due to changes in population characteristics. Local government may begin to operate more formally and bureaucratically as the volume and complexity of its responsibilities increase. Population increases pressure local government to add more community services, a strain on government may lead to structural alterations. As government becomes more professional and formal in its citizen-relationships, local farmers may experience feelings of alienation. The NFPP implements may disrupt traditional power structures, exacerbating resentment among local farmers towards the changes. The data of this indicator looks at two factors: (1) Whether the skill level present in local government is able to handle expanded government responsibilities (e.g., additional governmental supervision required for the implementation of NFPP and other environmental directives, compliance with state, provincial regulations or building codes designed to maximize the benefits and minimize negative impacts such as loss of economic income and job opportunity); (2) The need for changes in the actual number of local government staffs and structure of government agencies (e.g., by diagram illustration and explanation of the hierarchical structure of the local government before and after the NFPP implementation). If total percentage changes are more than plus or minus 25 percent, the impact of NFPP on local government is considered significant (Burdge *et al*. 2004) (see sample table 3).

B-2: Regulations on the access to forests (formal/informal). This indicator refers to the existence of enabling regulations for local communities' access to their traditional forestlands. This indicator applies not only to government issued laws and measures (formal), but also to rules developed by custom by generations in the community (informal), such as the traditional access to and use right of forest resources and the methods of resolving conflicts.

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[92] In some small or isolated communities, local government is known as local rule system, author, 2007.

[93] According to the pre-testing field research phase, the local government/rule system in the local communities usually includes the following four organizations/systems: the community level of Communist Party Committee which includes the Membership, Youth Union, Women Union and Possemen (trainband); the Village Committee which includes the Membership, Family planning group, Village affaire group, Financial monitoring group, Security group and Conflict management group; Farmer Association which contains the Membership, Fruit grower association, Culturist association and Crops association; and the local NFPP Committee which includes Membership, Forest stewardship and Forest fire, author, 2008.

If new regulation under the NFPP denies village communities traditional access to forest lands, the community may retaliate by overexploiting the forest resources, especially if traditional management has been lost and the forest has been appropriated by another owner or for some other use. Alternatively, a community may also be severely disadvantaged by a change in access rights, leading to overuse of the remaining resource base and the risk of its social disintegration. If traditional usage is prevented, increased pressure on forest resources and social conflict can result, severely affecting the successful implementation of the NFPP in the short term and the achievement of sustainable management of forests in the long run. Respecting traditional rights and local customs will avoid these problems. And since regulations on access of forests differs between state-owned and collective forest areas, recognizing the existence and adequacy of formal and informal regulations already in place can provide the NFPP with a sound legal foundation, so that its goals and objectives will be understood and respected, accomplished and enforced (Li *et al*. 2003, Wang 2005). Data for this indicator are collected by a combination of qualitative and quantitative methods. The categories of regulations concerning local forest use are recorded and noted through interviews and discussions with local key informants, and the answers are scored (score "+1" for answer "Yes" and score "0" for answer "No") in order to compare the situations before and after the NFPP implementation. The regulations on local access to forest use includes the access rules to timbers, NTFPs, fuel wood, bamboo shoots and grazing, regulations on forest protection and forest fires prevention, penalties of illegal harvesting and conflicts resolution (see sample table 4).

***B-3: Economic/industrial diversification*.** This indicator refers to the change in the diversity and the nature of economic activities in the local community from one kind of production to another, considering the change in the patterns of economic activities[94] (various industries and services) within the local community before and after the NFPP implementation. As the NFPP implements, it alters the type of access to local forest resources, restricts uses are relevant to the local economy such as logging and grazing. At the sectional level, the concentration of economic activity refers to the concentration of activity in a single industry; at the local community level, it refers to the concentration of household activity in a single income source. Since the local community is vulnerable if its changed livelihood is based on a single commodity, the capacity to diversify must be present if the benefits of development are to remain within the community. A diverse economy is better able to absorb the impacts and to benefit (Burdge *et al*. 2004). Experience also shows that development could lead to diversification, but the industrial and infrastructure capacity has to be present for the community to capitalize on the benefits (Burdge 1998). New employers are attracted to a diversified economy with diverse amenities. If the number of community economic patterns is large or community industrial/economic incomes are diverse, the community may be in a better position to receive or absorb the benefits or impacts from the NFPP implementation. Otherwise, the NFPP may have harmful impacts on economic diversification, negatively affecting local community development. If significant changes stem from differences in the

[94] At the macro level this might be from agricultural to industrial forms of production; at lower levels, it might be from subsistence farming to cash cropping, or from grazing stock to cropping or to horticulture. In this research, the pattern of economic activities refers to the following categories: industrial, agricultural, forestry, pastoral, construction, transportation, restaurant/hotel and services.

diverse industrial/economic income before and after the NFPP, then the inflation rate between 1998 to 2007 must be considered (see sample table 5).

Category C: Community infrastructure/public services.

This category of social change process involves a general measure of local community development and a description of community services such as transportation, education and health care facilities and services. It also includes information essential for determining sources of human impacts on forest resources, such as easy road that leads to the frequent use of forests, and community infrastructure and services as reflected by the local land use patterns and amenities. Two indicators are analysed:

C-1: Community infrastructure/public services. This indicator measures increases and decreases of basic infrastructure services and facilities within the community before and after the NFPP implementation. Road, school and clinic/hospital are selected as the verifiers evaluating the conditions of transport, education and health care in the local community. Not only quantity but also the quality and condition of the infrastructure and public services are considered. For example, the quality of schools along with the number of facilities and enrolment rate are recorded. The NFPP implementation altering population and the demands placed on both private and public sector facilities and services may result in the expansion or the building of new facilities, or the vacating of existing ones. At the end, the NFPP implementation may lead to an increase or a reduction in community service levels. It is also understandable that with the easily travelled roads people may go more frequently to natural forests, but also those same improved roads may encourage migrations to the adjacent towns and cities for labouring work[95], reducing dependence on local forest resources. Piped water that replaces the collection of drinking water from well or stream affects local sanitation and health issues in addition to eliminating a time-intensive activity. Transformations in community infrastructure and public services have an important influence on the local people's well-being and satisfaction with their community and enhance their perception of a safety and hopeful future life. Furthermore, it also influences the accessibility which results in various demographic changes such as the migration. The situation of each public facility shall be noted as "Good", "Adequate", or "Bad" and accordingly scored (score "+3" when marked as "Good"; score "+2" when "Adequate"; score "+1" when "Bad")[96] (see sample table 6).

C-2: Land use patterns. This indicator delineates shifts from one type of land use classification or ownership to another as the result of the NFPP implementation and how land is utilized in terms of area, activity and intensity. Two essential elements are considered: the type of land-use activities and the patterns or mix of those activities[97]. Change in land use

[95] It means migration work (*Dagong* in Chinese). More interpretations on the migration work are presented in the following analysis chapter.

[96] It provides more detailed information on scoring and categorizing the levels of infrastructure condtion in Chapter 6.1.3, when the measurement result from each indicator is presented, on pages from 111-114.

[97] It is known from the pre-testing phase that, there are following five categories of land use patterns in the local communities in the study areas: agricultural area which includes the wheat/corn land, paddy rise field and terrace; forest land which includes the natural forest, plantation, barren forestland that are served for the future plantation and rocky area; pastoral land; homestead and public land, author, 2007.

pattern resulting from the program may mean either financial loss or gain to the community. If the NFPP is a controversial one, the local people may resent the new land use pattern. If the land in private or collective use becomes publicly used or controlled due to the NFPP, this may mean a loss to the local economy, eliminating the tax base, since public property is not subject to local assessments. Such a tax loss may curtail public services and facilities in the area, affecting residents negatively. If the NFPP is to be sited on land which is already publicly owned, a change in land management policy may considerably affect the local people. Community infrastructure change may also influence the land use pattern. Since one of the important targets of NFPP is to increase forestland, an afforestation or reforestation project, especially on a large scale, may demand land from commonly used for other purposes and thus disturb members of the community. If percentages change of the land area from 1998 to 2007 is more than plus or minus ten percent, the nature of change in each land use pattern must be measured and described (see sample table 7).

Category D: Individual/family impacts.

This category measures the human impacts experienced and felt by households. It takes into account factors influencing household economy and disruptions in daily life and the movement patterns of individuals and families. It includes household income derivation and expenditure plus labour time distribution. Other important indicators may include local people's perceptions concerning public health and safety, and values of the local forests in their eyes. Data is collected by interviews and questionnaires at the household level. The selected indicators include:

D-1: Household income structure. Income distribution in household activities corresponds to changes in nature and extent of economic activities at the community level[98]. Local household characteristics include livelihood and sources of income, the way people combine the resources and assets at their disposal to sustain themselves and their families. An understanding of these may be helpful to better measure and understand the impacts of the NFPP on local households. This indicator measures shifts in household income derivation sources to determine economic benefits and losses to the households due to the NFPP implementation. Knowing income derivation sources, revealing levels of community dependency on the local forest resources, enables fact-based decisions on needed changes in forest management that diversify household occupation and income structures. For instance, if 90% of a household income is derived from forest resources, then obviously the household will suffer economic hardship unless the NFPP management initiates policies to ensure that local households have access to adequate livelihoods and incomes. If there is an increase in the sources of household income, then the NFPP may have positive impact[99]. The role of local strategies developed by the households and the alternative income generation activities are considered to compensate the income lost as result of the NFPP. The NFPP

[98] During the pre-testing phase it is known that, the local household incomes are usually derived from the following economic activities/income sources in the study areas: crops farming, joint harvesting/transportation, NTFPs collection/cultivation, vegetable/medicine plants, livestock raising, fuel wood collection, migration work/business, handcraft/sale/services and remittance from the family members, author, 2008.

[99] The amount of income derived from each type of household income resource is recorded, while non-cash income has also to be converted into equivalent monetary value of income based on the current market price, author, 2008.

implementation has significant impact on household income derivation with a ten percent (10%+*x*%)[100], or more, plus or minus, difference in total amount of income sources between 1998 and 2007. Statistic methods such as t-Test[101] are useful in identifying income difference, but depend upon the availability and cooperation of household informants to respond to the sensitive topic of income source.

D-2: Household expenditure (alternative energy costs). This indicator measures what each family annually spends on different production activities and necessary living expenses[102], emphasizing the increased costs of alternative fuel energy use such as coals, gas and electricity for cooking and heating. This is an important part of understanding local household characteristics and living standards. According to Wang, the most important impact from the NFPP on the local households might be the reduction of fuel wood collected, the main source for cooking and heating in rural Western China (2005). If fuel wood cannot be collected sufficiently, local households must turn more expensive alternative energy - coal, gas and electricity - that aggravates the economic burden to households, especially challenging poor household under the poverty line. The NFPP has significant impacts on household expenditures if the difference in alternative energy costs are greater than, plus or minus, ten percent (10%+*x*%) between 1998 and 2007.

D-3: Household labour time distribution. This indicator reviews the percentage of the labour time spent on household activity throughout the whole year, an important factor that teases out the daily living and movement patterns. Prior to 1998 many village households in Western China spent an average of 150-180 days per year, equivalent to 50-60% of the total labour time, in forest related activities such as joint harvesting and wood transportation, NTFPs cultivation, livestock raising and fuel wood collection (Wang 2005). It is relevant to know how the labour time of the local household is redistributed in each economic activity as the result of the NFPP especially if the difference greater than five percent, plus or minus, between 1998 and 2007, when the nature of each item should be described and interpreted.

D-4: Local perceptions on public health/safety. This is an important SIA indicator required in a formal environmental impact statement, and it refers to the feelings of local households in regard to physical health and safety as well as mental well-being that may be affected by the NFPP implementation. Information on the quality of human health indicates the general nutrition and well-being of people in the community, their quality of life and relative wealth. If the NFPP provides improvements in livelihood and income, and overall improvements in wealth in the community, improvements in the quality of human health are expected. But a widespread belief that the NFPP endangers the physical and mental health of present and

[100] The *x*% is the equivalent rate of price increase during the 10 years between 1998 and 2007, based on the statistic report.

[101] T-Test is the statistical test that helps to show if there is a real difference between different treatments being tested in a controlled clinical trial. The t-test is a significance test, as it states the significance of the difference between two sample means. All significance tests are tests regarding the null hypothesis which assumes if there is no difference between the averages of the two populations. If the null hypothesis in this context is accepted, then the probability that the difference between the two sample means occurs only by random is too big. Too big means always > 0.05, is following the convention for significance level in the research field, Anon., 2005.

[102] The local households suppose to have the following expenditures: agricultural expenditure, cost for culturist activities/NTFPs cultivation activities, tourism, education costs, medical treatment, living expenditure and alternative energy use, according to the pre-field research, author, 2007.

future generations, community acceptance of and support for the NFPP is lessens. Local households weigh the potential benefits of the NFPP to the community against their perceptions of the associated risk. Each verifier[103] of this indicator is noted from "+3" to "-3" that reflect the opinions that range from "highly agree" to "highly disagree" (See sample table 11). A total score difference between 1998 and 2007 greater than plus or minus ten percent, is considered as a significant change in the household's perception of public health and safety. T-Test is used as the statistic method to identify the significance of the difference.

D-5: Forest values perceived by people[104]. Local values and beliefs about natural forest resources indicate how people make choices and undertake actions related to resources use and management. The measurement of this indicator stresses the importance and benefit that the forests may serve for the life and local livelihoods in the eyes of the local households, the values associated with local forest goods and services and customary practices. Local values concerning forests determine local forest management options and ways of forest utilization. Knowledge of local people's views of their community and natural resources allows a deeper understanding of how changes induced by the NFPP influence behaviour in the local community. The structure and orientation of village community values and beliefs may undermine or enhance the NFPP management efforts and its success, so understanding this indicator allows for the effective integration of local people's values into the NFPP implementation structure, minimizing the adverse effects while ensuring sustainable management of local forests. Continued research that observes and analyses changes over time in local values about forest resources will indicate if participation in the NFPP implementation impacts peoples' values concerning conservation, essentially important to the future development of local forests. Through household's surveys, respondents select the importance of the local forests to their life and livelihood based on the giving options[105] (see sample table 12). T-Test or Chi-square Test is used as statistic methods to identify the significance of the changes in the value of forests as recognized by households between 1998 and 2007.

4.2 Selection of case study areas

Given that research objectives and questions target rural household and local community are

[103] There are three verifiers under this indicator: (1) Opinion of natural environmental condition; (2) Perceptions of public health; and (3) Perception of safety to the future, author, 2008.

[104] The notion of "value" has been debated in philosophical circles for hundreds of years. The focus here is on *instrumental values* (Pearce *et al*. 2001). Instrument value comes from some objective functions, i.e. the goal or purpose that is being sought. For example, economic value relates to the goal of maximizing human wellbeing (or welfare, or utility), where wellbeing has a particular connotation, namely that someone's wellbeing is said to be higher in situation A than situation B if they prefer A to B. Economic value is also *anthropocentric* – i.e. it is a value for humans – and it is preference based. Instrumental value is derived from human attitudes, wants, and appreciation of the object; it is possible to weigh one gain against another gain, and a gain against a loss (Pearce *et al*. 2001).

[105] It is known during the pre-testing phase of the field research, the local forests have the following three categories of the values recognized by the local households: 1. economic values which mean the forest offers the timber, fuel wood, NTFPs, medicine plants and job opportunities; 2. ecological values which include the soil conservation, water supply, flood/storm protection and climate change/carbon storage; 3. other special values such as recreation/tourism, cultural belongs/religious and amenity. This research is to know how many percentages of local people agree with these values. One person selects several options is possible. Respondents can add other values of the forests if it is not mentioned in the questionnaire, author, 2008.

surveyed and interviewed as basic units for analysis[106]; meanwhile, the supplementary primary data base is gathered by interviewing experts in the forestry sector, employees in forest enterprises and the leadership of the local communities. The Xiaolongshan state-owned forest area in Gansu Province and the Dazu collective forest area in Chongqing Municipality in Western China are selected as the two case study areas; each two villages from one case study area were selected. The field research was carried out in the two study areas during April - August 2007 and April - June 2008. Maps in Figure 4-1 indicate the study areas and the villages investigated in mountainous regions of Western China; detailed information on the two study areas and the four investigated villages are presented in Chapter 5.

The following factors were important criteria for the selection of these case study areas:

- Both study areas have been under the implementation of the NFPP since 1998.
- Both study areas are located in the mountainous regions in Western China, with common characteristics of the biophysical conditions, and in some parts with similar socio-economic conditions. Historically both areas have been economically poor and forests have been an important resource for local livelihood. People in both areas have been partly or even fully dependant on forests for generations.
- Both study areas represent state-owned forest area and collective forest area, the two major forest ownership structures in China. Historically, the study areas represent different socio-economic and culture settings and different forest development condition. The contrasts facilitate testing and demonstrating the possibilities of external factors (existing socio-economic condition, forest ownership structure and community history) and internal factors (household size, educational level of house head and house distance to forests) that influence the extent of social impacts of the NFPP on the local community and households.

[106] One of the very first things to do in any research project is decide on the unit of analysis (Bernard 1994:35). The social entities whose social characteristics are the focus of study would be the unit of analysis (Baker 1999).

Study site 1: Taohua and Maiji villages in Gansu

Study site 2: Nanmu and Xinshi villages in Chongqing

Figure 4-1: Locations of investigated villages in study areas in map of P.R.China

Source: Adopted and modified from The NFPP Information Centre on-line (2005) and field research, 2007 and 2008

4.3 Methods for quantitative and qualitative data collection

4.3.1 Introduction

Traditional SIA emphasises the qualitative research approach since SIA was developed primarily within the disciplines of sociology and related such-fields as rural sociology, environmental sociology and human geography (Little *et al*. 1988, Burdge *et al*. 1994, Machlis *et al*. 1997, Vanclay 1999, Barrow 2000, Becker 2003) where quantitative and qualitative research methods and techniques apply [107]. In China, the contemporary applications of SIA are mostly qualitative (Xu 2003), but quantitative social indicators developed by Burdge (1998), Barrow (2000) and other SIA practitioners are also required to extract data that is standardized, reliable and precise.

However, it is difficult to get data in the field that strictly follows quantitative methods. Qualitative data collection methods are required to appropriately measure people's behaviour, perceptions, opinions, experiences and values. Therefore, this empirical research employs a quantitative-qualitative combined approach, and methods for both quantitative and qualitative data collection and analysis are used in the field research. Although each of the research methods is described below separately, they have been developed and used in an integrated fashion.

4.3.2 Field reconnaissance survey

A *reconnaissance field visit* of the study sites was made to facilitate the subsequent information collection prior to the questionnaire survey and interviews for the primary data collection. The questionnaires were pre-tested in the field. Discussions were held with key informants and individuals in the local forest sectors and target villages to inform them about the purpose of the data collection and the type of the data sought in the field survey. General information about the study sites was obtained during this period, relevant documents collected and reviewed for an understanding of the local settings prior to the direct field research. This initial visit provided a good opportunity to meet large numbers of village households to establish good rapports with the villagers and a better understanding of the general situation in these areas.

4.3.3 Secondary data collection

Previous research and literature on SIA was selected and reviewed, offering a solid theoretical base and feasible methodology for the research design. Documents on planning, regulations and operation reports of the NFPP provided a historical background and practical concepts for the research subject group identification and questionnaire design. Other documents collected and reviewed concerned forestry legislations, policies, regulations, forestry development statistics (socio-economic development statistics from the relevant institutions, agencies and universities at national, provincial, and local levels), and annual

[107] Statz (2000:101) clarifies the differences between methods and techniques. Methods constitute the systematic process applied to test and to verify theories, whereas techniques are the very specific mode of operation within a methodical process.

working reports of local organizations. The multiple sources led to an understanding of the socio-economic conditions and policy environment in the case study areas.

The following facilities were used as main information sources for the research: libraries and information centres of the Chinese Academy of Forestry (CAF), the Beijing University of Forestry, the Southwest Normal University in Chongqing and the Lanzhou University in Gansu; websites of IAIA, United Nations Development Program (UNDP), World Bank and German Technical Cooperation Company (GTZ) for on-line documentations; the on-line documentation centre of China National Forestry Economics and Development Research Centre; documentary bureaus in Gansu and local bureau in Tianshui, documentary bureaus in Chongqing and Dazu, as well as the local documentary offices in the Xiaolongshan state-owned forest area and Dazu collective forest area. The secondary data were reviewed and acquainted prior to collecting the primary data.

4.3.4 Primary data collection

During the field research, the following methods were employed for primary data collection: Questionnaire survey, interview (semi-structured interview and key informant interview), focus group discussion and field observation. About 175 respondents were selected for the different data collection methods. Table 4-2 below provides an overview of the different methods used for data collection, the number of samples of each method and the sampling percentage of each case. A detailed statement of each method is presented afterwards; limitations of each method are also discussed individually. Through these methods, primary data both at the community level and household level were collected from the field; and these primary data are all provided in Appendix 4.

Table 4-2: An overview of methods for primary data collection during field research

Primary data collection methods	**Number of samples**						**Sampling percentage**
		Case study 1		Case study 2		*Total*	
		Maiji village	Taohua village	Nanmu village	Xinshi village		
Questionnaire survey	Community level	1	1	1	1	4	-
	Household level	20/201	20/143	20/397	20/550	80/1291	6%
	Total					*84*	-
Interview	Semi-structured interview	2	2	2	2	8	-
	Key informant interview	5	4	4	4	17	-
	Total					*25*	-
Focus group discussion	Woman group (2)	9	-	7	-	16	5%
	Man group (4)	8	12	8	9	37	7%
	Old farmer group (2)	6	-	-	7	13	5%
	Total					*66*	-
Field observation	Observed by the researcher						-
Total number of respondents	175						-

Source: from field research, 2007 and 2008

Questionnaire survey

The survey used a structured questionnaire[108]. Questions were designed concerning the four categories of social impact and twelve social indictors. The questionnaires were pre-tested and modified several times before used for data collection. The pre-testing and re-designing process helped to improve the quality of the questionnaire and to identify potential problems in data analysis.

According to research questions, the survey questionnaires aimed at the community level and the household level. The community level survey had more than twenty questions concerning the basic settings and certain social changes in the community before and after the NFPP, questions answered by community leaders or knowledgeable persons. The household level survey included all the questions on families and individuals, their livelihood conditions, opinions, perceptions and values. These questions were answered by household members.

Four village leaders or knowledgeable persons were interviewed in the community level survey. Eighty respondents from the four villages were selected and interviewed for the household level survey: Forty households from villages of Maiji and Taohua in Gansu, and forty households from villages of Nanmu and Xinshi in Chongqing were selected by simple random sampling that constituted six percent of all households in a village[109]. Most respondents answered the questionnaires in their houses and some filled them out at their work places. Mostly the heads of households were represented in the household surveys, but other members were included when available. The researcher recorded answers for local farmers when their sketchy education made it difficult for them to understand the questions appropriately or to read and write. Actually, the oral method creates a two-way communication to better understand and more completely answer the questions and is recommended to ensure a sufficient response rate and increased effectiveness (Babbie 2002). It makes it easier for the researcher to probe additional information and prepare better for key informants interviews and target group discussions (Czaja *et al*. 1996).

However, one problem with the oral questionnaire process is that respondents may be more likely to give socially acceptable answers that do not reflect their real opinions or the situation. In order to minimise this deviation, the researcher applied the "live and learn" approach during the field surveys. All the questionnaire surveys and interviews were independently conducted in the villages by the author of this study.

Interview

Semi-structured interview is the process of interactive communication, based on the questionnaires designed with open-ended questions (Czaja *et al*. 1996). Altogether eight semi-structured interviews were conducted with the respondents from four villages in their homes or at other appropriate places they considered it convenient to talk. The researcher learned how the main productive activities are changing, what the previous and current needs

[108] Sample questionnaires designed and used for field surveys are provided in Appendix 3, both at the local community level and the household level.

[109] See empirical data presented in Appendix 4.

of livelihoods are, and how the households have fulfilled these needs. In addition, researcher and interviewees discussed needed strategies and actions for mitigation of the NFPP impacts and improvement of the livelihoods. During the joint filling-in of the questionnaires, new issues for discussion arose, making the time spent with the farmers informative and worthwhile. Both sides could benefit from this kind of interview.

*Key informant interview*s undertaken in the field with seventeen interviewees included government officials, the experts in forestry enterprise, the village headmen and other persons (party secretaries, schoolteachers) with specific knowledge and keen interests on the NFPP and village development. The main issues cover the topics such as local operation plans for the NFPP and the main difficulties, problems and strategies for NFPP implementation in local communities.

Although the semi-structured interviews and the key informant interviews are the most expensive survey methods, both have benefits over others: the interviewer can observe the surroundings, use non-verbal communication and visual aids, and is permitted longer questionnaires (Neuman 1994). Yet semi-structured and key informant interviews run into the same problems as the oral questionnaire: respondents might be more likely to give socially acceptable answers and be reluctant to show their dissatisfaction when directly asked some sensitive questions, especially those directed at rating NFPP and governance.

Focus group discussion

Focus group discussion with concerned and knowledgeable persons is a fairly inexpensive but effective way to uncover responses of a small group of people on particular issues (Czaja *et al*. 1996). The process allows the researcher to draw together background information on an issue and to dig more deeply into an interest area and to identify and elicit information on major practical issues, the conflicts and interests of forest-dependent farmers during the field research, and to rectify information gathered by other data collection methods sources (Baker 1999).

Focus group discussions were conducted in four villages, and sixty-six farmers invited to engage in guided small group discussions. Discussions were organized for two groups of women in Maiji and Nanmu villages (includes sixteen people), four group of men in four villages (thirty-seven people), and two groups of the elderly in Maiji and Xinshi villages (thirteen people over 55-years old), representatives with sufficient knowledge and experiences in household management and economic activities.

The purpose of this method was to explore rather than to describe or explain any definitive issue (Babbie 2002). Participating farmers were asked to prioritize and score accordingly their “development options in the future” with a view to their importance for the household’s livelihood. Other topics discussed were labour time distribution in generating livelihoods for households before and after the NFPP, the local farmers’ attitudes to the NFPP, and the current conflicts between the NFPP and local needs as well as its strategies for a better management of both.

Field observation

Since information and data collected from interviews and questionnaires do not reflect the full picture of individual and society, *Field observation* is needed to reveal the characteristics of groups and individuals (Bell 1987). Direct observation may be more reliable than what people say in many instances, generating information on the most important events, beliefs and attitudes in a social environment (Baker 1999). Careful observation can help adjust and design interviews and raise new questions during the questionnaire survey, bringing greater clarity to the ambiguities of a particular social setting (Baker 1999).

During the field research, observations were made on physical evidence such as settlement patterns, land use patterns, distribution and management of household activities, infrastructure, public facilities, and household survival strategies. Direct observation verified data collected by questionnaires, interviews and group discussions, demonstrating this method as useful for the collection of additional information and the triangulation of important information.

4.4 Data processing and analysis

Both quantitative and qualitative data was manipulated and processed with Microsoft Excel and SPSS software. Each type of answers to a question was coded by assigning a number before entering it into the data for analysis.

For nominal[110] data such as variable of "Gender", the value of "Male" was coded as "1" and value of "Female" as "2" (see Appendix 4).

For ordinal data such as variable of "Education level", the value of "Illiterate" was coded as "1", and value of "Higher education" as "4", values of "Primary school" and "Middle school" as in between; also, for variable such as "Distance to the forests", value of "Less than 2 kilometres" was coded as "1", value of "2-5 kilometres" as "2" and value of "More than 5 kilometres" as "3", and so on.

For scale data, such as variable of "Incomes from household activities", concrete number of income generated from each household activity was input. A code manual was developed to record the terms used to instruct the computer in data analysis (see Appendix 4).

The data was statistically analysed after the coding, using both Microsoft Excel and SPSS softwares. All the quantitative data was first changed from the local unit into same standard unit, and then analysed through using descriptive statistics like sum, mean, frequency and percentage. The t-Test was used to test the significance of the differences between parameters and variables. For instance, the t-Test was used to ascertain the significance of the changes in forest-based incomes between 1998 and 2007. The difference or changes are considered statistically significant when probability of the t-Test result is equal or less than 0.05[111].

[110] For definitions of nominal, ordinal and scale data, see the footnote on page 77.

[111] See the footnote on page 67.

Qualitative analyses was also used to get in-depth understanding of behavioural characteristics in the rural society, such as changes in farmers' perceptions on the public health and safety, and forest values as perceived by farmers before and after the NFPP implementation.

4.5 Research procedure

According to the general process of the SIA which is presented by Barrow (2000), the research procedure specially designed for the empirical study is presented in Appendix 2.

4.6 Discussion on the attribution gap

Another difficulty within the application of SIA is the "attribution gap" (Kuby 2000). Kuby defines the "attribution gap" as a gap between the direct benefits which a project might have and developmental outcomes.

Some scholars argue that "it is impossible to make a social impact assessment of a project" because the model of social change process is too complicated because of its "non-linearity" characteristics (Aston *et al*. 1997). One social change process can cause another social change process and it becomes virtually impossible to link project outputs with highly aggregated benefits like poverty eradication. Kuby points out that:

> *"In today's international evaluation debate it is widely accepted that, with respect to highly aggregated development results, project impact must abandon the false idea of 'scientific proof'. Instead it should aim for plausibility. In the political arena where funding decisions are made plausibility lies at the core of credibility. I would argue that …. Nothing could be more devastating for the credibility of a development organization than an '82.3 percent success rate' reported in a glossy report with photographs of smiling target groups. People know development is difficult and complex. Whilst they expect accountability, they will, in the long run, believe plausible arguments more than bombastic 'proofs'."* (Kuby 2000:15).

This empirical study suggests that, solutions for minimizing the attribution gap might be two ways: (1) To analyze the impacts through a causal chain[112]; and (2) To assess the impacts based on a comprehensive understanding of the local context[113]; so that the attribution gap might be recognized and minimized.

4.7 Reliability and validity of the field research process

Reliability and validity are central issues in all scientific measurements (Neuman 1994). Both

[112] In philosophy, a causal chain is an ordered sequence of events in which any one event in the chain causes the next. Causal chain analysis traces the cause-effect pathways from the socioeconomic and environmental impacts back to its root causes. Causal chains are applied and demonstrated in Chapter 6, in the context of local case study experiences.

[113] In order to reach that goal, scoping and profiling selected case study areas and investigated communities are necessary and important for having a comprehensive understanding of the local context, of which is presented in Chapter 5.

concern how concrete measures or indicators are developed for constructs. "*Reliability and validity are salient in social science and perfect reliability and validity are virtually impossible to achieve*" (Neuman 1994:127). However, researchers need to maximize the reliability and validity of the selected indicators and to improve the field research process.

Reliability deals with the dependability of the indicator. A reliable indicator or a measurement provides the same result each time when the same thing is measured. Reliability means that the information provided by indicators (e.g., questionnaires) does not vary as a result of characteristics of the indicator, instrument, or measurement device itself (Neuman 1994:127). It is rare to have perfect reliability. There are four principles to follow in order to increase the reliability of measurements during the field research process:

(1) Clearly conceptualizing all constructs, which means developing clear theoretical definition of each single construct (i.e., category of impacts for this empirical study) or sub-dimension (i.e., indicators under the categories) of a construct (i.e., conceptual framework of the study, operationalization of research indicators);

(2) Increasing the level of measurement[114], of which is categorized as three different types of data collected in the field: nominal, ordinal and scale[115] (see Appendix 2);

(3) Use multiple levels of indicators, (i.e., under four categories are twelve indicator; some indicators are measured by verifiers; e.g., three verifiers are selected to measure the local infrastructure: road, school and clinic; and under the verifier road, there are also two items: number and quality of the road, etc.) (see Table 4-1);

(4) Use pre-tests and field reconnaissance surveys. A pre-testing phase in the field was conducted during the field reconnaissance survey, to test the feasibility of the questionnaire before the final version, and to find out whether the pre-selected indicators are feasible and measurable.

Validity is an overused term and is often confused with related ideas. Sometimes it is used to mean "true" or "correct". At its core, measurement validity is the degree of fit between a construct and indicators of it. It refers to how well the conceptual and operational definitions mesh with each other (Neuman 1994). The better the fit, the greater the measurement validity. The reason the research can never achieve absolute validity is that constructs are abstract ideas, whereas indicators refer to concrete observations.

"*This is the gap between our mental pictures about the world and the specific things we do at particular times and places*" (Neuman 1994:128).

[114] Level of measurement is an abstract but important and widely used idea. Basically, it says that some ways a researcher measures a construct are at a higher or more refined level, and others are crude or less precisely specified. The level of measurement depends on the way in which a construct is conceptualized, that is, assumptions about whether it has particular characteristics. The level of measurement affects the kind of indicators chosen and is tied to basic assumptions in a construct's definition. The way in which a researcher conceptualize a variable/indicator limits the level of measurement that he can use and has implications for how measurement and statistic analysis can proceed (Neumann 1994:137).

[115] Nominal measures indicate only that there is a difference among categories (e.g., gender, ethnical group, etc.). Ordinal measures indicate a difference, plus the categories can be ordered or ranked (e.g., level of education, opinion measures – Strongly agree, Agree, Disagree, Strongly disagree). Scale measures do everything all the other levels do, plus there is a true zero, which makes it possible to state relations in terms of proportion or ratios (e.g., economic income, area of land, etc.).

Even though, validity is more difficult to achieve than reliability, some measures are more valid than others. The ways to improve the validity of a field research process may include:

(1) To select appropriate indicators to measure the actual impacts because the same indicator can be valid for one purpose (i.e., a research question with units of analysis), but less valid or invalid for others.

(2) A clear operationalization of indicators, which is logical statements about the fit between indicators and definitions, can be used to reduce the gap between abstract ideas and specific indicators[116].

(3) A better designed questionnaire, which means to avoid confusion and keep the respondent's perspectives in mind. As learned from the field research that, for rural questionnaire surveys, questions should use simple, clear and unambiguous language[117].

(4) To minimize the interview bias. During the face-to-face interview, the appearance, the tone or voice, question wording and so forth of the interviewer may affect the respondent or lead the answer of respondent. Respondents may be more likely to give social acceptable answers that do not reflect their real opinions or the situation. In addition, local farmers as respondents very often overstate their costs and understate the income they got from their daily economic activities. In this case, the interviewer should help them to calculate income by adding items, such as land areas, agricultural production and labour time investment and so on, instead to ask them general income questions.

(5) For some secondary (unmeasured) data collected from local statistic bureaus, sometimes it is better to compare the data with the ones from other information sources, to reduce the bias and to get the data that is more closed to the fact. Meanwhile, it is always beneficial to compare the results with other research results measured by the similar indicators if the comparative research results are available.

[116] Defining and operationalizing the research indators are presented in Chapter 4.1, page 60.
[117] Questionnaire models are presented in Appendix 3.

5 SCOPING AND OBSERVATION OF STUDY AREAS

5.1 General remark

This chapter presents in parallel two case studies, Gansu and Chongqing, where the NFPP is being implemented. The studies of bio-physical, socio-economic and cultural conditions are directed at two different kinds of forest ownership: Gansu represents a state-owned forest area (Xiaolongshan), while Chongqing represents a collective forest area (Dazu). Profiles of each forest area and their accompanying villages investigated, their similarities and differences, are provided in subsequent chapters.

The characteristics of village communities dependent on contrasting forests, state-owned and collective, are investigated in order to answer research questions from one to four (see page 57), i.e., social impacts of the NFPP on local communities and households.

Meanwhile, following characteristics of the studied villages and households are also discussed, in order to answer the research questions from five to six (see page 57): the historical forest development conditions in the local communities as the external factors, and the household size, educational level of heads of households, and house distance to forests as internal factors that may influence the extent of social impacts in the two study areas.

Table 5-1 summarizes Gansu and Chongqing in terms of administrative level, land area, population, economic development and ethnic groups. Table 5-2 and Table 5-3 provide overviews of the bio-physical condition in two study areas, along with existing socio-economic contexts and cultural characteristics of the population in the four villages in case study areas.

5.2 Case study area 1: Gansu Xiaolongshan state-owned forest area

5.2.1 General information of Gansu Province

5.2.1.1 Biophysical information

Gansu Province (latitude 35°50' 40.9'' N, longitude 103°27' 7.5'' E) deemed to be one of the birthplaces of China. It is "an important land source of the ancient culture" (*Yearbook of Gansu* 2003). Located in the northwest, lying between the Tibetan Plateau, Inner Mongolia and the Loess Plateau, it is mountainous in the south and flat in the north. The Yellow River cuts through the southern part of the province flowing straight through its capital city, Lanzhou. The distribution of the land area of 45.5 million ha is as follows: about 16.6 million ha of grassland, 4.3 million ha of forests, 3.5 million ha of agricultural land, 7.7 million ha of wasteland suitable for agriculture and forestation, and 4.7 million ha of mountain slopes (*Yearbook of Gansu* 2003). The 4.3 million ha forests in Gansu, mostly in the central and southwest part of the province, house a commercial timber volume of 200 million cubic meters of which more than 80% belongs to natural forests (Xu 2000). The natural forests are rich in biodiversity with more than 650 species of wild animals and 4,000 species of wild

plants that include 1,000 species of medicinal value and hundreds of species of oil and fibre plants (Anon. 1996) (see Table 5-1).

Table 5-1: Study areas of Gansu and Chongqing at a glance

		Gansu	Chongqing
Administration type		Province	Province-level municipality
	Prefecture-level	14 divisions	-
	County-level	86 divisions	40 divisions
	Township-level	1344 divisions	1259 divisions
Capital		Lanzhou	Yuzhong Qu
Total land area		45.4 million ha (7th)[118]	8.23 million ha
	Agricultural land	3.53 million ha	1.35 million ha
	Grassland	16.64 million ha	0.94 million ha
	Forests	4.30 million ha	4.08 million ha
	Waster land for agriculture and forestation	7.66 million ha	0.75 million ha
	Mountainous slopes	4.67 million ha	1.11 million ha
Population		26 million (2004)	31.50 million (2005)
	- Density	57.7/km ²	379/km ²
GDP		192.8 billion Yuan (2005)	310 billion Yuan (2005)
	- per capita	7,487 Yuan	9,909 Yuan
Major ethnic groups		Han 90%; Hui 5%; Dongxiang 2%; Tibetan 2%; Others (Tu, Manchu, Uyghur, Yugur, Bonan, Mongolian, Salar and Kazakh) 1%	Han 91%; Tujia 5%; Miao 2%

Source: China Statistical Yearbook of 2005 and Tabulation on nationalities of 7th population census of China, 2006

5.2.1.2 Socio-economic context

Gansu's population of 26 million is unevenly distributed with huge densities in the southern part tapering to fewer in the northern part. Most of the population, 73%, are still rural. Ninety percent of the population are Han. The remaining ten percent of the 15 minority groups, living mostly in the mountainous areas, include: Hui, Tibetan, Dongxiang, Tu, Manchu, Uyghur, Yugur, Bonan, Mongolian, Salar and Kazakh (*Yearbook of Gansu* 2003).

Gansu is one of the economically poorest provinces in China. The Gross Domestic Product (GDP) of Gansu for 2005 was 192.8 billion Yuan (24.1 billion USD). The net income per capita of urban households in 2003 was less than 7,000 Yuan (875 USD) as contrasted with the national average of about 8,500 Yuan (1,062.5 USD), while that of rural households was 1,673 Yuan (209.1 USD) in contrast to the rural national average of 2,622 Yuan (327.8 USD) (*Yearbook of Gansu* 2003).

As for governance, Gansu has 14 prefecture-level administrative areas containing a total of 86 counties and 1,344 towns (Anon. 2003). Mining provides an important economic basis for

[118] The 7th national population census.

the province due to important deposits of minerals, such as antimony, chromium, coal, cobalt, copper, platinum, nickel, zinc, etc. (Anon. 2003).

Major farm crops include cotton, maize, millet, wheat, sugar crops such as cane, oil-bearing crops, vegetables and fruits, especially melons. Other important products are medicinal plants and tobacco. Animal husbandry produces beef, mutton, wool and cow milk.

Table 5-2: Biophysical characteristics of the study areas

	Xiaolongshan, Gansu		**Dazu, Chongqing**	
Investigated villages	Maiji	Taohua	Nanmu	Xinshi
Geographic location	33 °31' - 34 °41' N, 104 °23' -106 °43' E		29 °24' - 29 °52' N, 105 °29' -106 °E	
Administrative location	Beidao district, Tianshui municipality, Gansu Province		Dazu County, Chongqing provincial Municipality	
Distance to the major urban centre	10kms to Maiji town (market place), 50kms to Beidao district, 180kms to Baoji city	2kms to Maiji town, 12kms to Beidao district, 190kms to Baoji city	4kms to Shiwan town (market place), 10kms to Dazu county, 82kms to Chongqing city centre	2kms to Wangu town (market place), 8.5kms to Dazu county, 75kms to Chongqing city centre
Topography	Elevation ca. 2000 m above see level	Elevation ca. 750 m above see level	Elevation ca. 550 m above see level	Elevation ca. 300 m above see level
Climate	Temperate semi-humid and semi-arid climate; mean annual precipitation 900mm with four seasons; mean annual temperature 12^0C		Subtropical monsoon climate; mean annual precipitation 1006mm with four seasons; mean annual temperature 20^0C	
Soil	high soil fertility	Moderate to low soil fertility	Lateritic soil and paddy rice soil, moderate to high soil fertility	Lateritic soil and alluvium soil; moderate soil fertility
Agro-ecological zone	Wheat-corn zone with two short cropping seasons		Hot to warm sub moist lowlands, paddy rice-terrace with two-three cropping seasons	
Forest area	368,334 ha		26,200 ha	
Forest ownership	State-owned dominated		Collective	
Distance to the forests	Very near to the forests	About 1.5kms walking to the forests	About 2kms to the forests	About 5 kms to the forests

Source: Information collected during field investigation, 2007 and 2008

5.2.2 Profile of Xiaolongshan state-owned forest area

The Xiaolongshan forest area, in the south-eastern part of Gansu Province, is the biggest state-owned forest in the province with a total area of about 12,453,000 mu[119] (828,699 ha)

[119] "Mu" is one of the traditional area units used in China; especially used in rural areas commonly. During the field research most of the information about the land area (including the forest land area) was collected with "mu" as the main unit for a better understanding and a communication with local farmers. Later it was transferred into a scientific unit "hectare" (simply as "ha") by the author during the data analysis phase and the thesis writing. 15 mu = 1 ha. Author, 2008.

(Figure 4-1). The geographic location is about latitude 33°31' N to 34°41' N, longitude 104°23' E to 106°43' E. The altitude ranges from 700 to 3,200 meters and annual precipitation varies widely from 200 to 1,000 mm and the mean temperature is in the 7 to 12℃ range. The climate is typical of the temperate semi-humid and semi-arid forest grassland region and allows for the existence of many animal and plant species. Although Xiaolongshan is one of the main forest resource bases in Gansu, it accounts for only 1.83% of the total area of the whole province (Anon. 2001). Of the 77.4% of Xiaolongshan area that is forest area, 262,867 ha are characterized by natural forests and 105,467 ha belong to plantations. The area and the stock volume of the young, middle-aged and old-growth forests account for 18.8% and 7.0%, 65.9% and 70.5%, and 15.3% and 22.5%, respectively. Forest coverage is 52.5%.

Table 5-3: Socio-economic context and cultural characteristics of population in study areas

	Xiaolongshan, Gansu		Dazu, Chongqing	
Investigated villages	Maiji	Taohua	Nanmu	Xinshi
Population density	58 inhabitants/km ²		379 inhabitants/km ²	
Income per capita	1,673 Yuan/year[120]	2,011 Yuan/year	2,530 Yuan/year	3,426 Yuan/year
Household size (mean)	4.1 person (N=20)	5.0 person (N=20)	3.4 person (N=20)	4.2 person (N=20)
Household head schooling (mean)	5.8 years	7.2 years	7.9 years	8.7 years
Farm size	0.26 ha	0.28 ha	0.15 ha	0.22 ha
Ethnic group	Han (83%), Hui (17%)	Han (90%), Hui (10%)	Han (95.3%), Zang (4.7%)	Han (98.9%), Zang (1.1%)
Historical development	Traditional farming for generations, partly participated in the joint logging in adjacent state-owned forest areas since 1980s; to find the alternative income generation activities are rather difficult after the NFPP in 1998 due to the inconvenient traffic condition.	Traditional farming, joint logging and wood transportation in state-owned forest areas since 1980s; associated with the blossom of the adjacent state-owned forest enterprises, the local hostels and restaurants were rapidly developed since 1990s, but almost immediately shut down since the NFPP of 1998.	Traditional farming before 1980s; influenced by the agriculture reform, household responsible system and contract responsible system became popular since 1990s, NTFPs cultivation and migration work become the primary economic activities since then.	Traditional farming before 1980s; household responsible system and contract responsible system became very popular since 1990s and received a good result; since 1995 some immigrants moved to the village organized by the government; crops farming, NTFPs cultivation and migration work are the primary economic activities; local hotels and restaurants are also being quickly developed.

Source: Field research, 2007 and 2008

[120] According to the data in National statistic book of China in 2003.

Currently, Xiaolongshan is administrated by the Xiaolongshan Forestry Experiment Bureau (Enterprise), a typical state-owned forestry enterprise, and directly under the administration of the Forestry Department of Gansu Province. Since it is overseen by government above the county level, it is independent of Tianshui Municipality, the main county in which it is located. The whole forest area of Xiaolongshan covers 3 cities, 8 counties, 89 towns and 1,920 villages inside or at the border of the forest region with a total population that includes 300,240 households and 1,050,000 residents of which 430,000 belong to the farmer labours (Anon. 2001). Since the socio-economic development situation in those places is relatively poor, forest resources have been very important to the livelihood of rural farmers. In order to facilitate the management, the Xiaolongshan forest area is divided into twenty-one smaller state-owned forest areas which are managed by twenty-one state-owned forestry enterprises with a total of more than 7,000 employees.

The implementation of the NFPP of 1998 in Xiaolongshan forest area caused a dramatic decrease in logging production and forest revenue, but the forest land area increased due to reforestation and the conversion of agricultural land to forests, representing one of the initial targets of the NFPP (Anon. 2003b, 2003c). As the NFPP implementation, logging is prohibited, and about 4,000 employees shifted from logging to working as "rangers and in forest maintenance" (forest stewardship) (World Bank 2003).

As one of the twenty-one sub-forest areas in Xiaolongshan forest area, the Maiji forest area experienced several impacts due to the NFPP implementation. Table 5-4 provides information on the changes in the forest area and forest production in the Maiji enterprise from 1998 to 2005. The forest production volume was decreased by 2,667 cubic meters, as a result of the logging ban. However, the forest area was increased by 3,269 ha and the new plantation area by 3,263 ha because of the reforestation and the ban on harvesting. These are reflected in the production statistics offered by the official manager of the Maiji forest enterprise, and the interviews with local employees during the field investigation (Table 5-4).

Table 5-4: Changes in forest production and resources in Maiji forest enterprise since the NFPP

	1998	2005	Change	Change rate
Forest production volume (m^3/year)	3,667	1,000	- 2,667	-73%
Stock volume (m^3)	358,441	405,028	46,587	130%
Total area (ha)	27,122	27,122	0	0%
Forest area (ha)	7,212	10,481	3,269	45%
Plantation area (ha)	1,575	4,838	3,263	207%
GDP (Yuan)	1,100,000	300,000+120,000*	- 680,000	-62%
Forestry Tax 16% (Yuan)	176,000	48,000+3,960**	- 124,040	-70%
Forest cover rate	29.7%	41%	11.3%	38%

*Note: 120,000 Yuan was the annual tourism income from Maiji Forest Park, which was newly built in 2003. It is accepted by local foresters that the NFPP has improved the ecological environment and biodiversity of this area, and has been attracting more and more people to come here for tourism and recreation. Since 2004, about 240,000 people from surrounding areas have visited the park annually, and 120,000 Yuan was the income mainly from ticket fees. The park has also offered many job opportunities for local farmers, especially in the summer time, as told by local foresters.

** Note: 3,960 Yuan was the tax fee for annual tourism income of the Maiji Forestry Park. According to the information from the Maiji forestry enterprise, the tourism tax rate in 2006 was 3.3 % (Anon. 2006).

Source: Interviews with managers of the Maiji forest area during the field research, 2007.

5.2.3 Profiles of the villages investigated

5.2.3.1 Maiji Village

Maiji Village, in the north-western part of Xiaolongshan forest area, is surrounded by the forest area (Figure 4-1). The village of 708 habitants, 330 female, shares the total area of about 1,251.9 ha. The 165 households are divided into six farmer groups. The annual income of each farmer was 1,380 Yuan on average in 2006, derived from the following economic activities: migration work and industrial activities (37%), forestry (21%), agriculture (18%), transportation and services (9%), hostels, restaurants and hand crafts (8%) and others (7%). Regarding education levels, seven percent of the farmers are illiterate, 60% finished primary school, 32% have completed middle school, and only one percent hold higher education degrees. The nearest county is Beidao District[121], the main market place, which is 50 km away from the village by a paved traffic road which passes about one kilometre from the village. All the households have electricity; 40% of them are connected by telephone and telecommunication facilities; 70% of them have installed the water pipes while the rest go to wells or local streams for the drinking water. The village shares one rural clinic and one primary school with 133 registered pupils (Table 5-5). The main agricultural crops are wheat, corn, millet, beans, potato and yam. There are no collective or private forests in this village. The farmers use the surrounding forests of Xiaolongshan for multiple reasons, collecting fuel wood, mushrooms and medicine plants for subsistence use. Prior to the NFPP, most were employed by Maiji Forestry Enterprise which belongs to Xiaolongshan State-owned Forest Enterprise for harvesting, wood production and transportation. Passing through the village is the Wugou River, the second branch of the Jialingjiang River which in turn empties into the Yangtze River.

The village has engaged in traditional farming for generations and partly participated in the joint logging activities in adjacent to state-owned forest areas since 1980s. After the NFPP in 1998, it has become difficult for villagers to find work that would generate alternative income because the road is distant to the city centres, the public transports (buses) are less, and the traffic conditions are inconvenient.

5.2.3.2 Taohua Village

Taohua Village perched on the west edge of the Xiaolongshan forest area (Figure 4-1) has 669 residents of whom 324 are female and shares a total area of about 1,069 ha. The 148 local households are divided into three farmer groups. The annual average income of each farmer was about 1,850 Yuan in 2005 derived from migration work and industrial activities (49%), forestry (23%), agriculture (10%), hostels, restaurants and hand crafts (10%), transportation and services (5%), and others (3%). In comparison with Maiji Village only three percent of the farmers are illiterate, 47% of the farmers finished primary school, 45% completed middle school, and five percent hold higher education degrees. The distance to the nearest county, Beidao District is about 10 kilometres by a paved road which passes the village a mere 200 meters away. All the households have electricity; 65% of them have telephone and telecommunication facilities; 85% of them have installed the piped water while

[121] District is the administration level under the city or municipality in China, noted by author, 2008.

the rest 15% go to wells and streams to collect the drinking water. The village shares one rural clinic and one primary school with 138 registered pupils (Table 5-5). The main crops are wheat, corn, millet, beans, potato and yam. As with Maiji Village, there are no collective or private forests in Taohua Village. The distance from Taohua Village to Xiaolongshan forest area is very short, only about 300 meters. Farmers could easily collect fuel wood and medicine plants for their subsistence use and for sources of income. Employment by the adjacent Maiji Forestry Enterprise and involvement in forestry production and transportation were the main income sources for most of the farmers, contributing to 30% of their total income prior to the NFPP. Yingchuan River, one of the third-level tributaries of the Yellow River, passes through the village before continuing to the Xiaolongshan forest area.

The village has engaged in traditional farming, joint logging and wood transportation in state-owned forest areas since 1980s. Associated with the flowering of the adjacent state-owned forest enterprises, local hostels and restaurants developed rapidly in the 1990s, but almost immediately shut down because there were no more costumers due to the logging ban on harvesting since the NFPP in 1998.

Table 5-5: Information of Maiji and Taohua Villages in Xiaolongshan state-owned forest area

		Maiji Village	**Taohua Village**
Population		708	769
	Male	395	395
	Female	374	374
Households		165	154
Farmer groups		6	4
Agricultural land		212.5 ha	108.4 ha
Forest land		800.3 ha; surrounded by state-owned forests	652.6 ha; edge of state-owned forests
Average annual income		1,673 Yuan (209.1 USD)	2,011 Yuan (251.3 USD)
	Migration work and industrial activities	37%	49%
	Forestry	21%	23%
	Agriculture	18%	10%
	Transportation and services	9%	10%
	Hostels, restaurants and hand crafts	8%	5%
	Others	7%	3%
Education			
	Illiterate	7%	3%
	Primary school	60%	47%
	Middle school	32%	45%
	Higher education	1%	5%
Distance to nearest county		50 km, (to Beidao District)	10 km, (to Beidao District)
Distance to the nearest traffic road		1 km	200m
Access to infrastructure			
	Electricity	100%	100%
	Telephone	40%	65%
	Piped water	70%	85%
Rural clinic		1	1
Primary school		1 (133 registered students)	1 (138 registered students)

Source: Field investigation, 2007

5.2.4 Characteristics of household respondents in the two villages

Households are the basic social units of a local community. Random samples of selected households, changes in how they live and work, reflect characteristics and changes of the general households in the communities. The most commonly measured variables to understand the characteristics of the household respondents are household size, income, consumption, educational level, facilities (such as hygiene, electricity, communication and water), health and life expectancy (UNDP 2002b). Information on local household respondents was collected by the questionnaire survey and interviews during the field research. (Information on the local community in general was mainly gathered with key informant interview and group discussion methods).

The questionnaire surveys were conducted with 40 farmers in the two villages (Table 5-6). Of the 20 farmer respondents from Maiji, seven are females; of the 20 from Taohua, six are females. Five respondents in Maiji and three in Taohua belonged to ethnic minorities, such as Hui, Zang and Tong. The average age of the interviewees was about 43.9 years in Maiji and 47.3 years in Taohua. In Maiji, five of the respondents (25%) were illiterate, nine of them (45%) finished primary school, five of them (25%) completed middle school and only one person (5%) held a higher education degree. In Taohua, only two (10%) were illiterate, six (30%) passed primary schooling, ten (50%) completed middle school and two (10%) achieved higher education degrees. The average household size in Maiji is 4.1 persons/household, and 5.0 persons/household in Taohua. Both are above China's average household size which has dropped from an average of 4.4 persons in 1982 to 3.6 person in 2000 (UNDP 2002a). The average number of household labour was 2.1 per family in Maiji and 2.2 in Taohua. About 13 (65%) of the farmer respondents in Maiji Village live closer than two kilometres to the forests, more than 11 (55%) in Taohua. There are six (30%) farmers in Maiji Village and five (25%) in Taohua Village who live about 2-5 kilometres away from the forests; only one respondent (5%) in Maiji and four respondents (20%) in Taohua live in homes more than five kilometres from the forests. In both villages 100% of the respondents have access to electricity; nine households (45%) in Maiji and 13 (65%) in Taohua have telephone or mobile facilities; 14 of them (70%) in Maiji and 17 of them (85%) in Taohua have access to piped water; and 16 of them (80%) in Maiji and 18 of them (90%) in Taohua live near to paved roads.

Table 5-6 provides an overview of characteristics of the household respondents in the two villages of Maiji and Taohua.

Table 5-6: Sample numbers and characteristics of household respondents in villages of Maiji and Taohua

		Maiji Village		Taohua Village	
		n	**%**	***N***	**%**
***n* of respondents**		20	100	20	100
Gender					
	Male	13	65	14	70
	Female	7	35	6	30
Minorities (Hui, Zang, Tong ethnic groups)		5	25	3	15
Age					
	< 30	1	5	1	5
	30 – 40	6	30	6	30
	40 – 50	4	20	7	35
	50 – 60	6	30	5	25
	> 60	3	15	1	5
Education					
	Illiterate	5	25	2	10
	Primary school	9	45	6	30
	Middle school	5	25	10	50
	High education	1	5	2	10
Average household size		4.1		5.0	
Average working labour		2.1		2.2	
Distance to the local forests					
	< 2 km	13	65	11	55
	2 – 5 km	6	30	5	25
	> 5 km	1	5	4	20
Access to infrastructure					
	Access to electricity	20	100	20	100
	Access to telephone	9	45	13	65
	Access to pipe water	14	70	17	85
	Access to the road	16	80	18	90

Source: Field investigation, 2007

5.3 Case Study Area 2: Chongqing collective-owned forest area

5.3.1 General information of Chongqing Municipality

5.3.1.1 Bio-physical condition and historical importance

Chongqing (longitude 28 °10' - 32 °13' N, latitude 105 °17' - 110 °11' E,) is the youngest but the largest in area among the four provincial–level autonomous municipalities in China[122]. Situated where eastern and western China join, Chongqing is located on the edge of the Yungui Plateau[123], intersected by the Jialing River[124] and the upper reaches of the Yangtze

[122] The other three are Beijing, Shanghai and Tianjing. Beijing is the capital of P.R.China, with 16,808 square kilometers of land area and about 13 million of populations in 2007; Shanghai is the largest city in China in terms of population, with 6,341 square kilometers of land area and over 20 million of populations in 2007; Tianjin is the sixth largest city in China, south-east to Beijing, with 11,305 square kilometers of land area and 11.45 million populations in 2008.

[123] Yungui Plateau covers southwestern China, including two district areas: an area of high plateau averaging 2,000 m with mountain peaks as high as 3,700 m in northern Yunnan province, and an area of rolling hills, deep river-carved gorges and mountains in western Guizhou Province. It is the source of main rivers including the Yangtze and Yellow Rivers.

River. This is a relatively poor region, but with rich nature resource conserves (Figure 4-1). Chongqing covers about 82,400 km ²(1,236,000 ha), with countless small hills and highlands in the northwest and middle part, and the big mountains of Daba and Wu in the northeast, Wuling Mountain in the southeast, and Dalou Mountain to the south. The Yangtze River passes through the centre of the area. Chongqing mainly has subtropical monsoon climate condition, and an annual average temperature of about 20℃, with annual precipitation ranging from 1,000 to 1,400 mm (Anon. 2005a).

5.3.1.2 Socio-economic perspective

Chongqing Municipality is the region with the highest population density in Western China, and with a population of 28,080,000 in 2006. About 13,112,900 people live in urban areas, bringing in an average income of 11,570 Yuan, and about 14,967,100 live in rural areas, occupying about 53.3% of the total, gaining an average income of only 2,874 Yuan, lower than the national average of about 3,100 Yuan for rural populations (Shen 2007).

Because of its unique geographical location, Chongqing has been one of the most important inland commerce ports in China for the past centuries. It is also the biggest economic centre in the upriver region of the Yangtze, and is crucial to the industrial development, trade and transportation in South-western China. In order to speed up economic development in the central and western regions, the central government in 1997 raised Chongqing to a provincial-level municipality. The Three Gorges Project[125] which has various implications in the areas of tourism, relocation of residents and environmental protection, is expected to stimulate development of Chongqing's economy, as well as the western region as a whole. During the past decades, Chongqing experienced rapid economic growth with annual increases of GDP, the whole region reaching 348.62 billion Yuan in 2006 (Figure 5-1). Chongqing is also home to Asia's largest aluminium plant, South West Aluminium, which rolled out 213,000 tones of finished products in 2004 for companies engaged in building materials, printing, electrical appliances, aerospace, packaging, and vehicle production[126].

But the agricultural sector still employs a significant portion of the population. In addition to rice, fruits, especially oranges are important sources of income for the farmers.

Chongqing and surrounding areas are full of tourism resources, the most famous being the Three Gorges, the 200-kilometres long scenic area of the Yangtze River, the most visited canyon in China. Besides gorgeous natural scenery, this is a culturally rich area, including the popular tourist sites of Dazu Rock Carvings, mainly Buddhist themes carved during the Tang

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[124] He Jialing River is a tributary of the Yangtze River with its source in Gansu province, with 1,119 km long, and it joins the Yangtze River in Chongqing where is the lower reaches of the River.

[125] The Three Gorge Project (Three Gorge Dam) is a hydro-electric river dam that spans the Yangtze River in three gorges of Sandouping, Yichang, Hubei in Western China. It is one of the largest hydro-electric power stations in the world. Except the ship lift, all the original plan of the project was completed in October, 2008, when the 26th generator was brought to commercial operation. Six additional generators in the underground power plant are being installed, with the dam thus not expected to become fully operational until about 2012. The total electric generating capacity of the dam is expected to reach 22,500 MW. As with many dams, there are debates over costs and benefits. Although there are advantages such as flood control, clean hydroelectricity and navigation, there are also concerns about the relocation of people, siltation, loss of archaeological and cultural sites and impacts on regional ecosystem. http://en.wikipedia.org/wiki/Three_Gorges_Dam, 2008.

[126] http://news.bbc.co.uk/2/hi/business/4512015.stm

Dynasty, recognized as a UNESCO World Heritage site.

The Municipality is divided into 40 county-level subdivisions, consisting of 19 districts, 17 counties and four autonomous counties inhabited by the minority groups such as Tujia and Miao inhabit (Anon. 2005a).

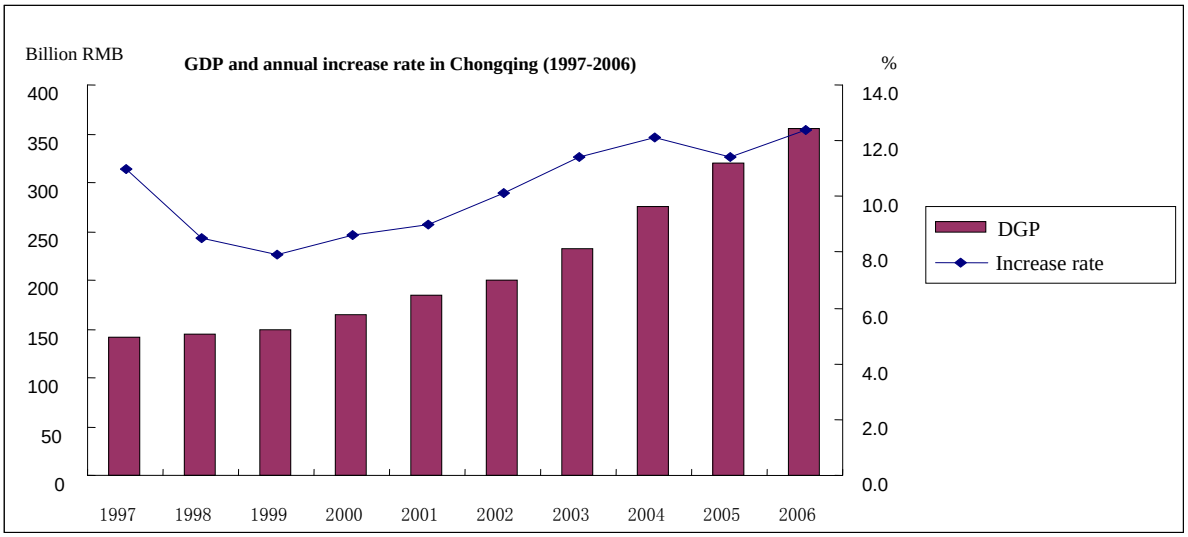


Figure 5-1: GDP and annual increase rate in Chongqing (1997-2006)

Source: Shen, 2007

5.3.1.3 Forest resources and forestry development

Rich in magnitude and species, the total forest area in Chongqing is about 4,078,700 ha, roughly half the total land area in Chongqing: Dense forest land extends over about 2,637,000 ha; more lightly scattered forest land covers 529,000 ha; and the remainder includes 340,200 ha of brush land, 144,300 ha of reforested area, 1,135,100 ha of newly planted area (afforestation area), and seedling land of 200 ha (Shen 2007). Based on the data in 2005, the forest cover rate was approximately 35% with a total forest stock volume of 120 million m^3. Forty-five protected areas include three national parks, occupying 10.1% of the total area in Chongqing. Chongqing has many subtropical evergreen broad leave tree species. The main forest species are pine, fir, cypress and bamboo (Anon. 2005b).

Table 5-7 presents detailed information on forest resources in Chongqing based on the data in 2005.

5.3.1.4 The NFPP in Chongqing

Since 1998, most areas in Chongqing have been covered by the NFPP. According to the information from local the NFPP office, the NFPP in Chongqing has two implementation periods with different targets:

(1) The first stage, 1999 to 2005, aimed at stopping commercial logging in the natural forests and forests in the ecological zone[127], reforestation in the upper regions of the main rivers, and transformation of workers in state-owned forest companies from loggers into forest steward officers (Anon. 2005c). (2) The second stage, 2006 to 2010, deals with "sustainable management of protected forests and biodiversity conservation" (Anon. 2005c). Goal of the second stage is to increase the forest rate to 36% by 2010; to appropriately restore the forest resources; and thus, to improve the ecological environment (Anon. 2005c).

Table 5-7: Forest resources in Chongqing in 2005

1. Total forest land (ha)		4,078,700
Include:	**Dense forest land (ha)**	2,637,000
	Scattered forest land (ha)	529,000
	Bushes (ha)	340,200
	Reforestation area (ha)	144,300
	New afforestation area (ha)	1,135,100
	Seedling land (ha)	200
2. Forest rate (%)		35%
3. Protected area (amount)		45 (3 national parks)

Source: Field investigation, 2008

Commercial logging in Chongqing has totally stopped with 2,388,000 ha of forests in these areas strictly protected. In the up reaches of the main rivers and reservoirs, where the ecological function is significant, 575,300 ha have been newly reforested as designed by ecologists or forest specialists with the support and investment by government using the budgets from the NFPP. By 2006 the NFPP in Chongqing covered 39 counties and districts, 910 towns, involving 3,100,000 households (Shen 2007).

So far, the NFPP has impacted profoundly on local forest industry development since its implementation: when the NFPP was implemented, the local forest industry transferred from logging and wood production to forest tourism, wood processing, flower business, forest food and other NTFPs utilizations. From 1998 to 2005 the number of forest parks and protected areas increased to 65, including 22 national parks, a total area increased of 140,000 ha (*Yearbook of Chongqing* 2005). But little information is so far available on the socio-economic impacts of the NFPP in Chongqing.

5.3.2 Information on Dazu County and its collective forest area

5.3.2.1 Natural condition

Dazu County (longitude 29°24' - 29°52' N, latitude 105°29' - 106° E) is located in the northern reach of Yangtze River, the west part of Chongqing Municipality, about 82

[127] The ecological zone is defined as "the area in up reaches of main rivers and reservoirs, where the ecological function is significant" (SFA 2000). Forests in ecological zones in Chongqing include not only the natural forests, but also a part of plantations established during past decades, noted by author, 2008.

kilometres away from city centre of Chongqing. The nearest highway of "Chengyu"[128] to Dazu County is about 30 kilometres. The total area of Dazu, typically mountainous with altitudes ranging from 264 to 869 meters, is about 2,703 km^2 (40,545 ha). Three rivers cross the county, the Laixi, Kulong and Huaiyuan which are sub-branches of the Yangtze. It has typical subtropical humid monsoon climate with four clear seasons, an average temperature is 19.8℃ and annual precipitation of 1,066 mm. There are lateritic soils and paddy rice soils, with moderate to high soil fertility (Anon. 2001b).

5.3.2.2 Socio-economic perspective

Dazu, encompassing 2,703 km^2 of total land area, has a population of about 917,000, of which 674,000 (73.5%) are rural. While the annual income of the urban population averages about 11,327 Yuan, and that for rural population drops to 3,663 Yuan, which is lower than the national average level but similar to the average of Chongqing Municipality (2,874 Yuan/capita) (Anon. 2001b, 2005c). The GDP in Dazu in 2005 was about 7.24 billion Yuan, averaging 11,768 Yuan/capita (Anon. 2006). Dazu is rich with mineral resources such as coal, gas, iron, copper and many kinds of structural materials such as argil clay, quartzite and strontium. The tourist resources are also very rich, the carved stones and Buddhist grottos built thousands of years ago attracting an average of 300,000 visitors every year (Anon. 2001b).

5.3.2.3 Forest resources and forestry development

Dazu has plentiful forest resources, an area totalling about 26,200 ha. The forest cover rate is 23.5%, stock volume of about 636,000 m^3. Main tree species are pines, firs, rubbers and bamboos (Anon. 2001b). Dazu forest area covers 32 towns, 534 villages, and 4,735 farmer groups, with total of 220,000 households (Anon. 2005b). Table 5-8 provides detailed information on the changes of production and forest resources from 1998 to 2005 in Dazu.

Table 5- 8: Forest resources in Dazu County

	1998	2005	Change	Change rate
Forestry production volume (m^3/year) (from legal logging)	14,500	1,250	-13,250	-91.4%
Stock volume (m^3)	41,600	509,200	467,600	1,124.0%
Total area (ha)	139,998	139,998	0	0.0%
Forest area (ha)	26,200	30,500	4,300	16.4%
Natural forest area (ha)	8,667	8,732	65	0.7%
Plantation area (ha)	4,846	11,512	6,666	137.6%
GDP (Yuan)	3,610,000	3,930,000	320,000	8.9%
Forestry Tax 16% (Yuan)	250,000	220,000	-30000	-12.0%
Forest cover rate	23.5%	34.9%	11.4%	48.5%

Source：Field research, 2008

[128] Highway of "Chengyu" was established in 1995, with 139 km long, connecting between Chongqing and Chengdu, the capital of Sichuan province, which is one of the economic centers in Western China, noted by author, 2008.

5.3.3 Profiles of the villages investigated

5.3.3.1 Nanmu Village

Nanmu Village, in the eastern part of the Dazu forest area (Figure 4-1), is poorly connected by paved roads as compared with the study village of Xinshi: about 4 kilometres away from the market town of Shiwan; about 10 kilometres to Dazu County, and 82 kilometres to Chongqing centre. The village of 1,807 inhabitants, of whom 835 are female, shares about 1,524.5 ha of total land area. The 531 households are divided into 18 farmer groups.

The average annual income of farmers was 2,530 Yuan in 2005, somewhat below the average in Chongqing (2,874 Yuan/capita). About 54% of total income was from migration work and industrial activities, and the remaining, 18% was from forest related activities, 11% was from agriculture, eight percent was transportation and services hostels, five percent was from restaurants and hand crafts and four percent was from other occupations (2005). As to education, five percent were illiterate, 45% finished primary school, 43% completed middle school, and about seven percent attained higher education levels. All the households have electricity, 88% of them have the telephone and telecommunication facilities, and 90% of them have access to piped water. The village possesses three rural clinics and two primary schools with a total of 198 registered pupils (Table 5-9). The main crops are rice, wheat, beans and yam. The surrounding forests are all collective forests. Before the 1980s there was traditional farming, but influenced by agriculture reform, the Household Responsibility System and Contract Responsibility System (see Chapter 2.1) became popular from 1990 on; NTFP cultivation, such as *Huajiao* (*Zanthoxylum bungeanum*) cultivation, and migration work became the primary economic activities. However, since the NFPP of 1998, all these NTFPs cultivations and other forest related activities have to some extent decreased. The Laixi River passes through the village. It is the second branch of the Jialingjiang River, which empties directly into the Yangtze River.

5.3.3.2 Xinshi Village

Xinshi Village, in the southeast part of the Dazu forest area, has relatively convenient traffic connections compared with Manmu Village: the nearest paved road is merely 200 meters from the village, which is only 2 kilometres from the market town of Wangu, 8.5 kilometres from Dazu County and about 70 kilometres from Chongqing city centre. The village of 2,738 inhabitants, of whom 1,295 are female, shares a total area of 1,788.4 ha. Its 652 local households are divided into 29 farmer groups.

The annual average income of each farmer is about 3,426 Yuan (2005), which was derived from migration work and industrial activities (58%), with the remainder from forest related activities (21%), agriculture (10%), hostels, restaurants and hand crafts (8%) and other occupations (3%). Comparing with Maiji Village, here only less than one percent of the farmers are illiterate while 42% have finished primary school, 48% have finished middle school, and 9% have a higher education. All the households have electricity, 95% of them have telephone and telecommunication facilities, and 95% of them have access to piped water. The village has two rural clinics and two primary schools with 230 registered pupils (Table

5-9). The main agriculture crops are rice, wheat and beans. As with Namnu Village, Xinshi has collective forests. Before the 1980s there was traditional farming, but the "Household Responsible System" and "Contract Responsible System"[129] became very popular in 1990s with successful results. Since 1995 some immigrants, encouraged by the government, moved to the village. Crop farming, NTFP cultivation and migration work had been the primary economic activities during that time; local hotels and restaurants had also been rapidly developed. The Kulong River, one of the third-level tributaries of the Yangtze, passes through the village before continuing to the northeast.

Table 5-9: Information of Nanmu and Xinshi villages in Chongqing Dazu collective forest area

		Nanmu Village	**Xinshi Village**
Population		1,807	2,738
	Male	972	1,443
	Female	835	1,295
Households		531	652
Farmer groups		18	29
Agricultural land		206.9 ha	249.1 ha
Forest land		990.5 ha; surrounded by collective forests	1210.8 ha; surrounded by collective forests
Average annual income		2,530 Yuan	3,426 Yuan
	Migration work and industrial activities	50%	58%
	Forestry	19%	21%
	Agriculture	14%	10%
	Transportation and services	8%	0%
	Hostels, restaurants and hand crafts	5%	8%
	Others	4%	3%
Education			
	Illiterate	5%	1%
	Primary School	45%	42%
	Middle School	43%	48%
	Higher Education	7%	9%
Distance to nearest county		10 km, (to Dazu County)	8.5 kms, (to Dazu County)
Distance to the nearest market		4 km to Shiwan Town (market place)	2 kms to Wangu town (market place)
Distance to the nearest traffic road		2 km	200m
Access to infrastructure			
	Electricity	100%	100%
	Telephone	88%	95%
	Drinking water	90%	95%
Rural clinic		3	2
Primary school		2 (198 registered students)	2 (230 registered students)

Source: Field investigation, 2008

5.3.4 Characteristics of household respondents in the two villages

The questionnaire survey in Chongqing was conducted with 40 farmers, from each village 20 respondents including six females (Table 5-10). Ethnic minority respondents, four in Nanmu

[129] See Chapter 2.2.3, pages of 15-16.

and three in Xinshi, represented mostly the Hui and Zang. The average age of the interviewees was 49.5 years old in Nanmu and 53.2 years old in Xinshi. About three of the respondents (15%) in Nanmu, but none in Xinshi, were illiterate; 11 of them (55%) in Nanmu and eight of them (40%) in Xinshi finished primary school; five of them (25%) in Nanmu and nine of them (45%) in Xinshi finished middle school; and only one person (5%) in Nanmu and three (15%) in Xinshi attained higher education. Among the four villages investigated, respondents in Nanmu have the smallest average household size with only 3.4 persons and respondents in Xinshi have the largest with an average of 4.2 persons in the household (China's average household size was 3.6 persons in 2002) (UNDP 2002a). Average number of labour workers is 2.5 per family in Nanmu and 2.9 in Xinshi. About 11 (55%) of the farmer respondents in Nanmu and ten of them (50%) in Xinshi live closer than two kilometres to the forests; about nine of them (45%) in Nanmu and seven (35%) in Xinshi live about two to five kilometres away from the forests; no one (0%) in Nanmu and three respondents (15%) in Xinshi live more than five kilometres between the forests and their home. Electricity is available to 100% in both villages; 18 of them (90%) in Nanmu and 19 of them (95%) in Xinshi have the telephone or mobile phone facilities at home; 17 of them (85%) in Nanmu and 19 of them (95%) in Xinshi have access to piped water; and 18 of them (90%) in Nanmu and 19 of them (95%) in Xinshi live near to paved roads.

Table 5-10 provides an overview of characteristics of household respondents in the two villages of Nanmu and Xinshi.

In summary, both villages have the common characteristics but also have the differences in terms of local conditions. The common characteristics include:

- Forest lands are mostly collective-owned, with the different management options as privately managed (*ziliu shan*), contracted responsible person managed[130] (*zeren shan*) and village management (*tongguan shan*);
- Land use types are similar: less agriculture land, extensive forest area, but the average ratio of forest area/ capita is low because of the dense population.
- Dramatic changes occurred in the structure of economic income sources in both villages since the NFPP implementation: forestry activities are no longer providing the main income sources, being replaced by non-forest activities such as out migrating for work and business.

The different conditions in two villages are:

- Individual households privately manage the collective-owned forests connected to Xinshi Village, while collective-owned forests are mainly managed by the village as a whole in Nanmu.
- The economic condition is better in Xinshi than in Naunmu; the rural annual average

[130] It is known from key informant interviews (with local forester and successful farmers) that, there are also certain amounts of collect forests in Dazu managed by responsible persons (private households) through contracts named "Contract for responsible management of collective forest". The contract is made between the local forest sector and the private farmers, and it is renewed usually in 30-40 rotation years, author, 2007.

income/capita in Xinshi Village is 3,426 Yuan, relatively higher than the average in Chongqing of 2,874 Yuan/capita, and higher than the 2,530 Yuan/capita in Nanmu Village.

- While Xinshi Village practices new forest utilization options such as ecotourism, orchard management, etc., Nanmu Village stays with traditional silvicultural management and fruit tree plantations since the NFPP implementation.

Table 5-10: Sample numbers and characteristics of household respondents in villages of Nanmu and Xinshi

		Nanmu Village		Xinshi Village	
		n	**%**	***N***	**%**
***n* of respondents**		20	100	20	100
Gender					
	Male	14	70	14	70
	Female	6	30	6	30
Minorities (Hui and Zang ethnic groups)		4	20	3	15
Age					
	< 30	0	0	0	0
	30 – 40	2	10	3	15
	40 – 50	4	20	8	40
	50 – 60	10	50	7	35
	> 60	4	20	2	10
Education					
	Illiterate	3	15	0	0
	Primary school	11	55	8	40
	Middle school	5	25	9	45
	High education	1	5	3	15
Average household size		3.4		4.2	
Average working labour		2.5		2.9	
Distance to the local forests					
	< 2 km	11	55	10	50
	2 – 5 km	9	45	7	35
	> 5 km	0	0	3	15
Access to infrastructure					
	Access to electricity	20	100	20	100
	Access to telephone	18	90	19	95
	Access to pipe water	17	85	19	95
	Access to the road	18	90	19	95

Source: Field investigation, 2008

6 ASSESSMENT OF SOCIAL IMPACTS AND CAUSAL ANALYSIS

6.1 Social impacts on the local community level

6.1.1 Change in the community population characteristics

The category A, *change in the community population characteristics* is defined as a social change process at the level of a local community. It refers to the changes in number, density and distribution of people in local communities affected by the NFPP; it also reflects the increase or decrease in the percentage of local people that live under the poverty line as the result of the NFPP implementation (see page 62).

Indicator A-1: Population size

In the field investigation it was observed that, between 1998 and 2007, the size of the population in four study villages in Gansu and Chongqing generally decreased (Figure 6-1). According to the annual local population records offered by village leaders, the average number of people per village in Gansu was 980 in 1998; it decreased to 708 in 2004 and continuously decreased to 630 in 2007. In Chongqing, the average number of people per village was 2,500 in 1998; it decreased to 2,390 in 2004 and continuously to 2,060 in 2007 (Figure 6-1), with decreasing rates of about 35.7% in Gansu and 17.6% in Chongqing, respectively (Table 6-1).

Source: Key informant interviews in field research, 2007 and 2008

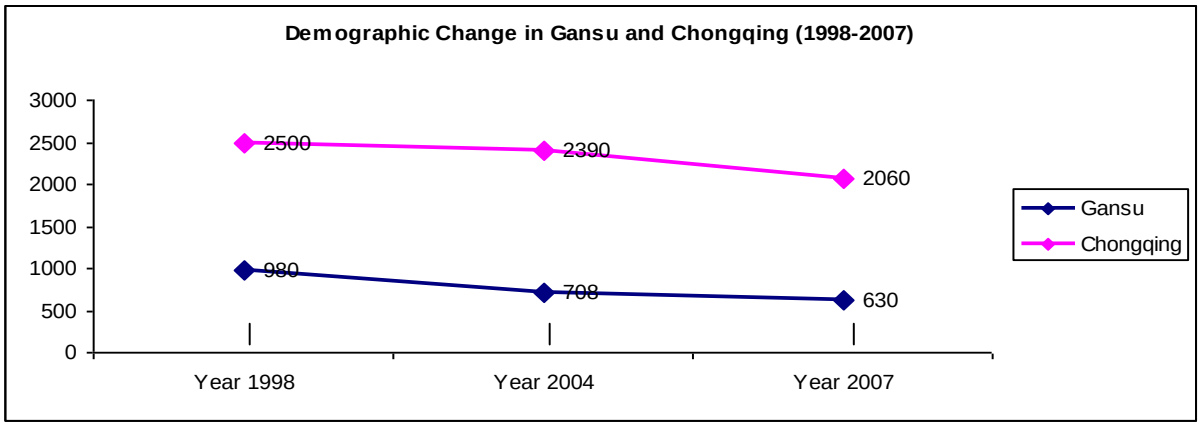


Figure 6-1: Decreasing trends of local population size in study areas

Table 6-1: Details of change in local population size in study areas

	No. of population in 1998 (per village)	In 2007	Difference (+ or -)	% Change
Gansu	980	630	- 350	- 35.7
Chongqing	2500	2060	- 440	- 17.6

Source: Key informant interviews in field research, 2007 and 2008

To understand the relationship between the population decrease and the NFPP, special interviews with key informants (village leaderships, school teachers) were arranged to discuss the main reasons for population decrease in the local community. Respondents from the key informant interviews and group discussions considered that, the NFPP has direct impacts on the local population decrease. The influencing process is illustrated through a causal chain as shown in following Figure 6-2.

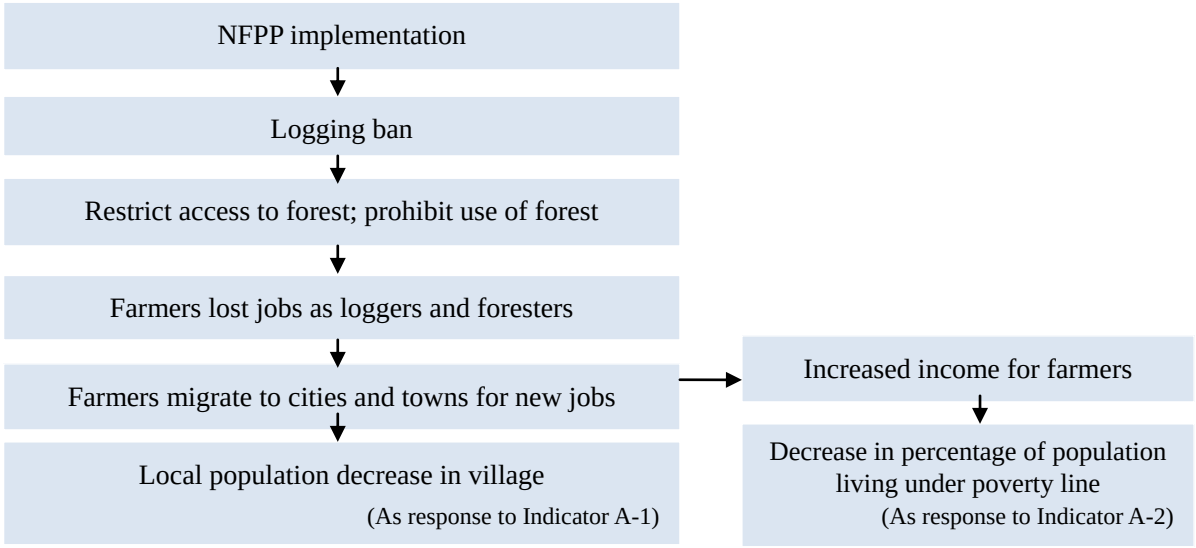


Figure 6-2: Causal chain of the NFPP implementation impacting local population size and percentage of population living under poverty line in study villages

Since the logging ban of the NFPP in 1998, the local farmers' access to the forests has been restricted; their use of local forests has been prohibited; thus, many farmers lost their jobs as loggers in forest harvesting, causing more and more people to migrate to cities and towns for new jobs. That is considered as the main reason for the local population decrease, as pointed out by local farmers. Of course, there might be other factors that can result in the population decrease[131]; however, more than 78% of the local farmer respondents agreed that the NFPP was the main cause for the local population decrease from 1998 to 2007.

As already defined, the change in population magnitude and rate has important implications for other social change processes[132]. Therefore, the decrease in community population may negatively influence the local community development and household economy in the long term.

In addition, the different decrease rates, of about 35.7% in Gansu and 17.6% in Chongqing, indicate that the impact of the NFPP on the population size is much more significant in Gansu than that in Chongqing[133].

[131] More discussion on this issue is presented in Chapter 7.

[132] See discussion on social change process in Chapter 3.3, page 44.

[133] Reasons (factors) determine the different extent of social impacts of the NFPP in study areas are discussed synthetically in Chapter 7.

Indicator A-2: Percentage of population living under the poverty line

The study defines who receives an average annual income of less than 637 Yuan (80USD) as the people living under the poverty line[134]. According to this standard, the field investigation obtained the following data results measured by this indicator:

In 1998, there were averagely about 10.7% in Gansu and 3.7% in Chongqing of the local people living under the poverty line. In 2007, the percentage has seen a decreased trend to 4.1% in Gansu, and that to 1.0% in Chongqing (Figure 6-3), with the decrease rates of about 62.0% and 73.0%, respectively (Table 6-2). The figure and table show that the sizes of population under the poverty line have decreased both in Gansu and Chongqing during the ten years between 1998 and 2007, with a relatively higher decrease rate in Chongqing.

The impact chain illustrated in Figure 6-2 explains the direct impacts of the NFPP on the decrease of poor population size in local communities. After the NFPP in 1998, increased numbers of farmers have migrated to cities and towns for new jobs; the migration work[135] in towns and cities brings increased incomes for households, and these households also include those who were formerly living under the poverty line.

However, there were always time gaps between the times when local farmers lost their jobs in forests and the times when they found the income generation alternatives such as migration work. The shorter the time gap, the sooner they recover their income losses. Despite of the decrease in poor population in recent years, many farmers complained during the interviews about the difficulties they have experienced, especially during the first implementation years of the NFPP: Most of the forest-related incomes lost overnight, and finding alternative income generation sources was difficult[136]. That is though to be an explanation to the slight increase in the poor population size per village in both study areas during the year 2003 and 2004, as shown in Figure 6-3. And as people gradually found alternative income generation activities such as migration work and tourism, the household income has continuously increased, the size of the poor population per village gradually sloped downward again soon after 2005 (Figure 6-3).

Table 6-2: Change in percentage of population living under poverty line in study areas

	% of population under the poverty line in 1998 (per village)	% in 2007	Difference (+ or -)	% Change
Gansu	10.7	4.1	- 6.6	61.7
Chongqing	3.7	1.0	-2.7	73.0

Source: Key informant interviews in field research, 2007 and 2008

[134] The standard of poverty line is defined in Chapter 4, Methodology, see footnote on page 62.

[135] Migration work (*dagong* in Chinese) nowadays is very much popular for the income generation activities in the local community since the NFPP, as many of the forestry activities have been strictly prevented, such as joint logging, harvesting, wood transportation and some of the NTFPs cultivation, according to the field research, author, 2007.

[136] Box 6-1 records individual samples of changes in income resource activities, see page 123.

Source: Key informant interviews in field research, 2007 and 2008

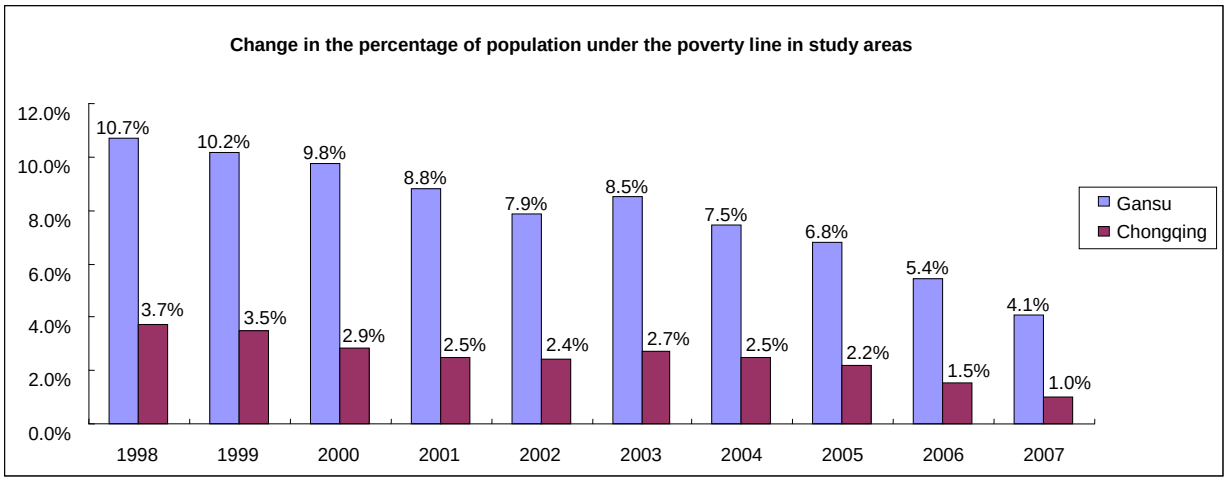


Figure 6-3: Dynamic changes in percentage of population under poverty line in study areas

6.1.2 Change in the community institutional arrangements

The category B, *community institutional arrangements* refers to the size, structure, and level of organization of local government. These also include historical and present patterns of local economy and industrial diversification; occupation opportunities; the size and level of activity of voluntary associations, interest groups, organizations; and related regulations and activities regarding local forest resources use.

Indicator B-1: Size/structure of local government/rule systems

After key informant interviews with the local leaderships in villages, it is known that, there are basically three main local-rule based organizations existing in the study villages in Gansu and Chongqing: Local Communist Party Committee (CPC), Village Committee (VC), and NGOs such as local Farmer Association (FA). These three organizational types and their sub-organizations constitute the local government/rule system (the network), and all have their clear functions and responsible employees. Sometimes these organizations and sub-organizations need to be integrated to fulfil the specific working tasks. These local government /rule systems are connected to individual families and households in the village and they are committed to the government systems and organizations at upper management levels.

Supervision of the Village Committee (VC) and NGOs such as local Farmer Association (FA) are undertaken by the local Communist Party Committee (CPC). The CPC contains two secretaries and membership followed by three sub-sections: Community Security Committee (Possemen or Train Band)[137], Women Federation and Youth Union.

[137] The posseman is an able-bodied man serving as a member of a posse, a member of the militia, and serves only during emergencies. It has been a traditional organization system existing in rural areas in China since the war period in 1930. In current rural society it has three main functions: (1) To participate in the agricultural production; (2) To protect as security guard; and, (3) To join the military when it is urgent. Noted by author, 2008.

The Village Committee (VC) is a local government body with a director and membership voted by the whole village. It contains five sub-sections: Family planning group, village affair group, financial monitoring group, security group and conflict management group. The Farmer Association working parallel to the Village Committee, and basically has two important sub-sections in the study villages: Culturist Association and Fruit Grower Association.

Figure 6-4 and Figure 6-5 illustrate the details of changes in the structure of local government systems/organizations and their integrating networks in villages in Gansu and Chongqing from 1998 to 2007. They show that, the number of local government staff has slightly decreased from 34 to 32 in the village of Taohua in Gansu while local government structure has remained the same (Figure 6-4). However, in the village of Nanmu in Chongqing, the staff number in the local government system has increased from 34 to 50 (Figure 6-5).

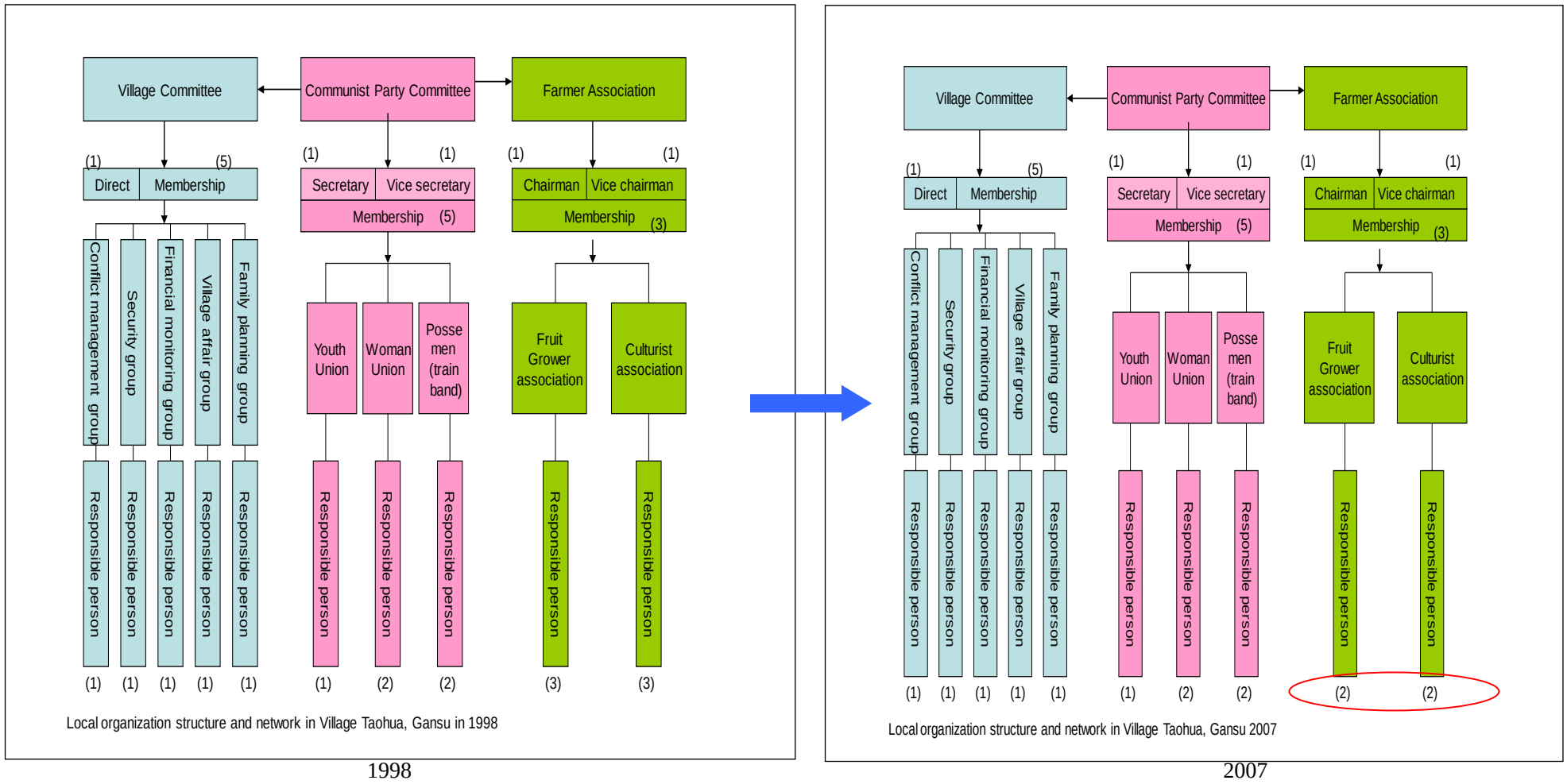
According to the interviews, a reduction of working staffs in the local Farmer Association (FA), which dropped from 11 to 9 from 1998 to 2007, is thought to be the main reason why the government staff number decreased in Gansu. A specific annotation from the local village leaders explains that, as forest-related activities became less, there was no need to keep so many staff numbers in the local Farmer Association in Gansu.

However, in Chongqing, taking an example from Nanmu Village, the working staff increased in local government due to the establishment of a "local NFPP Committee" in the village and the addition to the local government network in 1999. This local NFPP Committee is a sub-organization of upper NFPP Committee at county-level, meanwhile supervised also by the local Communist Party Committee and the Village Committee. Currently the local NFPP Committee includes 12 memberships and forest guards ("*hulingyuan*"), mainly responsible for the forest protection, stewardship, new plantations and forest fire. The four Committees, instead of the former three, constitute the local ruling system in Nanmu Village in Chongqing. Therefore, the local government has been enlarged (see Figure 6-6).

A causal chain is illustrated in Figure 6-6, in order to understand the pathways of the NFPP implementation deriving changes in size and structure of local government, those are, the decrease in staff member of the local government system in state-owned forest area (Gansu) and the increase in collective forest area (Chongqing). These changes imply the following arguments:

Along with the NFPP implementation, the roles of the local government in forest sector have been comparatively stronger in the collective forest communities and weaker in the state-owned forest communities. This may be due to the stronger role of local government connected to collective forests which in a better position to get budgets to compensate for income loss to household and community. But stronger role of local government intervention might also break the internal balance between the use and conservation of the local forests that formerly obeyed by the local people.

At the local community level



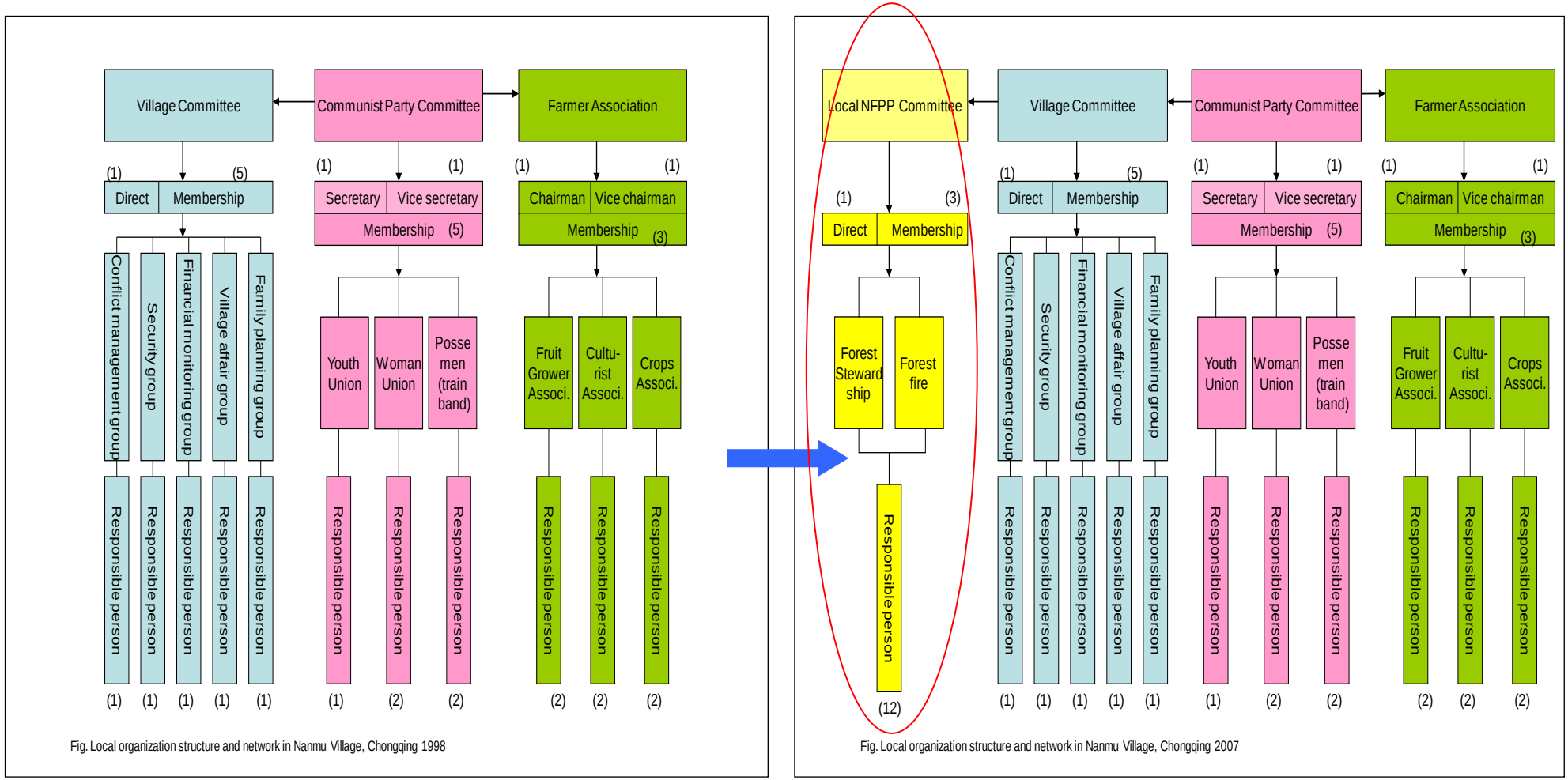
1998 2007

Note: (1) (2) (5)…mean the number of people in charge of the position

Figure 6-4: Change in size/structure of local government/rule system and its networks in Village Taohua of Gansu state-owned forest area

Source: Key informant interviews in field research, 2007 and 2008

At the local community level



1998 2007

Figure 6-5: Changes in size/structure of local government/rule system and its networks in Village Nanmu of Chongqing collective forest area

Source: Key informant interviews in field research, 2007 and 2008

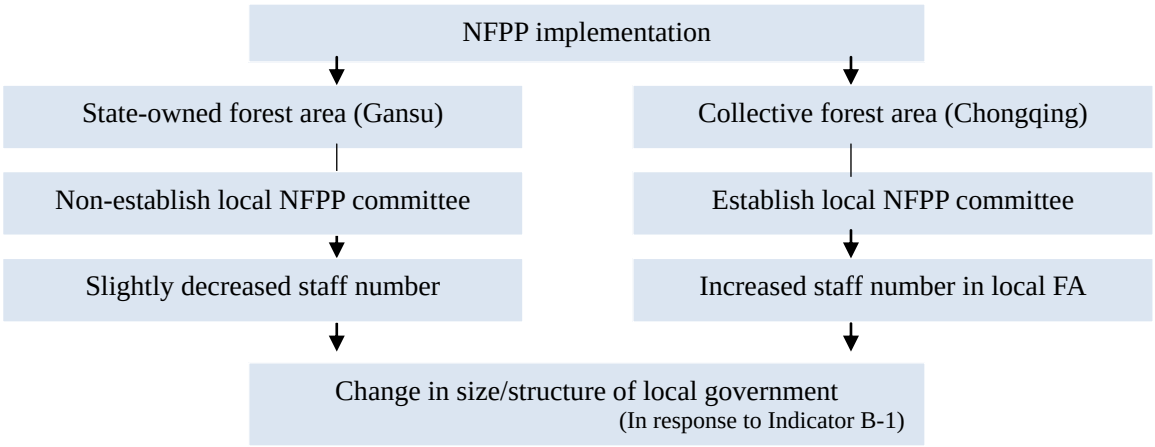


Figure 6-6: Causal chain of the NFPP impacting the size/structure of local government in study villages

The NFPP implementation may cause imbalances between use and conservation as customarily practiced by local people and that requested by the new governmental rules, creating conflicts, especially when compliance of the NFPP rules and local tradition as forest use are at odds[138]. It seems quite difficult to draw a conclusion as to whether the establishment of the local NFPP Committee and increase of the work staff member in the local government of collective forests have positive or negative impacts on the local community, but it is believed that, the decrease in the local government staff in state-owned forests will have certain negative influences on the local community's future development.

Indicator B-2: Regulations on access to the forests (formal and informal)

This indicator assesses the regulations and rules (formal and informal)[139] as applied to forest use by local people, how they are impacted by the NFPP, and how the villages understand the former and new regulations.

Through discussions with local expertises and leaderships of the villages, it is observed that, the local studied villages in Gansu (state-owned forests) and Chongqing (collective forests) possess following regulations for local farmers' access to forests and forest use:

(1) Membership rule[140] which means regulation on the state of being a member of a state-approved organization connected to the forests or a member of the forest collective; (2) Rules on access to timber, NTFPs, fuel woods, bamboo shoots harvesting and grazing; (3) Regulations on forest protection; (4) Regulations to prevent forest fire; (5) Penalty laws on illegal logging and forest fires; (6) Reward rules on forest protection and forest fire reporting; (7) Regulations on conflict resolution; and (8) Benefit sharing rules.

In Gansu most of the forests adjacent to the villages belong to the state, so farmers in this

[138] See the analysis of Indicator B-2 in the next section. There are also some individual cases recorded during the field research, regarding traditional use rights and conflicts between the local forest use and the NFPP, for details see Box 6-1 on page 123 and Box 6-2 on page 126.

[139] As defined in Chapter 4 on pages of 63-64, formal regulations imply the government issued laws and measures, whilst informal regulations mean rules developed by custom by generations in the community, such as the traditional access to and use right of forest resources and methods of resolving conflicts.

[140] It is known from the field research that, in local communities in case study areas, the local farmer must become a member of a state-approved organization related to forests, or a member of collective forest groups proved by the village, in order to have access to the forest and forest use, author, 2008.

area never possess membership rights to the forests. Villages had the access to NTFPs, fuel woods, bamboo shoots and grasses for grazing purpose except for timber prior to1998; however, all the access rights have been forbidden since 1998. Regulations on forest protection, the penalties for illegal logging and the reward rules remained unchanged from 1998 to 2007 (Table 6-3). Any regulation on benefit sharing no longer exists, but regulations on forest fire prevention that did not exist before now do. Penalty laws on forest fire formerly existed in both study villages in Gansu but now have been partly ignored as one village, Taohua, considered the regulation being not well performed. In terms of the conflict resolution regulations, only one village ,Maiji, applied them, while another village, Taohua, did not prior to 1998 (noted as "Yes" or "No" in Table 6-3); but in 2007 both villages developed and applied conflict resolution regulations.

In contrast, both villages in the collective forest area in Chongqing followed regulations/rules, existing or generations, on forest access and forest-use prior to 1998. Since the NFPP implementation in 1998, both villages considered that their access to the timber had been strictly forbidden (as noted with "No" in Table 6-3); one village, Nanmu, considered the access to the NTFPs, fuel woods, and grazing being slightly influenced; while one village, Xinshi, considered the regulation on benefit sharing being worsened in 2007 compared with the situation prior to 1998 (see Table 6-3).

Table 6-3 scores the changed status of regulation implementation on access to the forests from 1998 to 2007 as it affects the study villages, scoring based on methods presented in Chapter 4 on Methodology, i.e. "+1" when the answer marked as "Yes", and "0" when the answer as "No". Higher scores indicate better application of regulations on forest access and forest use by local communities.

Inferred from the impact chain illustrated in Figure 6-7, the NFPP influences the local regulation on access to forests in following several ways: Along with the logging ban associated with the NFPP, local communities have stricter rules and regulations that make for less access to timber, NTFPs, fuel woods, bamboo shoots and grazing. Meanwhile, local communities have more responsibilities for forest fire protection and conflict resolving. Benefit sharing mechanisms are harmed in both study areas. It is believed that, the changes in the local regulations for the access to the forests will influence the forest use patterns now and in the future within the local community.

Table 6-3: Regulations on local farmers' access to forests in study areas in 1998 and 2007

Regulation categories	Gansu (state-owned)						Chongqing (collective)					
	1998			2007			1998			2007		
	Village Maiji	Village Taohua	Score*	Village Maiji	Village Taohua	Score	Village Nanmu	Village Xinshi	Score	Village Nanmu	Village Xinshi	Score
1. Membership rule	No	No	*0*	No	No	*0*	Yes	Yes	*2*	Yes	Yes	*2*
2. Access rule to												
- timbers	No	No	*0*	No	No	*0*	Yes	No	*1*	No	No	*0*
- NTFPs	Yes	Yes	*2*	No	No	*0*	Yes	Yes	*2*	No	Yes	*1*
- fuel woods	Yes	Yes	*2*	No	No	*0*	Yes	Yes	*2*	No	Yes	*1*
- bamboo shoots	Yes	Yes	*2*	No	No	*0*	Yes	Yes	*2*	Yes	Yes	*2*
- grazing	Yes	Yes	*2*	No	No	*0*	Yes	Yes	*2*	Yes	No	*1*
3. Protection	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*
4. Forest fire	No	No	*0*	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*
5. Penalty of												
- illegal harvest	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*
- forest fire	Yes	Yes	*2*	Yes	No	*1*	Yes	Yes	*2*	Yes	Yes	*2*
6. Reward rule	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*
7.Conflict resolution	Yes	No	*1*	Yes	Yes	*2*	Yes	Yes	*2*	Yes	Yes	*2*
8. Benefit sharing	Yes	Yes	*2*	No	No	*0*	Yes	Yes	*2*	Yes	No	*1*
TOTAL			***19***			***11***			***25***			***20***

* Note: Score as "+1" when marked as "Yes"; Score as "0" when "No".

Source: Key informant interviews in the field research, 2007 and 2008

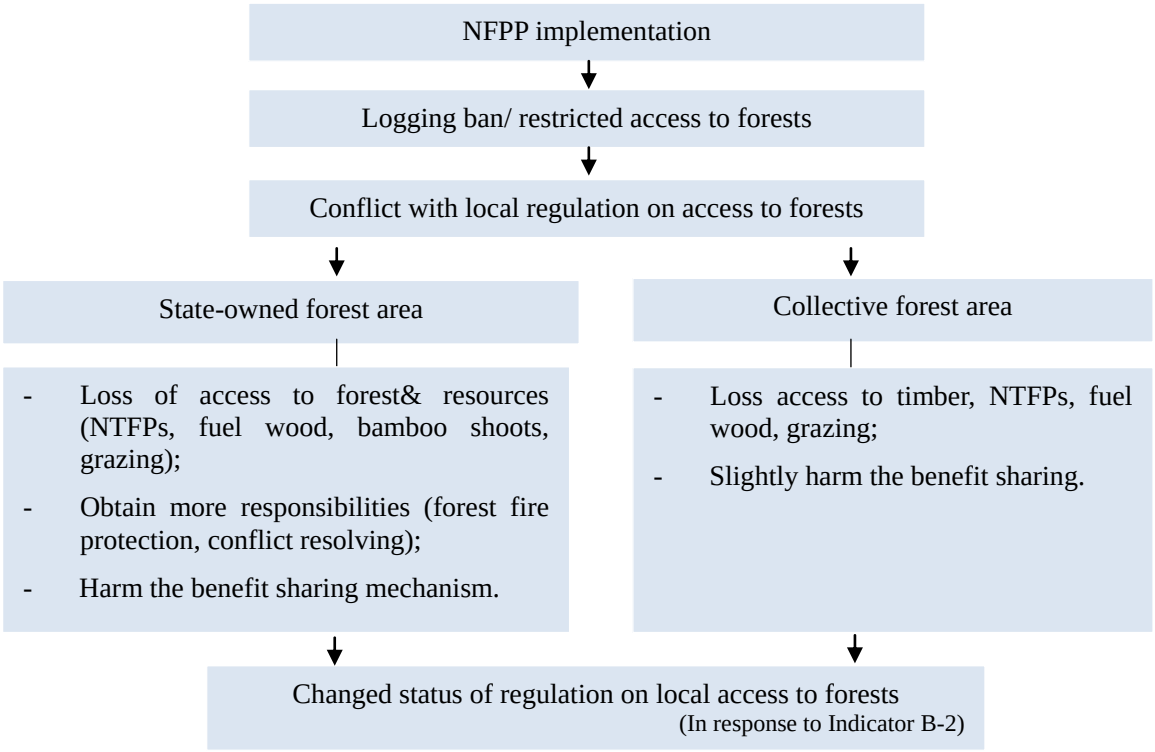


Figure 6-7: Causal chain of the NFPP impacting status of regulations on local access to forests in study villages

Indicator B-3: Local economy/industrial diversification

Local economic activities of the study villages in Gansu and Chongqing consist of the following common income categories: industry, agriculture, forestry, pastoral, construction, transportation, and various services including restaurant and hotel.

Through discussions with local expertises and leaderships in villages, Table 6-4 lists detailed information on the income generated from the above activities from 1998 to 2007 in the local community in study areas.

In Gansu each village community received an average total income of about 691,375 Yuan in 1998. Ranked by economic levels: agriculture brought in 178,375 Yuan per village, accounting for 25.8% of the total; transportation provided 168,073 Yuan per village, for 24.3% of the total; forestry amounted to 112,971 Yuan (16.3%); restaurant and hotel 95,617 Yuan (13.8%); pastoral 53,028 Yuan (7.7%); services 41,344 Yuan (6.0%); industrial 17,146 Yuan (2.5%); construction 15,003 Yuan (2.2%); and other economic activities 9,818 Yuan (1.4%) (Table 6-4).

By 2007 the average income generated from village community increased dramatically to 1,955,293 Yuan, an increase of about 182.3%. And the economic ranking levels altered: industry income, previously low in the listing, occupied the biggest proportion of the total income at about 631,560 Yuan per village (32.3%); agriculture was at 314,216 Yuan per village (16.1%); construction, 270,613 Yuan (13.8%); pastoral, 188,686 Yuan (9.7%); forestry, 182,828 Yuan (9.4%); restaurant and hotel, 172,652 Yuan (8.8%); services, 16,229 Yuan (0.8%); and other income resources, 69,022 Yuan (3.5%) (Figure 6-8).

In Chongqing, each village community averaged about 1,694,986 Yuan in 1998. The economic ranking by occupations was as follows: agriculture, the top income source, brought in about 462,731 Yuan (27.3%); forestry, 345,269 Yuan (20.4%); industrial, 292,216 Yuan (17.2%); transportation, 230,518 Yuan (13.6%); restaurant and hotel, 140,684 Yuan (8.3%); services, 77,122 Yuan (4.6%); pastoral, 66,104 Yuan (3.9%); construction, 44,748 Yuan (2.6%); and other economic activities, 35,595 Yuan (2.1%) (Table 6-4).

There was a 259.5% leap in the average income per village by 2007, reaching about 6,094,232 Yuan. And income from industry moved to the top of the ranking list with about 1,522,339 Yuan (25.0%) per village; This was followed by: agriculture, 798,344 Yuan (13.1%); forestry, 777,015 Yuan (12.8%); restaurant and hotel, 554,575 Yuan (9.1%); pastoral, 528,979 Yuan (8.7%); transportation, 478,397 Yuan (7.9%); services, 457,067 Yuan (7.5%); and other economic activities, about 269,365 Yuan (4.4%) (see Table 6-4 and Figure 6-9).

Figure 6-8 and Figure 6-9 on the distribution of economy/industrial structure in the local communities show the dramatic increase in community incomes and a shift in the ranking of economic sources as the local economic structure remained diversified. The biggest increase was from the industrial, shifting to 32.3% in 2007 from 2.5% in 1998. This occurred with the decrease in the economic contribution of forestry, agriculture, transportation (of wood) and related services.

For example, before 1998 the transportation of wood was one of the most important economic activities in study villages in Gansu, producing 24.3% of the total income due to the huge amount of logging assignments from the adjacent Maiji state-owned forest enterprise. It decreased to only 5.6% in 2007 with the halt of logging from forest enterprises. In Chongqing villages there was a significant decrease in the economic contribution of agriculture and forestry from 1998 income levels. In 1998 the agriculture income (27.3%), forest income (20.4%) and transportation income (13.6%) were the most important sources, but by 2007 they decreased to 13.1% for agriculture, 12.8% for forestry, and 7.9% for transportation. Industrial activities, important in 1998 with a 17.2% income source, climbed to nearly 25.0% of the total due to the additional local investment in that sector such as textile companies. So the contribution of income from industrial, pastoral, construction and services significantly increased, and restaurant and hotel slightly increased as well.

Discussion with local target groups revealed that as local forests were preserved, tourism based on forest resources flourished, becoming an emergent economic income source, especially with the added investment in roads and supporting services. Industrial, agricultural and forestry income remain the top three most important economic activities for Chongqing in 2007. Forest incomes from logging and cultivation activities such as *Mu'er*[141] (*Auricularia auricula-judae)* cultivation were replaced by cultivation of orchard (fruits) and *Huajiao* (*Zanthoxylum bungeanum*)[142].

The increase in income from forestry from 1998 to 2007 is mainly due to the rise in the market price for wood and forest products along with new cultivation technology for *Huajiao*

[141] *Mu'er*, the Latin name *Auricularia auricula-judae*, or the local name of *wooden ear* or *Jelly ear*, is an edible fungus, traditionally used often in Asia for cooking; *Jelly ear* is known as a medicinal mushroom as it also has medicinal values. *Mu'er* is often found on dead elder trees but also can be cultivated by using wood materials, author, 2008.

[142] *Huajiao*, Sichuan pepper, the Latin name *Zanthoxylum bungeanum*, is the outer pod of the tiny fruit of a number of species in the genus *Zanthoxylum*, widely grown and consumed in Asia as a spice, and widely used in the cuisine of Sichuan, China, from which it takes its name, Tibetan, and other regions in China. It is also favored by Nepalese, Japanese, Korean in Asia, noted by author, 2008. A list of NTFPs used by locals is presented in Appendix 4.

(*Zanthoxylum bungeanum*) which only use the fruits from the trees replacing the *Mu'er* (*Auricularia auricula-judae)* which requires the consumption of the whole wood materials.

The causal chain in Figure 6-10 illustrates the pathway of the NFPP impacting the economic and industrial structure in local communities in both state-owned (Gansu) and collective (Chongqing) forest areas. As the result, the NFPP implementation shifts the local economy from reliance on local forest resources to dependence on industrialization. This has changed the local community economic structure tied to the joint logging and wood transportation in Gansu and to traditional forestry cultivation activities in Chongqing. Chongqing seems to have more options, developing better local strategies for alternative incomes such as tourism and orchard development. Consequently, the local economic and industrial structure and diversification in Gansu have changed more significantly than that in Chongqing.

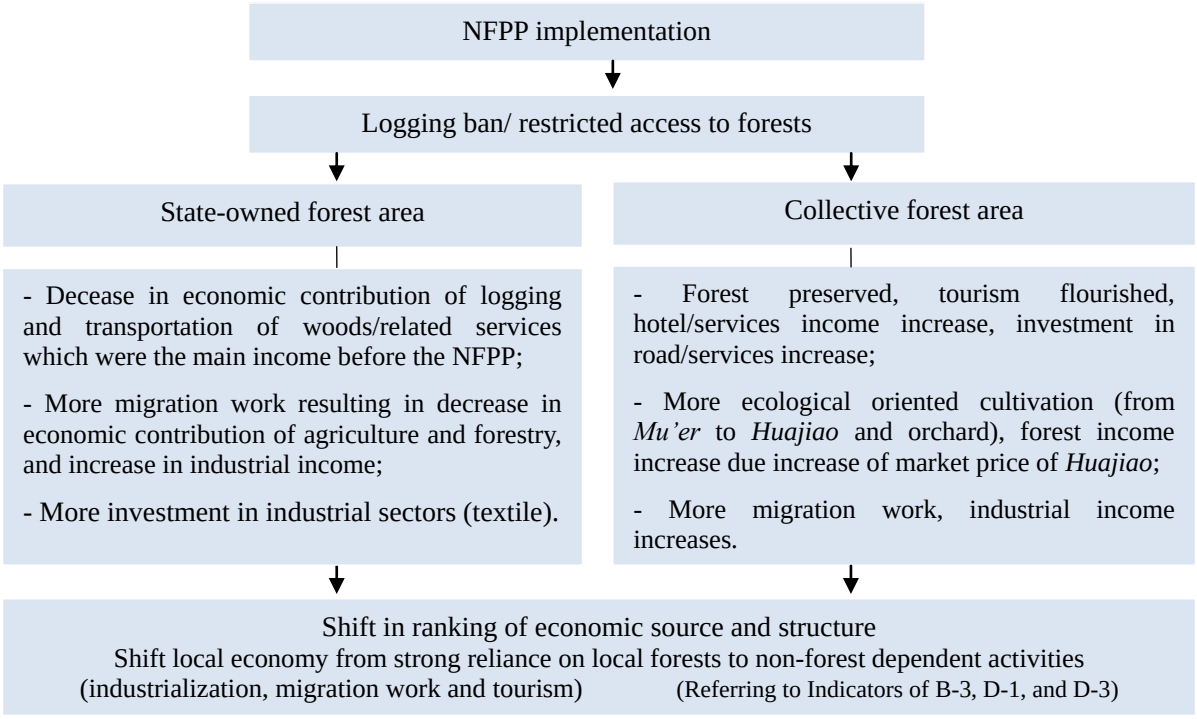


Figure 6-8: Causal chain of the NFPP impacting local economic structure and diversification

Table 6-4: Economic and industrial structure in local communities in study areas in 1998 and 2007

Category of economic activities	Gansu (state-owned)						Chongqing (collective owned)					
	1998			2007			1998			2007		
	Income (Yuan/ village)	%	Ranking*	Income (Yuan/ village)	%	Ranking	Income (Yuan/ village)	%	Ranking	Income (Yuan/ village)	%	Ranking
1. Industrial income	17,146	2.5	***7***	631,560	32.3	***1***	292,216	17.2	***3***	1,522,339	25.0	***1***
2. Agriculture income	178,375	25.8	***1***	314,216	16.1	***2***	462,731	27.3	***1***	798,344	13.1	***2***
3. Forestry income	112,971	16.3	***3***	182,820	9.4	***5***	345,269	20.4	***2***	777,015	12.8	***3***
4. Pastoral income	53,028	7.7	***5***	188,686	9.7	***4***	66,104	3.9	***7***	528,979	8.7	***6***
5. Construction income	15,003	2.2	***8***	270,613	13.8	***3***	44,748	2.6	***8***	708,150	11.6	***4***
6. Transportation	168,073	24.3	***2***	109,496	5.6	***7***	230,518	13.6	***4***	478,397	7.9	***7***
7. Restaurant/hotel	95,617	13.8	***4***	172,652	8.8	***6***	140,684	8.3	***5***	554,575	9.1	***5***
8. Services	41,344	6.0	***6***	16,229	0.8	***9***	77,122	4.6	***6***	457,067	7.5	***8***
9. Others	9,818	1.4	***9***	69,022	3.5	***8***	35,595	2.1	***9***	269,365	4.4	***9***
TOTAL	691,375	100		1,955,293	100		1,694,986	100		6,094,232	100	

Note: *Ranking shows the importance of income generation activities for the local community.
From 1998 to 2007 the inflation rate in study areas is about 7%, according to the local statistic bureau, 2008.

Source: Key informant interviews in field research, 2007 and 2008

Source: Key informant interviews in field research, 2007 and 2008

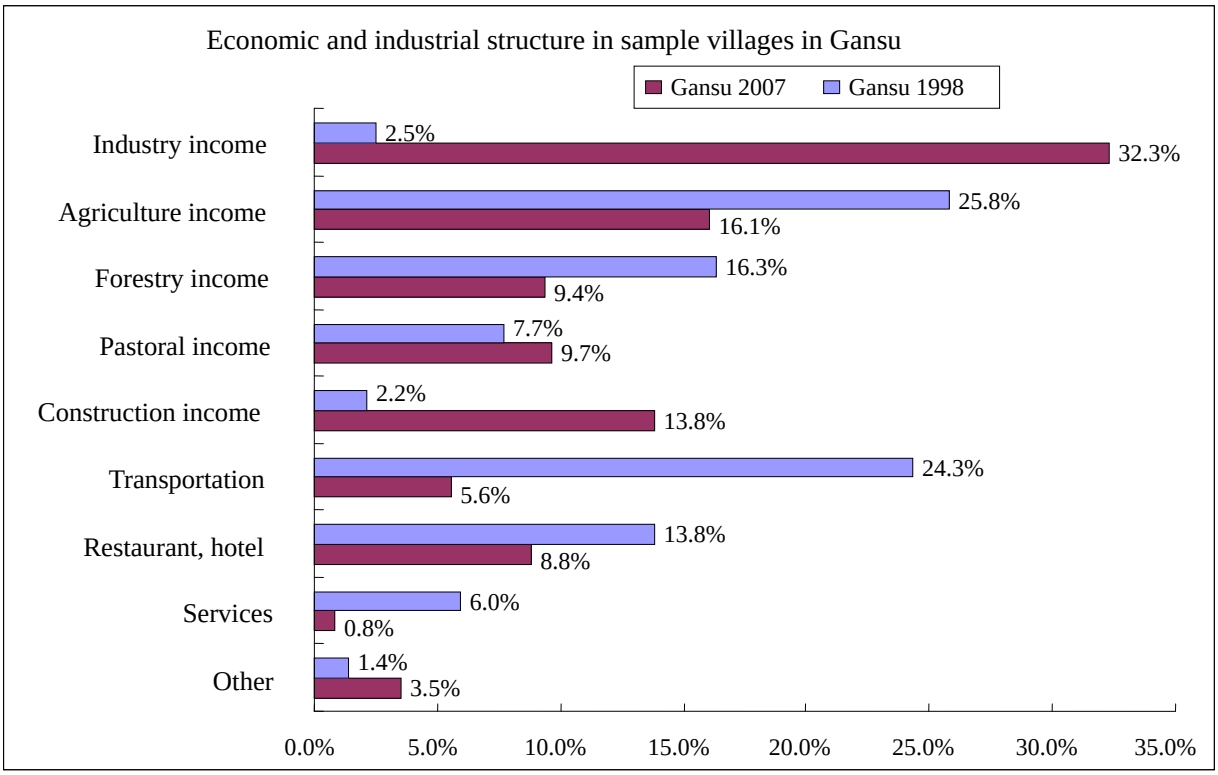


Figure 6-9: Change in economic and industrial structure in Gansu from 1998 to 2007

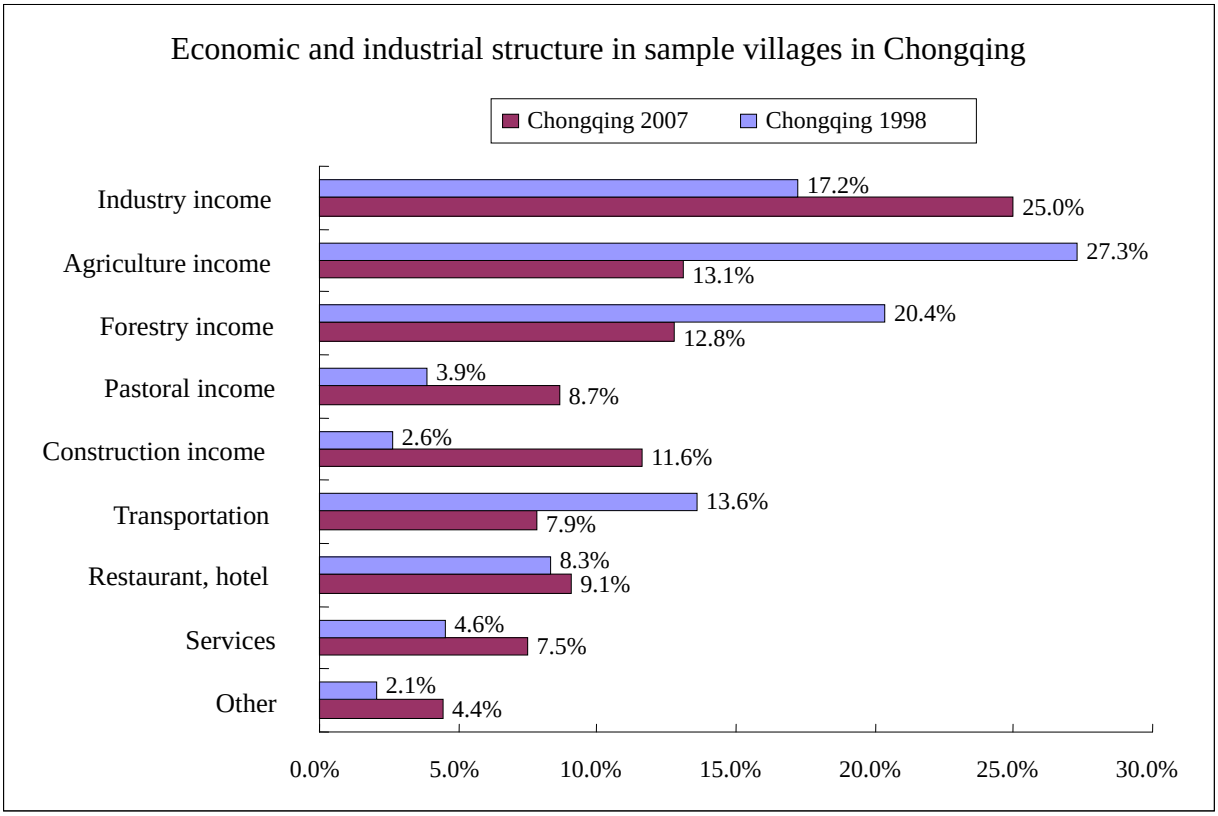


Figure 6-10: Change in economic and industrial structure in Chongqing from 1998 to 2007

6.1.3 Change in the community infrastructure and public services

The category C, *change in the community infrastructure/public services* refers to a general measure of local community development along with services such as education and health care (e.g. schools, clinics), transportation facilities and services (e.g. roads). It also includes the information essential for determining sources of human impacts on forest resources. For instance, with available road links people have easy and frequent access to natural forests; such road links may encourage migration to adjacent towns and cities for labour (migration work, *dagong*), reducing dependence on local forest resources. Meanwhile, the community infrastructure and services may also influence the accessibility of the community which results in various demographic changes such as in-flux and out-flux of the population. Besides, community infrastructure and services are also reflected by the local land use patterns. This category attempts to understand the quantity of infrastructure facilities and qualitative factors such as the villagers' sense of well-being and satisfaction with their community and their perception of future security[143].

Indicator C-1: Infrastructure and public services (transport, education and health care)

Through discussions with local key informants and leaderships in villages during the field investigation, it is known that, in 1998 in Gansu, seven roads serviced the two study villages, and five of them built by the Maiji forest enterprise from 1992 -1996, to facilitate logging and wood transportation. Since 1998, the roads were gradually abandoned as less logging activities were engaged, and those roads destroyed by the flooding catastrophes of 2001 and 2002 not repaired or replaced since there was no more investment from the state enterprise. By 2007, only four roads remained in use in the study villages, all of them in worse condition (Table 6-5).

Through interviews with school teachers in local villages, it is known that, in terms of the school facilities, each village had one primary school in 1998, its condition was not good, and neither the number nor the conditions changed in 2007. School enrolment rates remained stable from 1998 to 2007, maintaining 96% of the school enrolment rate in Maiji Village and slightly increased from 96% to 97% in Taohua Village (Table 6-5).

As for health clinics, a newly established, privately-owned one in Maiji Village increased the number from five to six between 1998 and 2007, but quality did not improve or slipped. Rating clinics in 1998, Maiji Village answered "adequate"[144] and Taohua Village "good"; rating clinics in 2007, Maiji Village still answer "adequate" while Taohua Village consider scored "bad". Apart from the establishment of the new, privately owned clinic, the rest of the village clinics were worse in terms of quality.

Based on the scoring, Gansu is recorded with the score "+10" in 1998 and "+5" in 2007 for the assessment of transport/road item, which means the transport/road facility has been severely impaired from 1998 to 2007. In terms of education/school condition, Gansu is recorded with the score "+11" in 1998 and "+11" in 2007, which means the condition of local education/school facilities from 1998 to 2007 has not been changed seriously. In terms of health care/clinic condition, Gansu is recorded with the score "+10" in 1998 and "+9" in 2007, which means the health care/clinic facility has been also slightly worse (Table 6-5).

[143] Which are partly measured by employing Indicators of D-4 and D-5, see pages of 67-68.

[144] In order to differentiate the quality and condition of local infrastructure facilities (including roads, school and clinics), three different levels of description are used: "good", "adequate" and "bad"; and they are scored as "+1", "+2" and "+3" accordingly and respectively. For details see Chapter 4, Methodology, on page 65.

However, Chongqing villagers saw improvement of road and the addition of one more between 1998 and 2007, bringing the number from ten to eleven. The improvements are reflected in a score that went from "+9" in 1998 to "+11" in 2007. Education/schools improved slightly between 1998 and 2007 and a newly established school in Xinshi Village raised the number from three to four in the surveyed villages. Quality remained the same, one village considered "good" and another "adequate". Enrolment rates rose slightly, from 95% to 97% in Nanmu Village and from 95% to 99% in Xinshi Village (where the enrolment rate had decreased during 2004), according to interviews with local teachers. This infrastructure improvement in Chongqing village schools is reflected by improved scores which rose from "+14" in 1998 to "+16" in 2007.

As for clinics, the number decreased by one, from six to five, and they remained "adequate" in terms of the quality. Actually the infrastructure under healthcare/clinic slightly regressed, scoring "+10" in 1998 and "+9" in 2007. But local leadership indicated that a new privately financed clinic was planned for 2009, reflecting the additional household income by young people who migrate to work and the increased needs of the elderly who remain in the villages.

To summarize, infrastructure and public services deteriorated in Gansu and improved in Chongqing. Gansu is recorded with a total score of "+25" in 2007, lower than that in 1998 which was "+31". Chongqing is recorded with the score of "+36" in 2007, higher than that in 1998 which was "+33". Table 6-5 details changes in the condition of the community infrastructure and public services since introduction of the NFPP in the respective study areas.

In order to understand the attribution of the NFPP to the deterioration or improvement of the infrastructure facilities and public services in local communities, a review on the historical development of the local community and its influence from forestry sector is necessary:

Prior to introduction of the NFPP, state forestry enterprises flourished, having a positive economic impact on local infrastructure in the state-owned forests, according to interviews. To facilitate wood harvesting and log transportation, the government invested generous budgets to build new roads, bridges and hospitals. When these investments stopped with the NFPP implementation local community infrastructure and public services suffered in villages connected to state-owned forests; however, villages in the collective forests system benefited by compensation from the government and the development of better economic alternatives. The purpose of investment for the repair and new construction of the roads in villages of collective forests is to facilitate the local industrial development. Local industrial development becomes the most important local income source and the income would be added to government revenues. The increased household income is considered as the main reason for the rise in enrolment rate from 2004 to 2007 in villages of collective forest areas (Chongqing)[145].

The following, Figure 6-11, illustrates the causal chain of the NFPP implementation impacting the condition of the community infrastructure and public services. The NFPP has directly resulted in the deterioration of the local infrastructure and public services (including the conditions of the roads, schools and hospitals) in Gansu and the improvement in Chongqing.

[145] For details see the measurement of indicator D-1, household income structure, which is presented in the later section.

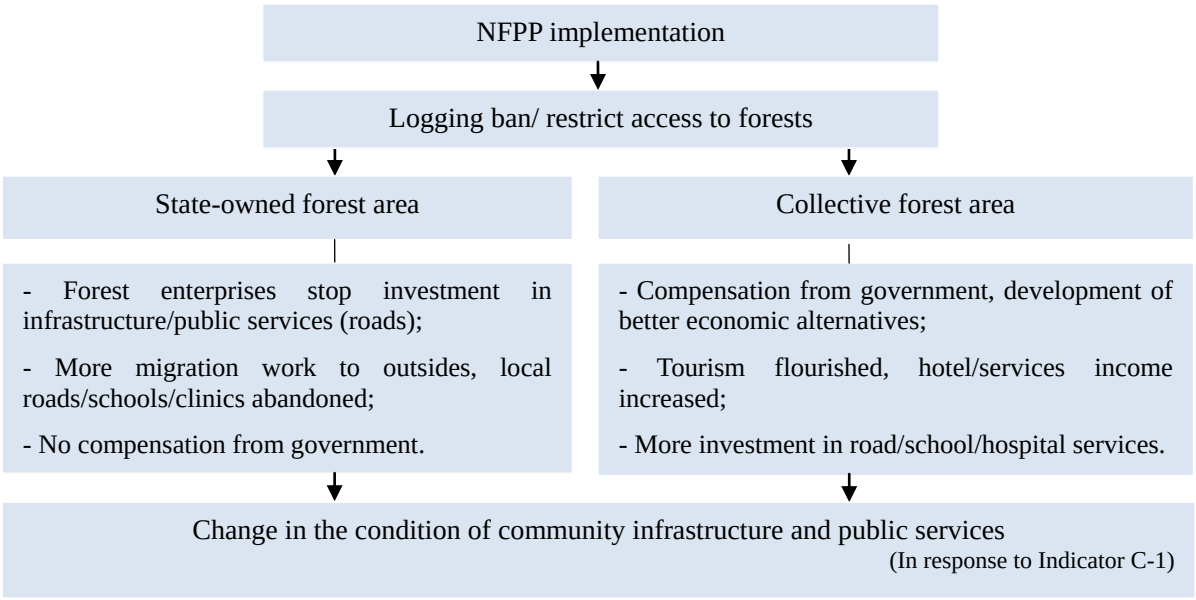


Figure 6-11: Causal chain of the NFPP impacting condition of community infrastructure and public services

Indicator C-2: Land use patterns

Through the interviews with local leadships of villages, it is known that, the following five land-use types are very common in the surveyed villages of Gansu and Chongqing: agriculture (wheat and cornfields in Gansu; paddy rice and terrace lands in Chongqing); forest (natural forest, plantation, barren forestland and rocky area); pasture; homestead and home garden (the latter more common in Chongqing); and public-use (e.g., water bodies and boundary of the villages).

While in Gansu's Maiji Village the total land area of about 1,251.9 ha was unchanged from 1998 to 2007, however, the land used was altered. Agricultural land was converted to forest. For instance, in 1998 the agricultural lands (wheat and corn fields) occupied 466.3 ha, 37.2% of the total land area. Forest lands accounted for about 567.9 ha (45.4%), of which of 400.5 ha (32.0%) was natural forests, 88.5 ha (7.1%) was plantations and 78.9 ha (6.3%) was barren forestland. Additionally, about 129.9 ha (10.4%) was homesteads and home gardens; and 87.8 ha (7.0%) was public lands. In 2007, the agricultural lands were significantly reduced from 466.3 ha (37.2%) to 212.5 ha (17.0%), mainly the wheat/corn field; the latter change was due to the Program of Conversion of Sloping Land into Forests (PCSLF)[146] tied to the NFPP after 1999, according to the key informant interviews with local leadership. As agricultural land was converted into forest, total forest lands increased to 800.3 ha, accounting for 63.9% of the total. Within the forest land category, the plantation areas significantly increased to 366.1 ha (29.2%), increasing by 277.6 ha; the barren forestland was reduced to 28.7 ha (2.3%) as was reclaimed and replanted; and natural forests maintained a relatively stable amount of 405.5 ha (32.4%) of the total from 1998 to 2007. Pastoral land increased to 13.3 ha (1.1%); homesteads and home gardens slightly increased to 143.6 ha (11.5%); and public land slightly decreased to 82.2 ha (6.6%).

[146] More information about the program PCSLF is presented in Chapter 2, the footnote on page 34.

Table 6-5: Change in infrastructure and public services in local communities in study areas in 1998 and 2007

Infrastructure categories		Gansu (state-owned)										Chongqing (collective owned)									
		1998					2007					1998					2007				
		Village Maiji		Village Taohua		Total score	Village Maiji		Village Taohua		Total score	Village Nanmu		Village Xinshi		Total score	Village Nanmu		Village Xinshi		Total score
		Condition	Score	Condition	Score		Condition	Score	Condition	Score		Condition	Score	Condition	Score		Condition	Score	Condition	Score	
1.Transport condition (road)						***10***					***5***					***9***					***11***
	Number**	Adeq.	2	Adeq.	2	*4*	Few	1	Few	1	*2*	Adeq.	2	Many	3	*5*	Many	3	Many	3	*6*
	Quality*	Good	3	Good	3	*6*	Bad	1	Adeq.	2	*3*	Adeq.	2	Adeq.	2	*4*	Good	3	Adeq.	2	*5*
2. Education condition (school)						***11***					***11***					***14***					***16***
	Number	Adeq.	2	Adeq.	2	*4*	Adeq.	2	Adeq.	2	*4*	Many	3	Adeq.	2	*5*	Many	3	Many	3	*6*
	Quality	Adeq.	2	Bad	1	*3*	Adeq.	2	Bad	1	*3*	Good	3	Adeq.	2	*5*	Good	3	Adeq.	2	*5*
	Enrolment rate	Adeq.	2	Adeq.	2	*4*	Adeq.	2	Adeq.	2	*4*	Adeq.	2	Adeq.	2	*4*	Adeq.	2	Good	3	*5*
3. Healthcare condition (clinic)						***10***					***9***					***10***					***9***
	Number	Adeq.	2	Many	3	*5*	Many	3	Many	3	*6*	Many	3	Many	3	*6*	Many	3	Adeq.	2	*5*
	Quality	Adeq.	2	Good	3	*5*	Adeq.	2	bad	1	*3*	Adeq.	2	Adeq.	2	*4*	Adeq.	2	Adeq.	2	*4*
TOTAL						***31***					***25***					***33***					***36***

Notes: *:- Quality of road, school and clinic are categorized as three levels: “Good”, “Adeq.” and “Bad”. Accordingly, scoring “3” when marked as “good”; scoring “2” when “Adeq.”; and scoring “1” when “Bad”. Adeq. = Adequate.

**:- Number of road is categorized as following three levels: “Few” when number is between 0 and 2; “Adeq.” for number between 3 and 4; “Many” for number over 5. Accordingly, scoring “3” when marked as “Many”; scoring “2” when “Adeq.”; and scoring “1” when “Few”.

- Number of school is categorized as following three levels: “Few” when number is 0; “Adeq.” when number is 1; “Many” when number is 3 or more. Accordingly, scoring “3” when marked as “Many”; scoring “2” when “Adeq.”; and scoring “1” when “Few”.

- Number of clinic is categorized as following three levels: “Few” when number is between 0 and 1; “Adeq.” when number is 2; “Many” when number is 3 or more. Accordingly, scoring “3” when marked as “Many”; scoring “2” when “Adeq.”; and scoring “1” when “Few”.

- Condition of enrolment rate is categorized as following three levels: “Bad” when enrolment rate is less than “94%”, “Adeq.” when enrolment rate is between “95%” and “98%”; “Good” when enrolment rate is higher than “98%”. Accordingly, scoring “3” when marked as “More”; scoring “2” when “Adeq.”; and scoring “1” when “Few”.

Source: Key informant interview in the field research, 2007 and 2008

Taohua Village in Gansu, with land area of about 1,069.0 ha, provides a similar picture. Agricultural lands (the wheat and corn fields) decreased from 236.5 ha (22.1%) in 1998 to 108.4 ha (10.1%) in 2007. Forest land increased from 539.7 ha (50.5%) to 652.6 ha (61.0%). Within the forest land category, the plantation area increased from 130.8 ha (12.2%) to 323.2 ha (30.2%); barren forestland decreased from 110.1 ha (10.3%) to 32.4 ha (3.0%); the rocky area decreased from 15.4 ha (1.4%) to 12.5 ha (1.2%); and natural forests remained similar which was 283.4 ha (26.5%) in 1998 and 284.5 ha (26.6%) in 2007. Conservation associated with the NFPP has increased pastoral land area from 0 to 10.6 ha (1.0%). Homesteads and home gardens have slightly increased from 170.7 ha (16.0%) to 175.6 ha (16.4%). The public land has slightly decreased from 122.1 (11.4%) to 121.8 ha (11.4%) for reasons that are not clear.

Turning to Chongqing, Nanmu Village with a land area of about 1,524.5 ha, also saw a big change in the proportion of the land area, especially an increase in forestland and a decrease in agricultural land. In 1998, the agricultural land of about 592.4 ha (38.9%), included 366.9 ha (24.1%) of rice paddy field and 225.5 ha (14.8%) of rice terrace. Forest land occupied 40.0% of the total, about 609.5 ha, of which 399.2 ha (26.2%) was plantations, 118.2 ha (7.8%) was barren forestland, 85.3 ha (5.6%) was rocky area, and natural forest was only about 6.8 ha (0.4%). The remainders were pasture land with 28.9 ha (1.9%), homesteads and home gardens at 238.3 ha (15.6%), and public lands of 55.4 ha (3.6%). By contrast, in 2007, the agricultural land decreased to only 206.9 ha (13.6%), including paddy rice field, 171.1 ha (11.2%) and rice terraces, 35.8 ha (2.3%). And forest lands expanded to 990.5 ha (65.0%), of which plantations increased to 902.5 ha (59.2%), natural forests slightly increased to 7.8 ha (0.5%), barren forestland decreased to 31.4 ha (2.1%), and rocky area decreased to 48.8 ha (3.2%). The barren forestland and rocky areas have been reforested since 1998; pastoral land has also increased to 50.5 ha (3.3%); homesteads and home gardens increased to 239.8 ha (15.7%); and public land has decreased to 36.8 ha (2.4%).

In Chongqing, Xinshi village, a total land area of about 1,788.4 ha, forest land increased significant at the expense of agricultural land, which dramatically decreased from 924.4 ha (51.7%) in 1998 to 249.1 ha (13.9%) in 2007. Agricultural land includes rice paddy field, decreasing from 468.6 ha (20.5%) to 198.5 ha (11.1%), and rice terraces, decreasing from 455.8 ha (12.6%) to only 50.6 ha (2.8%). Consequently, forest land increased significantly, from 585.4 (32.7%) in 1998 to 1210.8 ha (67.7%) in 2007: plantations jumped from 545.3 ha (30.5%) to 1050.5 ha (58.7%); barren forestland increased from 20.8 ha (1.2%) to 142.5 ha (8.0%); rocky area slightly decreased from 8.8 ha (0.5%) to 7.8 ha (0.4%); and natural forests remained almost the same, from 10.5 ha (0.6%) to about 10.0 ha (0.6%). Pastoral land has also increased from 73.5 ha (4.1%) to 104.2 ha (5.8%); homesteads and home gardens increased from 184.6 ha (10.3%) to 203.8 ha (11.4%); public land remained similar, about 20.5 ha (1.1%) from 1998 to 2007.

Table 6-6 provides an overview of land-use patterns in study areas from 1998 to 2007.

As known from Table 6-6, the land-use patterns in the surveyed villages of Gansu and Chongqing have been changed, with a specific increase in forestland and a decrease in agricultural land. The change is connected to the implementation of the NFPP with objectives of banning logging and the Program of Conversion of Slope Land into Forest (PCSLF)[147], increasing plantation and forest cover areas, which is associated with the NFPP. Field observation noted that may formerly cultivated sloping lands have been planted with new young trees. All the villages reflect similarities, but with some differences. The agricultural

[147] See the introduction of the PCSLF program in Chapter 2, the footnote on page 34.

and forest lands are the two main land-use types in the surveyed villages, occupying nearly 77.0% and 80.8% of the total land, respectively. While the total land area of each village in Gansu and Chongqing has remained unchanged, land use altered from 1998 to 2007. As large areas were converted into forest lands, the areas of agricultural land decreased, wheat/corn fields from 29.7% to 13.6 % in Gansu villages and in Chongqing villages rice paddy fields and rice terraces dropped from 45.3% to 13.8%. The areas of forest lands have prominently increased from 47.9% to 62.5% in Gansu and 36.4% to 66.3% in Chongqing.

Following Figure 6-12, the causal chain of the NFPP, gives an idea on how the NFPP influences the local land use patterns through the logging ban and the program PCSLF.

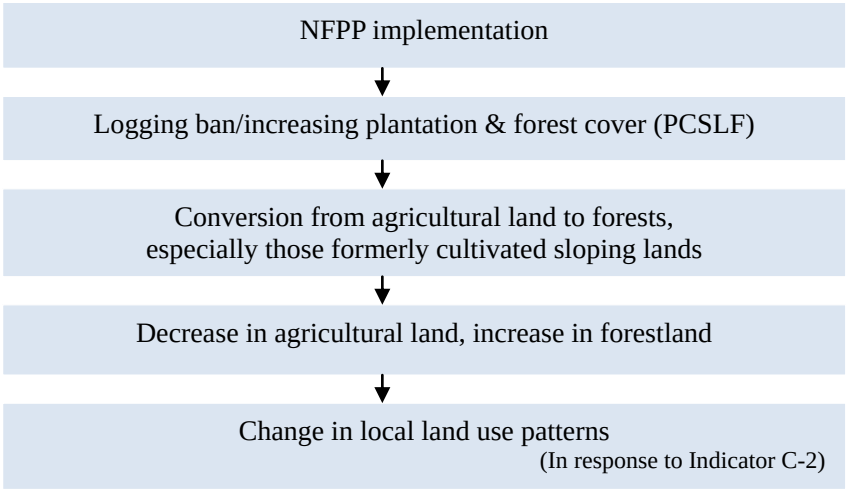


Figure 6-12: Causal chain of the NFPP impacting local land use patterns

These changes in community land use patterns have impacts on the local economic structure and development, and will have influences on local household economic and labour contribution, especially concerning the agricultural farming with its decreased labour contribution and downsized income since the NFPP in 1998, of which are discussed more in details in the next section.

Table 6-6: Change in land use patterns in study areas from 1998 to 2007

Category of land use type		Gansu (state-owned)												Chongqing (collective owned)									
		1998						2007						1998						2007			
		Maiji		Taohua		Average		Maiji		Taohua		Average		Nanmu		Xinshi		Average		Nanmu		Xinshi		Average	
		Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%	Area (ha)	%
1. Agricultural lands		466.3	37.2	236.5	22.1	351.4	29.7	212.5	17.0	108.4	10.1	160.5	13.6	592.4	38.9	924.4	51.7	758.4	45.3	206.9	13.6	249.1	13.9	228.0	13.8
	Wheat/corn	466.3	37.2	236.5	22.1	351.4	29.7	212.5	17.0	108.4	10.1	160.5	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Paddy rise	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	366.9	24.1	468.6	20.5	417.8	22.3	171.1	11.2	198.5	11.1	184.8	11.2
	Terrace	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	225.5	14.8	455.8	12.6	340.7	13.7	35.8	2.3	50.6	2.8	43.2	2.6
2. Forest lands		567.9	45.4	539.7	50.5	553.8	47.9	800.3	63.9	652.6	61.0	726.5	62.5	609.5	40.0	585.4	32.7	597.5	36.4	990.5	65.0	1,210.8	67.7	1100.7	66.3
	Natural forest	400.5	32.0	283.4	26.5	342.0	29.3	405.5	32.4	284.5	26.6	345.0	29.5	6.8	0.4	10.5	0.6	8.7	0.5	7.8	0.5	10.0	0.6	8.9	0.5
	Plantation	88.5	7.1	130.8	12.2	109.7	9.7	366.1	29.2	323.2	30.2	344.7	29.7	399.2	26.2	545.3	30.5	472.3	28.3	902.5	59.2	1,050.5	58.7	976.5	59.0
	Barren forestland	78.9	6.3	110.1	10.3	94.5	8.3	28.7	2.3	32.4	3.0	30.6	2.7	118.2	7.8	20.8	1.2	69.5	4.5	31.4	2.1	142.5	8.0	87.0	5.0
	Rocky area	0.0	0.0	15.4	1.4	7.7	0.7	0.0	0.0	12.5	1.2	6.3	0.6	85.3	5.6	8.8	0.5	47.1	3.0	48.8	3.2	7.8	0.4	28.3	1.8
3. Pastoral land		0.0	0.0	0.0	0.0	0.0	0.0	13.3	1.1	10.6	1.0	12.0	1.0	28.9	1.9	73.5	4.1	51.2	3.0	50.5	3.3	104.2	5.8	77.4	4.6
4. Homestead		129.9	10.4	170.7	16.0	150.3	13.2	143.6	11.5	175.6	16.4	159.6	13.9	238.3	15.6	184.6	10.3	211.5	13.0	239.8	15.7	203.8	11.4	221.8	13.6
5. Public land		87.8	7.0	122.1	11.4	105.0	9.2	82.2	6.6	121.8	11.4	102.0	9.0	55.4	3.6	20.5	1.1	38.0	2.4	36.8	2.4	20.5	1.1	28.7	1.8
TOTAL		1,251.9	100	1,069.0	100	1,160.5	100	1,251.9	100	1,069.0	100	1,160.5	100	1,524.5	100	1,788.4	100	1,656.5	100	1,524.5	100	1,788.4	100	1,656.5	100

Source: Key informant interviews in the field research, 2007 and 2008

6.2 Social impacts on the household level

6.2.1 Impacts on households and families

Impacts on families are the human impacts experienced by the households and families. They measure household economy and perceived disruptions in daily life and movement patterns of individuals and families. This category includes household income derivation, expenditure and labour time distribution. The data are basically collected through eighty household questionnaires and interviews.

Indicator D-1: Household income structure

According to the household questionnaire interview and field observation, rural household incomes in the study villages are mainly derived from the following sauces: crops farming, joint timber harvesting and transportation, NTFPs collection and cultivation, vegetable gardens cultivation and collecting, medicinal plants collecting and cultivation, livestock raising, fuel wood collection and migrant work, as well as the handicraft making and sale. As more people migrate to cities for work, remittance from those family members becomes one of the important income sources for some households.

Table 6-7 provides a detailed overview of the income from each household income generation.

The result of forty household questionnaire interviews in Gansu shows that, Gansu village households received averagely about 3,052 Yuan in total income for 1998. Forestry incomes[148], especially the income from joint forest harvesting/transportation was the top income source, 1,003 Yuan, accounting for 32.8% of the total. Income from crops farming ranked second, 813 Yuan, 26.6% of the total. Other incomes included the income from livestock raising, 330 Yuan (10.8%), NTFPs collection and cultivation 308 Yuan (10.1%), vegetable garden and medicinal plant collection 287 Yuan (9.4%), and fuel wood collection 50 Yuan (1.6%). Hereby, the incomes from forestry occupied 64.8% (32.8%+10.1%+9.4%+10.8%+1.6%) of the total, about 1,978 Yuan. In 1998 income from migration work was 224 Yuan, for only 7.3%, and handicraft and sale 39 Yuan, for 1.3%.

By 2007 each household annual income tripled to an average of 9,293 Yuan in surveyed villages of Gansu. The dramatic jump in income attributed to market price increases in agricultural and livestock products as well as the increased migration to towns or cities for work since the NFPP; meanwhile the condition of roads may also influence this migration[149]. Income from those migration works in cities climbed to the top, 4,298 Yuan, accounting for 46.2% of the total household income. Forestry income was second, 2,555 Yuan, at 27.5% of the total. Other sources ranked as follows: NTFPs collection and cultivation, 1,578 Yuan, accounting for 17.0%; vegetable and medicinal plants, 421 Yuan, 4.5% of the total; and livestock raising, 556 Yuan, 6.0%. Almost no income was derived from the joint forest harvesting/transportation and fuel wood collection. Crops farming produced 1,170 Yuan, 12.6% of the total; income from handicraft and sales increased to 820 Yuan, 8.8%; and remaining income, 450 Yuan, about 4.8%, was from remittance (Figure 6-13). The significances of

[148] Even though there might be other classifying, forestry incomes in this field study generally include incomes from following household activities: Joint harvesting and transportation, NTFPs collection and cultivation, vegetable gardens and collecting, medicinal plants, livestock raising and fuel wood collection, noted by the author, 2008.

[149] The influence of infrastructure on migration is discussed in Indicator C-1 on page 112; and more discussions on this issue are presented in Chapter 7.2, page 148.

differences of income sources between 1998 and 2007 have been statistically proven by t-Test (see Table 6-7).

According to the forty household questionnaire interviews, it is known that, in Chongqing village households, the average annual income was about 4,745 Yuan in 1998, forestry income, about 2,883 Yuan, ranking as the top income source at 59.7% of the total. Farmers, with a long tradition of NTFPs collection and cultivation, especially, *Huajiao* cultivation, brought in about 1,411 Yuan, 29.7% of the total income for households. The rest of the forestry incomes, such as income from harvesting/transportation of the loggings, about 600 Yuan, accounted for 12.6%; livestock raising, 580 Yuan, 12.2%; and vegetable/medicinal plants, 242 Yuan, 5.1% of the total. Crops farming income, 1,105 Yuan, accounted for 23.3%, ranking as the second important income source. Income from migration work/business amounted to 742 Yuan, 15.6%, and handicrafts/sales, 65 Yuan, at 1.4%.

By 2007, each household's annual income was 17,218 Yuan, approaching a fourfold increase due to more robust market price for agricultural products, forest products, live stock, and additional migration works in towns or cities since the NFPP. In fact, income from business and migration works in towns and cities attained the top income rank, 10,738 Yuan, accounting for 62.4% of the total. Income from crops farming, 2,925 Yuan, accounted for 17.0%, ranking as the second most important source. Forestry income ranked as third, 2,791 Yuan, 16.2% of the total, including: income from NTFPs collection and cultivation (*Huajiao, Zanthoxylum bungeanum*), 1,258 Yuan, accounting for 7.3%; livestock raising, 1,133 Yuan, 6.6%; vegetable/medicine plants, 375 Yuan, 2.2%; and small amount from harvesting/transportation of the loggings, 25 Yuan, 0.1%. Remaining incomes were from handicraft/sale, 535 Yuan, 3.1%; and remittance, 230 Yuan, 1.3% of the total.

The NFPP has impacts on local community economic structure and diversification (as shown in Figure 6-10); accordingly, the NFPP has impacts on household income structure since a household is the basic unit of a local community. Based on this adjustment, the data presented above can be interpreted within following four arguments:

- The NFPP has resulted in a significant increase in the annual total household income in villages of both state-owned and collective forest areas. More specifically, average annual income for each household has increased from 3,052 to 9,293 Yuan in Gansu (state-owned), and 4,745 to 17,218 Yuan in Chongqing (collective), with the increase rates of 204.5% and 262.9%, respectively. Chongqing has more significant income increase than that of Gansu. The reasons for income increase are partly due to the increase of market prices for agricultural and forest products as well as livestock, and also the increased prevalence of migration work in towns or cities for alternative livelihood brings in more income. Obviously the local households do not benefit directly from any measurements associated with the NFPP, but indirectly and positively influenced by the NFPP in terms of the income. However, income data from the household interviews also show that the NFPP may have increased the income disparity among the study areas, especially in Chongqing.

- The contribution of forestry incomes, including the joint timber harvesting/transportation, NTFPs cultivation/collection, livestock raising and fuel wood collection, was less important to total household income since the NFPP. More specifically, forestry income ranked as top income both for households in Gansu and Chongqing in 1998, amounting to more than half of total income. However, after that the proportion of forestry's contribution to total income decreased to only 27.5% in Gansu and 16.2% in Chongqing.

Joint harvesting/transportation, ranked as the top sources of income decreased to nearly zero in Gansu, and in Chongqing NTFPs cultivation/collection (*Huajiao, Zanthoxylum bungeanum*), once top ranked, dropped to third. Nevertheless, the forestry income for each household has increased from 1,978 to 2,555 Yuan in Gansu while only slightly decreased in Chongqing from 2,883 to 2,791 Yuan due to the market price increase for the forest products during the past ten years. Moreover, the kind of forest cultivation shifted in both areas from *Mu'er* (*Auricularia auricula-judae*) cultivation which consumes great amounts of wood materials and may necessitate the harvesting of the whole tree to *Huajiao* (*Zanthoxylum bungeanum*) cultivation which only collects the fruits without destroying the trees. Nevertheless, t-Test proves that Gansu has a more significant decrease in forestry income compared with that in Chongqing (Table 6-7, Figure 6-13).

- Crop farming is still the foremost priority for household income generation since most farmers consider it as the main activity of their daily life. This may also involve some culture factors, and farming has been the traditional livelihood and lifestyle for generations in many rural areas of Western China.

- The contribution of income from migrant work/business has become increasedly important to the rural household economy, rising to the top rank income in both study areas of Gansu and Chongqing, accounting for 46.2% and 62.4% of income, respectively. The increase of migration work income was more significant for Gansu villages since in 1998 it accounted for only 7.5% of income total, ranking sixth. Chongqing has a relative longer history in the migration work/business category as noted by the 1998 figure of 15.6%, ranking third in 1998. The reason for the difference is that in Gansu it was easier to find jobs such as joint timber harvesting/transportation in state-owned forest areas and less of a need to migrate to towns or cities for work prior to the NFPP. In contrast, migrating to work was relatively popular in Chongqing because of the rare job opportunities in collective forests and the superior road connections. Much evidence shows that local households are shifting from sole dependence on forest resources to labour intensive work that involves new technical training required by jobs in towns and cities.

The influence of the NFPP on the household economic structure can be explained through a causal chain as similar to Figure 6-10 in section of Indicator B-3. Even though the influencing process was similar, the main difference between the Indicator D-1 and the Indictor B-3 was the data sauce and the data collection methods: The data of household income was basically collected by household questionnaires and interviews while the data of community economic structure was obtained from the key informant interviews such as village leadership interviews (see Methodology in Chapter 4).

Since the NFPP has been implemented for almost ten years, local households have developed their own strategies to cope with its negative impacts; the consequences of the local strategies developed by the farmers should be properly considered and integrated into the measurement of the real impact of the NFPP.

Apparently the NFPP directly impacts local household income and work structures, and has led to new and better paying household income sources. However, not every household has been lucky enough to smoothly find the alternative income sources and this led to some difficult times. According to interviews, finding jobs in adjacent towns or cities is rather difficult for the farmers, especially for those who have a low education and have been living

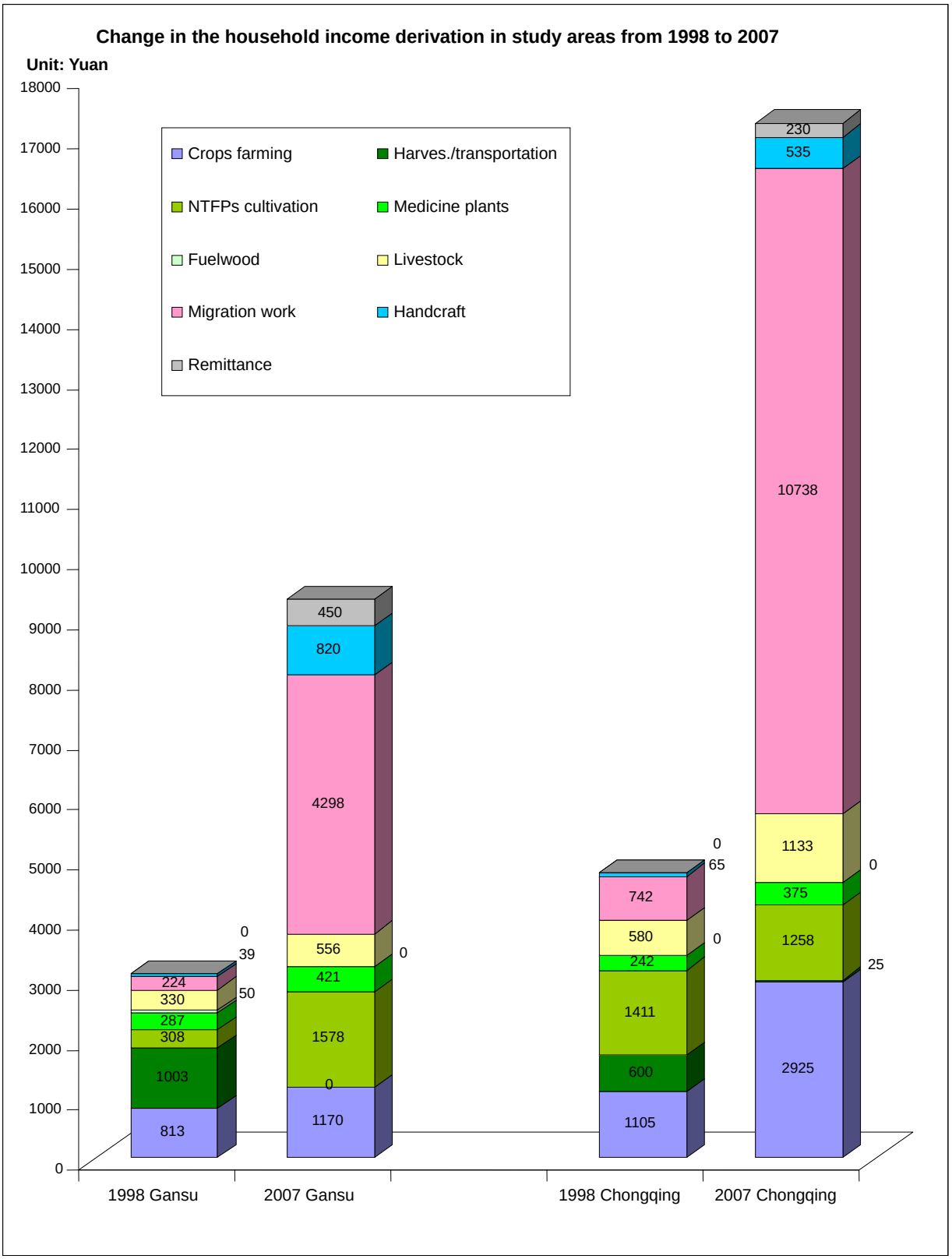
Table 6-7: Ranking of household income derivation in study areas in 1998 and 2007

Main HH Income Resources	Gansu (N=40)						Chongqing (N=40)						T-Test result of Gansu	T-Test result of Chongqing
	1998			2007			1998			2007				
	Mean Income (Yuan)	Account. for %	Ranking*	Mean Income (Yuan)	Account. for %	Ranking	Mean Income (Yuan)	Account. for %	Ranking	Mean Income (Yuan)	Account. for %	Ranking		
Crops Farming	813	26.6%	***2***	1,170	12.6%	***3***	1,105	23.3%	***2***	2,925	17.0%	***2***	**0.000****	**0.000****
Joint Harvesting/ Transportation	1,003	32.8%	***1***	0	0.0%	***8***	600	12.6%	***4***	25	0.1%	***8***	**0.000****	**0.000****
NTFP Collection/Cultivation	308	10.1%	***4***	1,578	17.0%	***2***	1,411	29.7%	***1***	1,258	7.3%	***3***	**0.000****	**0.514**
Vegetable/Medicine Plants	287	9.4%	***5***	421	4.5%	***7***	242	5.1%	***6***	375	2.2%	***6***	**0.082**	**0.425**
Livestock Raising	330	10.8%	***3***	556	6.0%	***5***	580	12.2%	***5***	1,133	6.6%	***4***	**0.002****	**0.013**
Fuel Wood Collection	50	1.6%	***7***	0	0.0%	***8***	0	0.0%	***8***	0	0.0%	***9***	**0.323**	-
Migrant Work/ Business	224	7.3%	***6***	4,298	46.2%	***1***	742	15.6%	***3***	10,738	62.4%	***1***	**0.000****	**0.000****
Handicraft/Sale	39	1.3%	***8***	820	8.8%	***4***	65	1.4%	***7***	535	3.1%	***5***	**0.128**	**0.026**
Remittance	0	0.0%	***9***	450	4.8%	***6***	0	0.0%	***8***	230	1.3%	***7***	-	-
Average Total	3,052			9,293 **	+204.5% ***		4,745			17,218	+262.9% ***		-	-

Notes: From 1998 to 2007 the inflation rate in the study areas is about 7%, author, 2007.
*: Ranking shows the importance of main economic income sources for the HH.
**: Means the result of the t-Test is significant (<0.05).
***: Means the increase rate from 1998 to 2007 in both areas. Detailed information on empirical data of household income is presented in Appendix 4-2.

Source: Household interviews and questionnaire surveys in the field research, 2007 and 2008

Source: Household interviews, questionnaire surveys in the field research, 2007and 2008



Note: From 1998 to 2007 the inflation rate in the study areas is about 7%; interviewed household number N=80, see Appendix 4 for detailed data information.

Figure 6-13: Changes in household income derivation in study areas from1998 to 2007

Box 6-1: Individual samples of changes in income resource activities

- Joint harvesting of timber and labour employment: Wenge Ren, 40 years old, a farmer in Taohua Village in Gansu. His family neighbours the Maiji state-owned forest enterprise, only 350 meters away from the forests. This gave his family a good opportunity to be employed and participate in the forestry activities such as cutting and transportation of the timber in the former harvesting seasons. It usually brought an annual income of 2,000 Yuan to his family. In 1996 he personally spent 3,000 Yuan to purchase a second-hand truck in order to facilitate the transportation of the timber. That was the biggest investment for the family and he expected to pay back the loan. However, after the NFPP in 1998, logging work stopped and village employees were fired. Like other farmers, Wenge Ren lost his job in the forest enterprise. The truck was abandoned in the corner of the house for several years. From 2001 to 2003, he did not find jobs anywhere. Life was even more difficult than before. After the Spring Festival in 2005, a friend brought them good news. He was introduced by friends to work for a transportation company in the adjacent town, and the family decided to use the truck for the long haul transportation of goods. This new job brings the family about 5,000-6,000 Yuan income annually.

- Services and small business: Wenge Ren said that in former times there were several hostels, restaurants, and stores in Taohua village owned by the villagers or their relatives. Business was quite good, especially during harvest seasons. Most of these small businesses shut down as a result of the logging ban associated with the NFPP in 1998. However, since summer 2005, these have been more and more tourists from cities to visit the forests here, attracted by the newly established forest park invested and developed by the forest enterprise near to the village. The tourists like to live in the farmer's houses, or bring their kids to play with the cows, goats, or simply come here for enjoying the fresh air and recreation. Several hostels, restaurants and stores have been reopened, and there will be more opened in the near future. These new tourists bring the village household about 3,000-6,000Yuan annually.

- Timber harvesting: Shihong Deng, 50 years old, a farmer in Nanmu Village in Chongqing where she and her family live in about 500 meters away from the nearest forest which is collective-owned. The family contracted 60 ha of forests from the village as responsible hills for management. She has two sons who are already working age, and sometime, the sons help take care of the responsible forests. In former times, they earned the annual profits of 2,000-3,000 Yuan from the forests, including 1,500-2,000 Yuan by cutting trees (limited to about 30 m^3/year) and transporting them to government agencies (in China, timber is not allowed to be privately sold in the market) or cultivating the NTFPs in forests which brought about 500 Yuan annually. Since the NFPP logging ban the family has had to search for other possibilities for livelihood. In the beginning of the NFPP, the family total income was decreased, and life was even much harder than before 1998. But since 2005 the two sons have finished the secondary school study and have found jobs in the adjacent counties, their lives improving as they earned an average of 5,000 Yuan annually. Meanwhile, Shihong Deng and her husband also cultivate Huajiao in the forests, earning a 3,000 Yuan income annually.

- Non-timber forest products: Linfu Yang, 66 years old, a farmer in Xinshi Village in Chongqing, belongs to a family that has had abundant knowledge and experiences in the cultivation of mushrooms and Mu'er (Auricularia auricula-judae) for generations. This had usually brought the family an annual income of about 600-1,000 Yuan. Since the NFPP, they could not continue the cultivation of mushrooms and mu'er due to a lack of raw wood materials which they mainly obtained from forests. Nowadays they cultivate the Huajiao in barren forest land, an activity encouraged and supported by government. Planting the Huajiao trees in the barren forest land has been quite prevalent in Western China since the NFPP, as it brings more trees, but also is used by households to collect the fruits for income sources. The current market price for Huajiao is approximately 800 Yuan/kg.

Source: Household interviews in the field research, 2007 and 2008

in remote areas with poor road connections. Many unsuccessful stories were recorded with individual examples during the field research, along with accounts of how changes in income affected people in surveyed villages in Gansu and Chongqing (see Box 6-1).

Indicator D-2: Household expenditure (alternative energy cost)

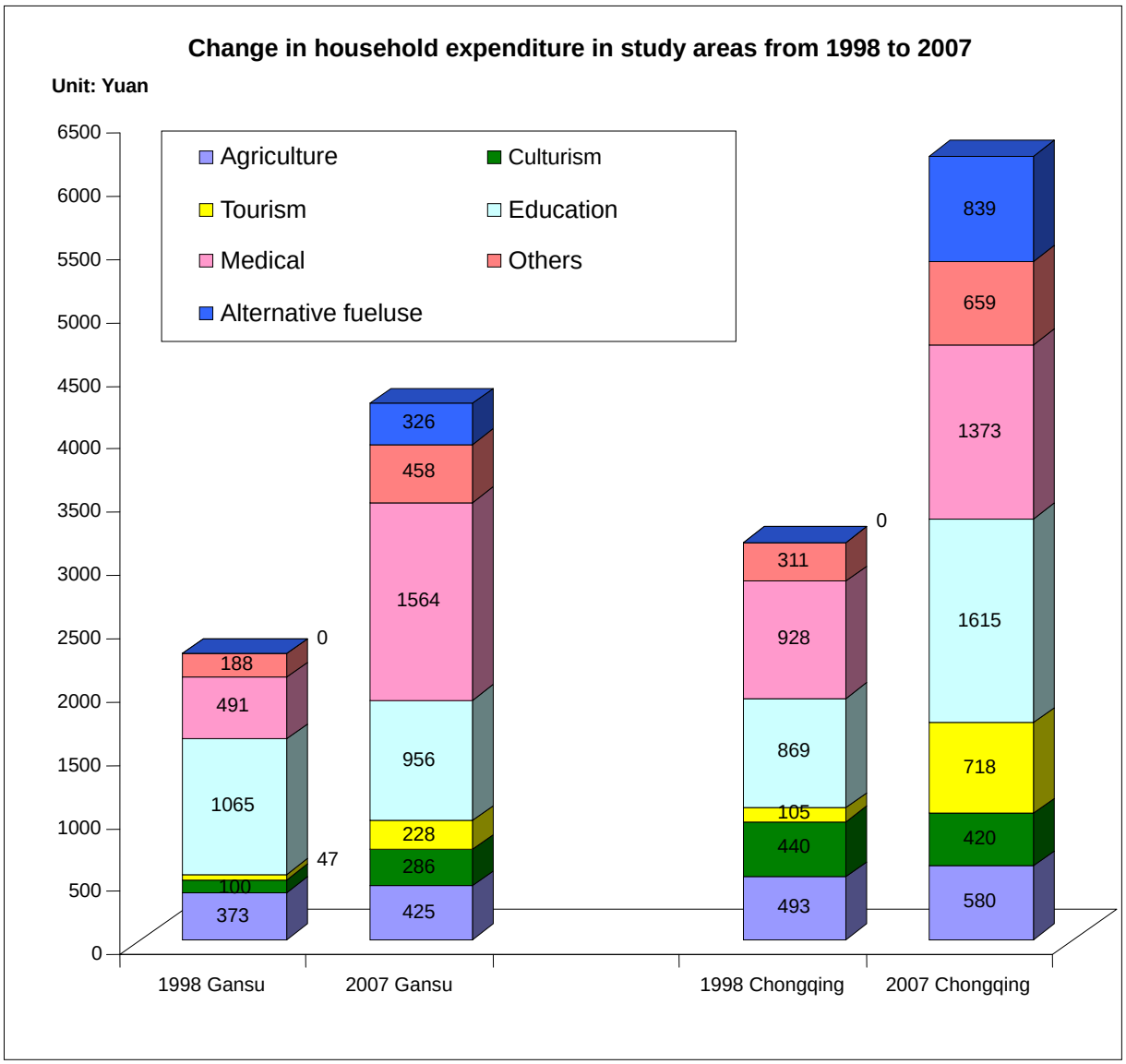
The local households in Gansu and Chongqing spend their yearly earnings on following items: agriculture investment, such as purchasing seeds and pesticides; cultivation investment, such as introduction of the culturing wood, seeds and culturing techniques; tourism expenditure, such as the cost for visiting family members who migrated to towns or cities for work; education cost; medical expenditure; and other living expenditure such as food, clothing and so on. Recently villagers have to meet newly increased household expenditure for cooking and heating, namely, alternative fuel energy costs (coal, gas and electricity). Figure 6-15 profiles the increase of the household expenditure due to the alternative energy use from 1998 to 2007.

Farmers in both areas had a long tradition of using fuel wood for cooking and heating. Before 1998 when each household annually collected on average 3,500-4,500 kg of the fuel wood, costs were negligible. Since 1998 as the fuel wood could not be collected sufficiently, local households had to turn to alternative fuels, which increased costs of cooking and heating. As one of the consequences, field research shows the dramatic drop of fuel wood consumption by each household, from an average of about 4,500 kg annually in 1998 to only 600 kg in 2007 in Gansu and in Chongqing from 4,000 kg in 1998 to nearly 200 kg in 2007 (Figure 6-16). (Box 6-2 provides individual samples of farmers' alternatives for fuel wood consumption.). Meanwhile, each Gansu village household spent an additional 326 Yuan in 2007, 7.7% of the household expenditure on alternative energy; and in Chongqing the amount was 839 Yuan, accounting for 13.5% of the total household expenditure. Energy costs and other increases for household expenses have pushed household expenditures up by 87.5% in Gansu and 97.2% in Chongqing.

Table 6-8 provides a detailed overview of changes of household expenditure and alternative energy fuel costs from 1998 to 2007 in Gansu and Chongqing. The significances of differences of the household expenditure between 1998 and 2007 are also proven by t-Test.

The data presented above can be interpreted as followings: The NFPP implementation negatively impacted families with increased energy costs by an average of an additional 326 Yuan in Gansu, and an average of 839 Yuan in Chongqing. Meanwhile, the NFPP implementation positively affected families by freeing up time once used to collect the fuel wood, allowing for income generated activities which more than compensate for the additional energy costs. The influencing process of the NFPP on the household expenditure can be explained through a causal chain illustrated in Figure 6-14.

Source: Household interviews and questionnaire surveys in the field research, 2007and 2008



Note: N=80, see Appendix 4 for more detailed data information.

Figure 6-14: Comparison of household expenditure in study areas in 1998 and 2007

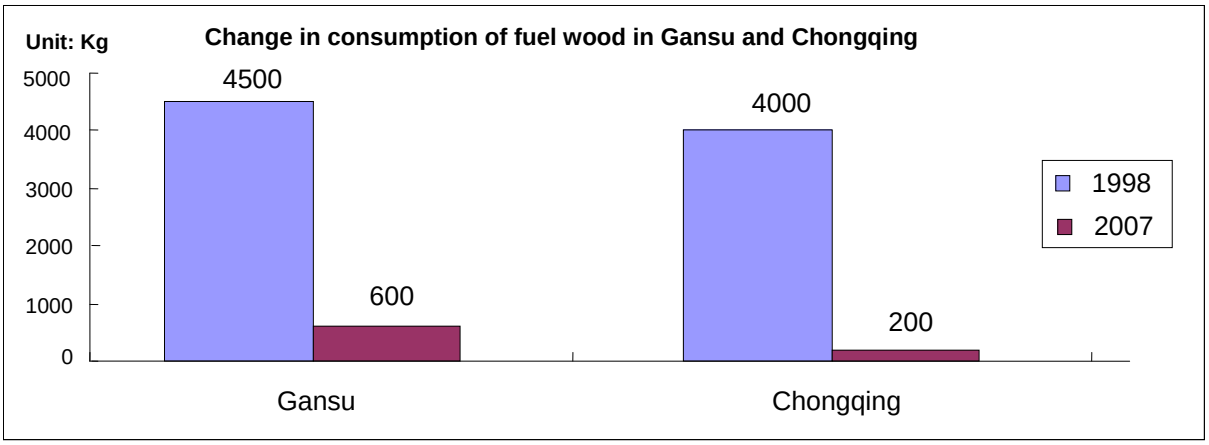


Figure 6-15: Changes in annual consumption of fuel wood for each household in study areas

Box 6-2: Individual samples of alternatives fuel wood consumption in study area of Gansu

- Fuel wood: Chang'an Yang, 55 years old, a farmer in Taohua Village has a family with seven members, including his wife, son, daughter- in-law and their three children at 19, 17 and 14 years of age. He said that his family annually needed 6,000 kg fuel wood, freely collected from forests, for cooking and heating before the NFPP. With the NFPP, they lost access to nearby forests, having to obey the new rule for forest protection prescribed by the local forest enterprises. They must spend much time collecting dead branches far way from their house. They can still collect about 2,000 kg fuel woods a year, but must buy coal to bridge the gap for cooking and heating. The current market price of coal is about 350 Yuan/ton. For the six persons' household, 3,000-4,000 kg coal per year is needed, which means that they have to spend additionally about 1,000-1,500 Yuan per yea, an extra expenditure for which there is no government subsidy.

- Self-consumption wood: It is a special cultural feature and a long term tradition for the local people to bury dead family members in wooden coffins. The relatives prepare the coffin for the old people beforehand and store it at home. Zheng Pinggui, a farmer in Maiji Village said that in the previous year he had prepared a coffin for his elderly mother. Normally one coffin would need 1-2 m^3 wood material. They used to get wood materials from forests or from forest enterprises nearby for a low prices (normally 80-120 Yuan/m^3) bringing the total cost of a coffin to about 300 Yuan. Due to the implementation of the NFPP, there is a shortage of wood materials and the farmers must buy these materials, or the ready-made coffin at market prices, wood about 300-400 yuan/m^3 and one coffin about 1,000-2,000 Yuan.

Source: Household interviews in the field research, 2007 and 2008

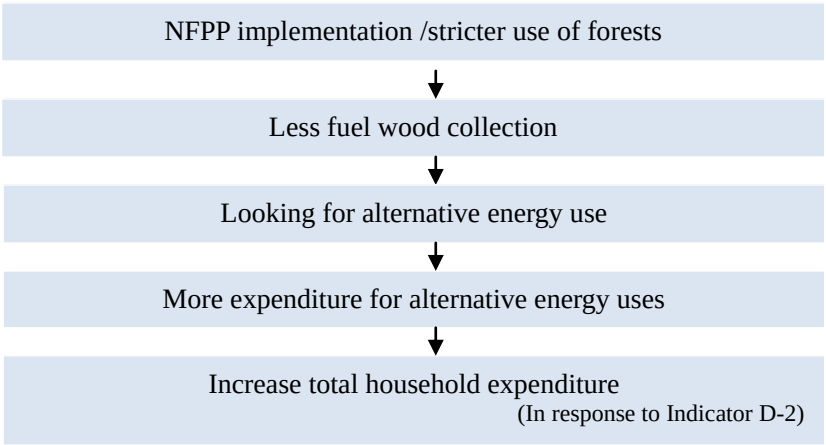


Figure 6-16: Causal chain of the NFPP implementation increasing the local household expenditure for alternative energy uses

Table 6-8: Changes in household expenditure and alternative energy costs in study areas from 1998 to 2007

Main HH Income Resources	Gansu (N=40)						Chongqing (N=40)						T-Test result of Gansu	T-Test result of Chongqing
	1998			2007			1998			2007				
	Mean Expenditure (Yuan)	Account. for %	Ranking*	Mean Expenditure (Yuan)	Account. for %	Ranking	Mean Expenditure (Yuan)	Account. for %	Ranking	Mean Expenditure (Yuan)	Account. for %	Ranking		
Agricultural expenditure	373	16.5%	***3***	425	10.0%	***4***	493	15.7%	***3***	580	9.4%	***6***	**0.244**	**0.136**
Culturing expenditure	100	4.4%	***5***	286	6.7%	***6***	440	14.0%	***4***	420	6.8%	***7***	**0.002****	**0.805**
Tourism expenditure	47	2.1%	***6***	228	5.4%	***7***	105	3.3%	***6***	718	11.6%	***4***	**0.001****	**0.000****
Education expenditure	1,065	47.1%	***1***	956	22.5%	***2***	869	27.6%	***2***	1,615	26.0%	***1***	**0.749**	**0.047**
Medical expenditure	491	21.7%	***2***	1,564	36.9%	***1***	928	29.5%	***1***	1,373	22.1%	***2***	**0.005**	**0.131**
Alternative energy expenditure	0	0.0%	***7***	326	7.7%	***5***	0	0.0%	***7***	839	13.5%	***3***	**0.000****	**0.000****
Other expenditure	188	8.3%	***4***	839	10.8%	***3***	311	9.9%	***5***	659	10.6%	***5***	**0.000****	**0.000****
Average Total	2,263	100%		4,242	100%		3,146	100%		6,203	100%		-	-

Notes:
*: Ranking shows the importance of main household expenditure, especially the alternative energy costs expenditure.
**: The T-test result is less than 0.05, which means the difference of each expenditure for household from 1998 to 2007 is significant.

Source: Household interviews and questionnaire surveys in the field research, 2007 and 2008

Indicator D-3: Household labour time distribution

The study assumed that total annual labour time for each household is ten months (approximately equal to 300 days) with a total of two months for recreation purpose and holidays during winter and the Spring Festivals.

Based on the field investigation, Figure 6-10 illustrates the change in distribution of household labour time in Gansu and Chongqing from 1998 to 2007. Table 6-8 provides an overview of labour time distribution in both areas.

Before the NFPP, farmers in Gansu annually spent about 105 days in joint harvesting/transportation, 78 days in crops farming. The rest of the time they spent for NTFPs cultivation/collection (21 days), livestock rising (21 days), vegetable/medicinal plants (21 days) and fuel wood collection (36 days). As the NFPP curtailed the farmers' ties to the forests, dramatic changes occurred in the labour structure and labour time distribution of the farmers in the Gansu villages. While crops farming was still a priority in the farmers' daily life (annually 60 days), the ranking of time distribution for other labour activities totally changed. The time spent on joint harvesting of forests and transportation of woods rapidly decreased from 105 days annually in 1998 to nearly 0 days in 2007. The freed up time was spent on looking for jobs in adjacent towns or cities (annually 114 days in 2007). More time was spent on NTFPs cultivation (42 days) as the market price for NTFPs such as *Huajiao* (*Zanthoxylum bungeanum*) was rising. A little more time was spent on livestock (27 days) due to more favourable prices for pork and poultry. Farmers spent less time on vegetable/medicinal plants (annually 18 days), and very little time on fuel wood collection (15 days). Again, the most important factor for these changes was that farmers lost access to the forest after the NFPP and the nearby state-owned forest enterprise applied stricter rules for collection of fuel wood[150].

The NFPP impact was milder on Chongqing villagers since timber cutting and wood production were not the main occupation in the collective forest area and migrating to towns or cities for work was more common than it was for the Gansu villagers. In 1998, before the NFPP, farmers in Chongqing spent annually 84 days on crop farming and 78 days on NTFPs cultivation, namely *Huajiao* (*Zanthoxylum bungeanum*), *Daliao* (*Fructus Anisi Stellati*)[151], *Mu'er* (*Auricularia auricula-judae*), Mushrooms, etc. Wood harvesting and transportation took up only 27 days worth of time, as did livestock and animal husbandry. About 12 days worth of time was spent on vegetable gardens and medicinal plants, 30 days on fuel wood collection, 33 days on migration work/business, and nine days for handicrafts. In 2007 crop farming remained the priority for some farmers in Chongqing (annually 84 days), while migration work/business was more common (129 days), bringing additional income for the entire family. Less time was budgeted to other forest related activities: about 39 days for NTFPs cultivation/collection, nine days for vegetable/medicinal plants, 21 days for animal husbandry (livestock raising) and only six days for fuel wood collection. There was zero time spent on harvesting/transportation, but time spend on handicraft increased slightly to 12 days annually (Figure 6-17).

[150] According to the implementation plan of the NFPP set by Xiaolongshan Forest Experiment Bureau, only dead wood branches with diameter > 1.5 cm can be allowed to collect as fuel wood in forests. Farmers get amercement of at least 50-100 Yuan for breaking the rule. This criterion has been implemented in the 21 enterprises of Xiaolongshan Forestry Experiment Bureau, including in Maiji forestry enterprise, author, 2007.

[151] *Daliao*, Star Anise Fruit, the Latin name *Fructus Anisi Stellati*, fruits from the Illicium verum Hook plants, is a traditional cuisine material for cooking, also used for producing oil and medicinal purpose, author, 2008.

The significance of differences in the labour time distribution on various household activities in study villages are tracked by t-Test as shown in Table 6-9 below.

The household labour time distribution is usually connected with the household income condition of each economic activity. Similarly, Figure 6-10 in the section of Indicator B-3, *local economic/industrial diversification* and the Indicator D-2, *household income derivation*, can be taken as the reference to understand the influencing process of the NFPP on the household labour time distribution.

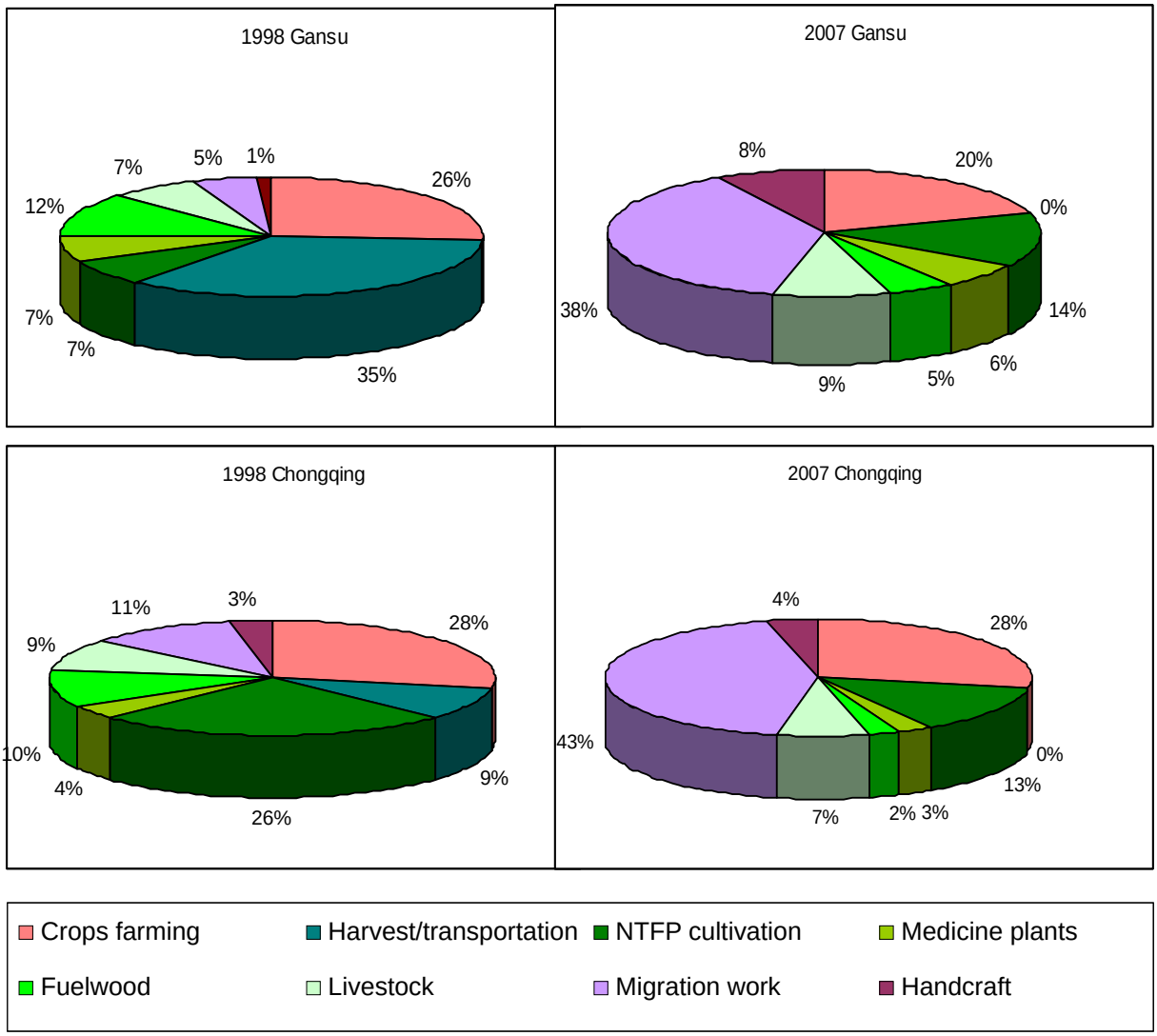


Figure 6-17: Changes in household labour time distribution in study areas from 1998 to 2007

Table 6-9: Transformation of labour structure and household labour time distribution in study areas from 1998 to 2007

Labor Categories	Gansu						Chongqing						T-Test result of Gansu	T-Test result of Chongqing
	1998			2007			1998			2007				
	Mean of Time (days/yr)	Account. for %	Rank-ing*	Mean of Time (days/yr)	Account. for %	Rank-ing	Mean of Time (days /yr)	Account. for %	Rank-ing	Mean of Time (days /yr)	Account. for %	Rank-ing		
Crops Farming	78	26.1%	***2***	60	20.5%	***2***	84	28.1%	***1***	84	27.8%	***2***	**0.002****	**0.858**
Joint Harvesting/ Transportation	105	34.8%	***1***	0	0.0%	***8***	27	8.9%	***6***	0	0.2%	***8***	**0.000****	**0.000****
NTFP Collection/Cultivation	21	6.5%	***6***	42	14.2%	***3***	78	25.6%	***2***	39	13.1%	***3***	**0.001****	**0.000****
Vegetable/Medicinal Plants	21	6.6%	***5***	18	5.9%	***6***	12	4.0%	***7***	9	2.6%	***6***	**0.531**	**0.246**
Livestock Raising	21	7.4%	***4***	27	8.5%	***4***	27	9.1%	***5***	21	7.5%	***4***	**0.347**	**0.304**
Fuel Wood Collection	36	12.0%	***3***	15	4.8%	***7***	30	10.2%	***4***	6	2.3%	***7***	**0.000****	**0.000****
Migrant Work/ Business	15	5.2%	***7***	114	38.5%	***1***	33	11.2%	***3***	129	42.7%	***1***	**0.000****	**0.000****
Handcraft/ Sale	3	1.4%	***8***	24	7.6%	***5***	9	3.0%	***8***	12	3.9%	***5***	**0.016**	**0.563**
Average Total	300	100%		300	100%		300	100%		300	100%		-	-

Notes:
*: Ranking shows the main labour time distribution in different household activities.
**: The T-test result is less than 0.05, which means differences of the labour time distribution from 1998 to 2007 is significant.

Source: Household interviews, questionnaire surveys in the field research, 2007and 2008

6.2.2 Impacts on individuals

Impacts on individuals are the human impacts felt and experienced by the individual farmers. It notes local people's perceptions concerning the public health and safety, and the value of the local forests perceived by farmers.

Indicator D-4: Local perceptions on public health and safety

This indicator was assessed based on the three following verifiers:

Verifier 1: Local opinions of natural environmental condition;

Verifier 2: Local perceptions on the public health; and,

Verifier 3: Local perceptions on the future security.

Following questions were among those asked of local households with regard to the three verifiers: "Do you feel the natural environmental condition is better now?" (Verifier 1); "Do you feel your family members and people surrounding you are healthier than before?" or "Have you heard more diseases in your family members with your neighbours than before?" (Verifier 2); and "Do you feel more confidence in your future life?" (Verifier 3), and so on. An assessment result of the overall three verifiers is summarized in Table 6-10 below. The scoring methods are explained as well.

Table 6-10, summarizes the score difference between 1998 and 2007 in Gansu and Chongqing. For Gansu, local households' perceptions on public health and safety slipped slightly with a total score of "-3". More specifically, they considered the natural environmental condition slightly improved, as the score for this Verifier 1 is "+17"; they considered the public health slightly worse, as the score for the Verifier 2 is "-11"; and perceptions of a save and secure future slipped, Verifier 3 being "-9". In contrast, households in Chongqing considered public health and safety improved, as the total score for this indicator is "+75". The score for each verifier are as follows: natural environmental condition "+33", pubic health "+22", and secure future "+20". The significance of the difference between 1998 and 2007 regarding this indicator is proven through t-Test (see Table 6-11)

The interviewed information for each verifier is presented in detail in following sections.

Table 6-10: Summary of assessment result of local perceptions on public health and safety in study areas

	Gansu N=40		difference	Chongqing N=40		difference
	1998	2007		1998	2007	
Opinions of natural environmental condition	128	145	17	140	173	33
Perceptions of public health	131	120	-11	138	160	22
Perceptions of safety to the future	47	38	-9	47	67	20
Total score	306	303	-3	325	400	75

*Note: score as "+3" when "highly agree", "+2" when "very much agree", "+1" when "agree", "0" when "no significant opinion", "-1" when "disagree", "-2" when "very much disagree" and "-3" when "highly disagree".

Source: Household interviews and questionnaire surveys in the field research, 2007and 2008

Verifier 1: Change in opinions of natural environmental condition

Figure 6-11 presents a statistical distribution of households holding different opinions as to the improvement - or not - of the environment between 1998 and 2007.

The natural environmental condition seems to be more improved in Chongqing while slightly improved, or even in some places, slightly worse in Gansu, as the following statistics prove this empirical finding: the majority (70%) of the Gansu village households surveyed believed that the natural environmental condition was good in 1998: with 29% of the households highly agreed, 18% very much agreed, and 23% of them agreed. Of the remaining households, 14% disagreed, 2% very much disagreed, and 14% had no opinion regarding this question. Meanwhile, 73% of the household agreed that the natural environmental condition was good in 2007: with 33% of them highly agreed, 20% very much disagreed and 18% disagreed. Of the remaining, about 10% of them hold the disagreed opinion, and 20% had no comments on this point. Based on the scoring methods, the score difference between the 1998 and 2007 of this verifier for Gansu is "+17" (Table 6-11).

In contrast, in Chongqing, the greater majority (71%) of the local households consider that the natural environmental condition was good in 1998: with 35% of the households highly agreed, 21% very much agreed and 15% agreed; meanwhile, 8% of them disagreed, 4% very much disagreed and 2% highly disagreed, and 15% of the households had no opinion. There were even more households (80%) positively holding the opinion that the natural environment condition was good in 2007: with 45% of them highly agreed, 25% very much agreed, and 10% agreed; while in remaining households, 2% disagreed, 10% very much disagreed, and about 8% had no clear opinion on this point. The score difference between 1998 and 2007 of this verifier for Chongqing is "+33" (Table 6-11).

The evidence above shows that Chongqing benefited more from the NFPP implementation, showing a relatively significant improvement of the natural environmental condition compared with Gansu. More than 90% of the local households in both study areas believed that the NFPP had made a great contribution for such improvement in ecological environmental conditions since the NFPP encouraged the prevention of logging and rehabilitation of trees and new plantations, according to the interviews during the field research.

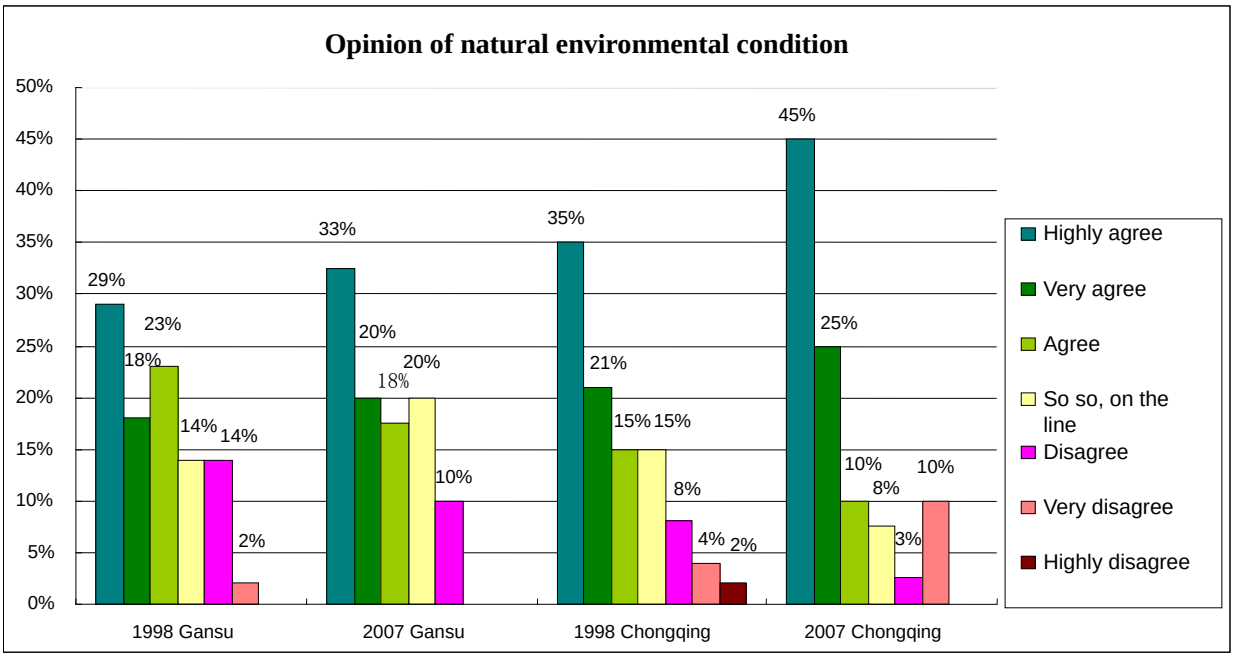


Figure 6-18: Change in opinion of natural environment condition in study areas
Source: Household interviews and questionnaire surveys in the field research, 2007and 2008

Verifier 2: Change in local perceptions on public health

The Gansu villagers believed that public health declined between 1998 and 2007, the scored difference being "-11". Reflected by the statistics of the opinions, about 78% of the households considered that the public health condition was good in 1998: with 15% of them highly agreed, 31% very much agreed, and 32% of them agreed; only 8% disagreed, and about 14% had no opinion. About 73% of the households believed the health condition was good in 2007: with 13% of the them highly agreed; 30% very much agreed and 30% agreed; still about 8% of them with disagreements and about 20% of households had no comments on this point (Figure 6-12 and Table 6-11).

In contrast, the Chongqing villagers believed public health had improved between 1998 and 2007, the scored difference for this verifier being "+22" (Table 6-11). Among them, 77% of the households consider that the public health condition was good in 1998: with about 26% of the households greatly agreed, 29% very much agreed and 22% agreed; the remaining of the households, 8% disagreed, 6% very much disagreed, and about 9% had no opinion. Even though, a lower percentage (75%) of the households considered the public health condition was good in 2007, but with 35% of them greatly agreed, 30% very much agreed and 10% agreed, so the total score was still higher. Of remaining the households, about 5% disagreed, 5% very much disagreed, and 15% had no opinion on this point (Figure 6-12 and Table 6-11).

So the evidence is that local people's perceptions in Gansu believe public health conditions have gotten worse and in Chongqing that it has improved between 1998 and 2007. The village leaderships in Gansu and Chongqing both agreed that the NFPP had great influence to the local perceptions of health and safety since the NFPP influenced the state of income and livelihood as well as the overall improvements in wealth in the communities. Accordingly, the Chongqing villagers have more positive acceptance and the Gansu villagers has more negative opinions regarding the NFPP implementation, according to the information obtained

from interviews during the field research.

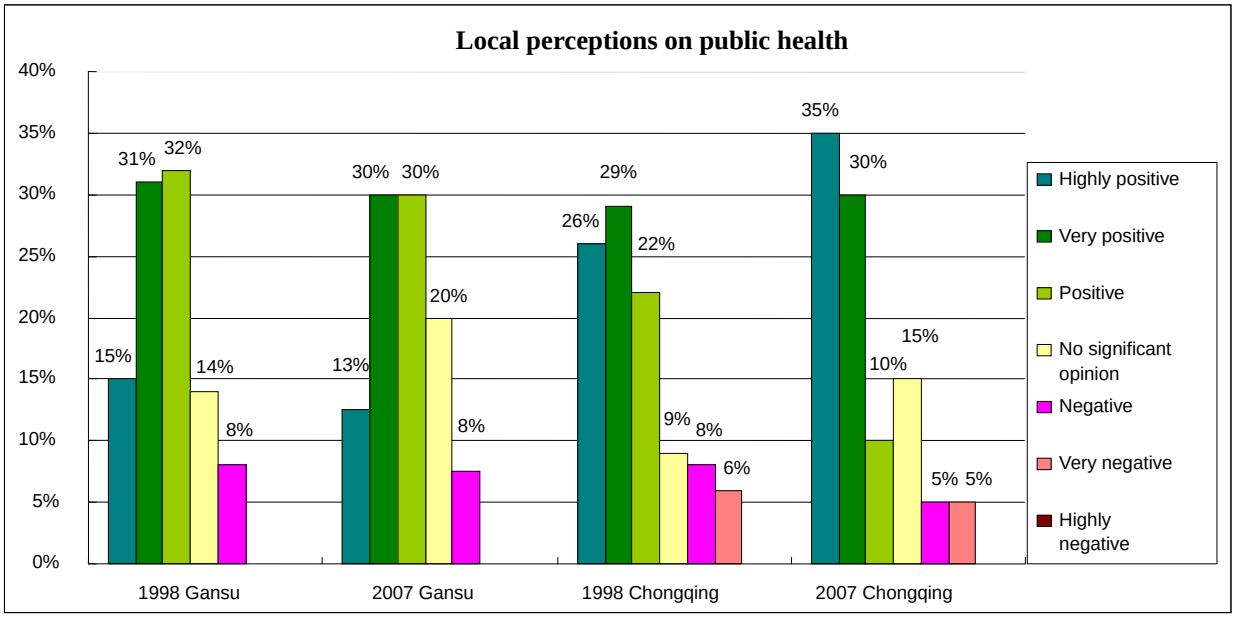


Figure 6-19: Change in local opinions on public health in study areas
Source: Household interviews and questionnaire surveys in the field research, 2007and 2008

Verifier 3: Change in perceptions on future security

This verifier measures the state of mind or a feeling of emotional security resulting in the faith one has in the future, as indicated by answers to: "Will we get enough food and money for livelihood in future?", "Will we have a better life than now?", "I have no idea how the future will be for our family...", and so on. Figure 6-13 profiles the statistic distribution of household opinions regarding the intensity of feelings concerning a secure future.

Local households in Gansu felt more secure about the future in 1998 than they did in 2007, implying that the NFPP implementation led to increased insecurity feelings. The scored difference for this verifier for Gansu is "-9" (Table 6-11). Of Gansu households, regarding the conditions in 1998, about 9% had highly positive attitudes concerning their future security, feeling assured of financial security and improvement in living conditions. About 16% had very positive attitudes and 30% had a positive attitude. But 18% had a negative view and 12% a very negative attitude. About 19% had no comment. However, regarding the conditions in 2007, 7% expressed a highly positive attitude to their future life, 15% very positive, 21% positive. About 12% had a negative and 11% very negative views, the remaining 34% having no significant opinion (Figure 6-13). Thus, a higher percentage of households in Gansu felt uncertain about their future life 2007 (34%) than they did in 1998 (19%).

Chongqing villagers were more optimistic about their future in 1998 than those in Gansu and this optimism increased in 2007, as indicated by the "+20" scored difference (Table 6-11). Regarding the conditions in 1998, 49% of Chongqing local households expressed confidence in their future: 14% highly positive, 16% very positive and 19% positive. But 30% of households revealed negative feelings: 16% negative, 12% very negative, and 2% highly negative. And 21% had no clear idea. In 2007, an impressive 50% of them believed that they

would have a better life: 15% highly positive, 20% very positive and 15% positive. Still, about 17% held negative views and an additional 8% very negative one. And 25% of them felt vague concerning this point (Figure 6-13).

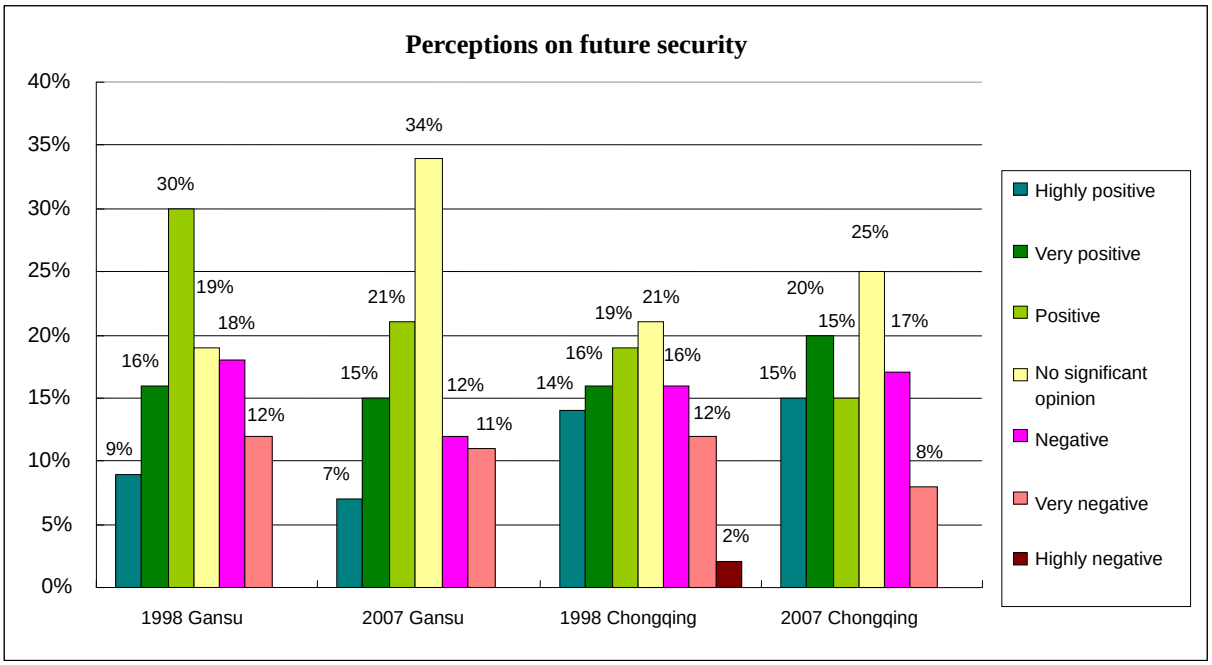


Figure 6-20: Change in intensity of feelings concerning a secure future in study areas
Source: Household interviews and questionnaire surveys in the field research, 2007and 2008

The data measured by verifier 1-3 presented above can be interpreted as the followings:

Verifier 1, the NFPP has resulted in the improvement in Gansu and even more in Chongqing in terms of ecological environmental conditions. As applied to Gansu, scores were "+128" in 1998 and "+145" in 2007; and to Chongqing, they were "+140" in 1998 and "+173" in 2007

Verifier 2, public health, was perceived as getting worse in Gansu and in Chongqing as getting better, as the result of the NFPP. In Gansu, the scores were recorded as "+131" for 1998 and "+120" for 2007 but in Chongqing they were "+138" for 1998 and "+160" for 2007.

Verifier 3, future security, indicates that Gansu has become more pessimistic about the future and Chongqing more optimistic, influenced by the NFPP. Scores for Gansu decreased from "+47" to "+38" as those for Chongqing increased from "+47" to "+67".

In conclusion, the NFPP had a negative impact on Gansu's perceptions and a positive one on Chongqing's. In Gansu the total scores for the indicator D-4, "ecological environmental condition", "public health" and "future security" added up to "+306" in 1998 but slipped to "+303" in 2007. In Chongqing the scoring went up, "+325" in 1998 to "+400" in 2007.

In Figure 6-21, a causal chain is illustrated to understand the pathway of the NFPP implementation deriving changes in local perceptions on public health and safety.

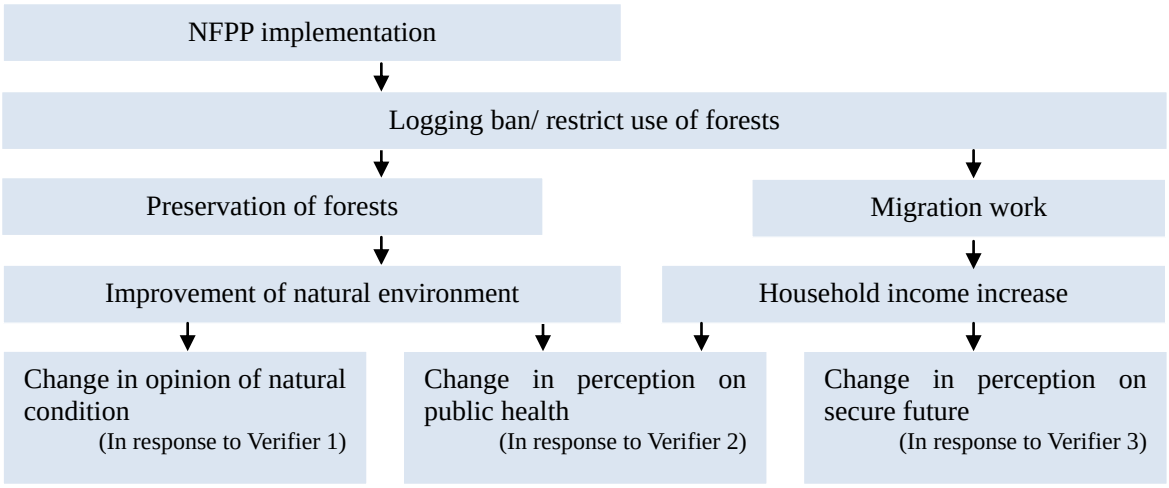


Figure 6-21: Causal chain of the NFPP impacting local perceptions of public health and safety

Indicator D-5: Forest values perceived by the local people

Scholarly literature and results of interviews and discussions with key persons in the field indicate that, local households see forests and forest resources as having the following important values (see Table 6-12):

(1) Economic values: timber, fuel wood for heating and cooking, NTFPs and medicinal plants for income, and job opportunities (employment in adjacent forest enterprises).

(2) Ecological values: soil conservation, water supply, flood/storm protection and climate change/carbon storage.

(3) Cultural: recreation/tourism, feelings of cultural belonging, religious and aesthetic values as its amenities, greenness and its ability to make the living environment more beautiful.

The result of eighty questionnaire interviews with local households shows that, from 1998 to 2007, the change of the forest values perceived by the local people can be stated as follows:

in Gansu, in 1998 before the NFPP, local households considered the following values served by forests as economically important to their daily life and livelihood: fuel wood (considered important by 100% of households); job opportunities (considered by 70% of households, referring to employment in Xiaolongshan state-owned forest enterprises); medicinal plants (52.5%); NTFPs such as *Mu'er* (*Auricularia auricula-judae*) (42.5%) and timber (25%). As stated, these values were concentrated on the economic values of the forests. But in 2007, ten years after the NFPP implementation, the forests were seen in a new light: 70% of households realized that local forests were important for flood/storm protection; 10% saw the forests as valuable for soil conservation and water supply. But economic values were still a factor, although a decreased one in 2007: farmers viewing the forests as fuel wood values decreased to 40%; NTFPs values decreased to 20%; medicinal plants values decreased to 10%. Very few people (only 2.5%) considered that the forest were important for timber. And a new factor entered: 7.5% of households thought of the forest as a good place for recreation/tourism for themselves and visitors; however, these values were never mentioned by any of them in 1998 before the NFPP (Figure 6-22).

Table 6-11: Summary of assessment result of local perceptions on public health and safety in study areas

Verifiers		Gansu (N=40)								Chongqing (N=40)								Differences
		Percentage of different opinions							Score	Percentage of different opinions							Score	
		Highly agree (+3)*	Very agree (+2)	Agree (+1)	So so (+0)	Dis-agree (-1)	Very disagree (-2)	Highly disagree (-3)		Highly agree (+3)	Very agree (+2)	Agree (+1)	So so (+0)	Dis-agree (-1)	Very disagree (-2)	Highly disagree (-3)		
Opinion of natural environment condition	1998	29%	18%	23%	14%	14%	2%	0%	128	35%	21%	15%	15%	8%	4%	2%	140	-12
	2007	33%	20%	18%	20%	10%	0%	0%	145	45%	25%	10%	8%	3%	10%	0%	173	-28
Perception of public health	1998	15%	31%	32%	14%	8%	0%	0%	131	26%	29%	22%	9%	8%	6%	0%	138	-7
	2007	13%	30%	30%	20%	8%	0%	0%	120	35%	30%	10%	15%	5%	5%	0%	160	-40
Perception of safety to the future	1998	9%	16%	30%	19%	18%	12%	0%	47	14%	16%	19%	21%	16%	12%	2%	47	0
	2007	7%	15%	21%	34%	12%	11%	0%	38	15%	20%	15%	25%	17%	8%	0%	67	-29
Total	1998	53%	65%	85%	47%	40%	14%	0%	**306**	75%	66%	56%	45%	32%	22%	4%	**325**	-19
	2007	53%	65%	69%	74%	30%	11%	0%	**303**	95%	75%	35%	48%	25%	23%	0%	**400**	-97
	Differences								**-3**								**+75**	

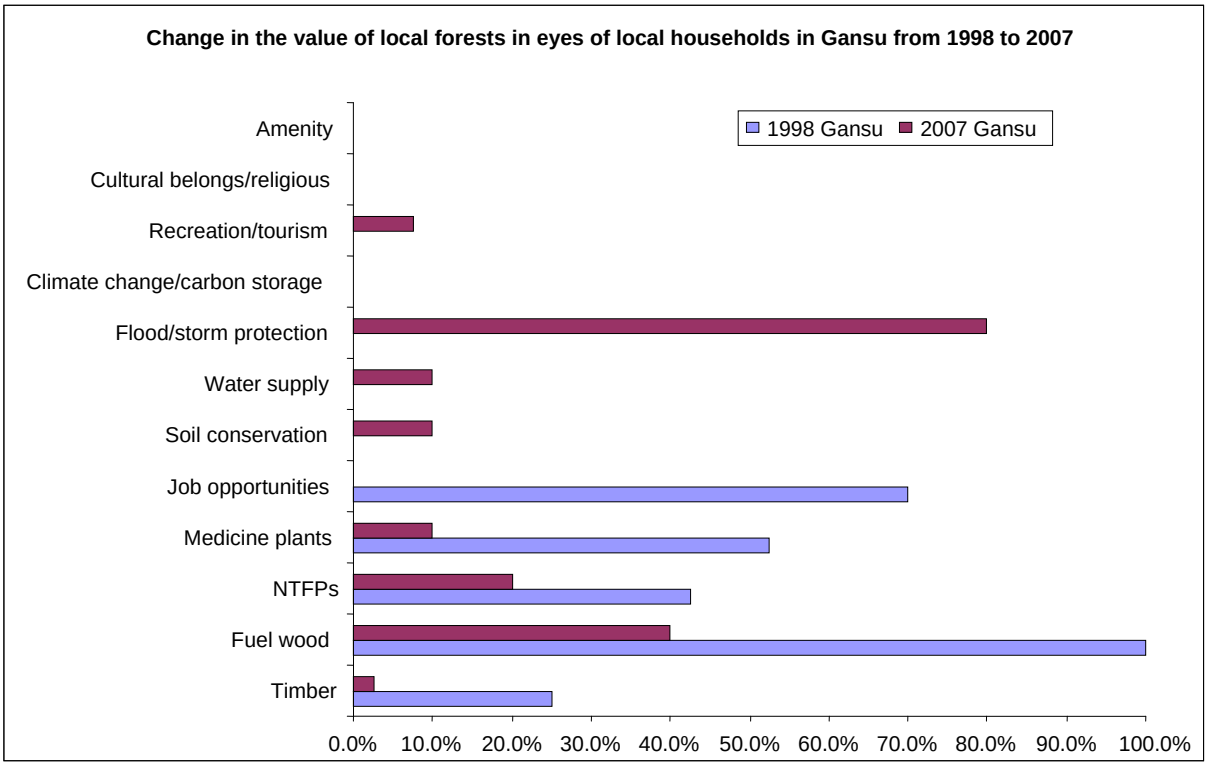
Note: *: Scoring methods are as follows: +3 with “highly agree”, +2 with “very much agree”, +1 with “agree”, 0 with “no significant opinion”, -1 with “disagree”, -2 with “very much disagree” and -3 with “highly disagree”.

Source: Household interviews and questionnaire surveys in the field research, 2007and 2008

In Chongqing, in 1998 before the NFPP, local households valued forests mainly for economic reasons: fuel wood (considered by 95% of the households); NTFPs such as *Mu'er* (*Auricularia auricula-judae*) and *Huajiao* (*Zanthoxylum bungeanum*) (75%); timber (35%); medicinal plants (32.5%) and job opportunities (5%). But even in 1998 the forest was also valued as a place for holding cultural activities and rituals for gods (20%) and a few (about 5%) mentioned the ecological values of the forests such as flood storm protection. However, by 2007 the ecological wellbeing of the forest was overwhelmingly valued, an impressive 80% of local households considering forests crucial for flood/storm protection in the area in which they lived; 25% valuing soil conservation; 10% placing value on water supply; and 2.5% even commenting on the climate change/carbon storage value of the forests. Fewer people considered the economic values of the forests: only 20% considered that forests were important for NTFPs since fewer NTFPs were provided by the local forests after the NFPP implementation; only 12.5% valued fuel wood value (less fuel woods could be collected from the forests); and only 5% mentioned the timber value since logging was prohibited. A greater percentage of local households mentioned cultural and even aesthetic values concerning the forests: recreation/tourism increased to 20%; feelings of cultural belongs/religious to 17.5% and aesthetic values to 17.5%, for instance, 17.5% of households mentioned "the forests bring more green amenities and make their living environment more pleasant and beautiful" (Figure 6-23).

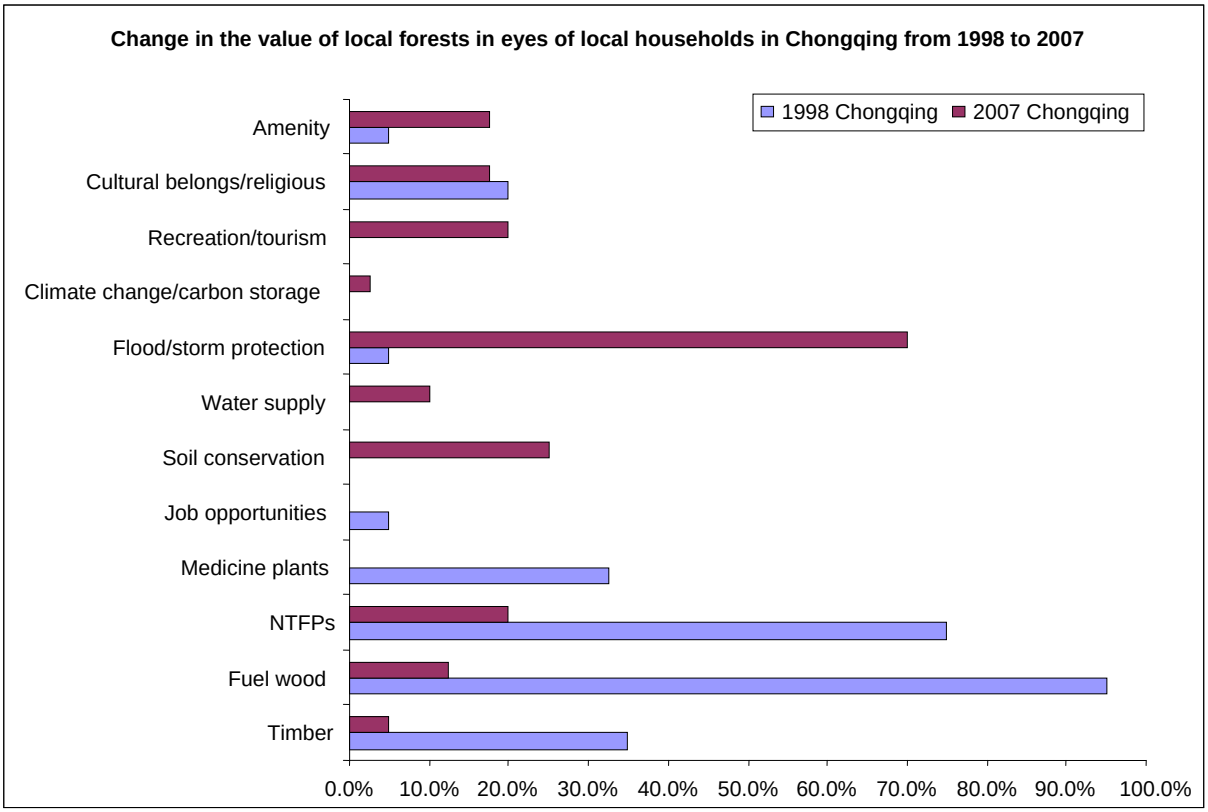
Figure 6-22 and Figure 6-23 show the shift from mainly economic values such as fuel wood, job opportunities, timber and NTFPs to ecological values, especially the value of flood/storm protection, of the local forests perceived by households. From the figures, it can be seen that, compared with Gansu, local households in Chongqing have a deeper appreciation of ecological and cultural/aesthetic values.

Value change is a long and complicated process. There will be many other reasons/factors contributing to the local value change regarding the forests. To understand the real impacts of the NFPP on the local forest values perceived by farmers, special interviews and discussions with various groups of the local people were arranged in the field. As a result, the influencing process of the NFPP on the changing value towards forest is illustrated through an impact chain as in Figure 6-22. That is, the local changing value towards forest was partly caused by the change in the function of forests (from economic oriented to ecological function) associated with the logging ban, and the ways of forest utilization related to the restricted access to forests since the NFPP implementation. Meanwhile, the local people's new views towards forests which was from formerly more economical values oriented to more ecological value important, was directly connected to the dissemination of information regarding the ecological value of forests provided by the forest sector since the NFPP implementation. It was told by local farmers during interviews that, there were lots of information disseminated through radio, newspaper, poster, television and personal contact, introducing the ecological value of forests, and the importance of the NFPP, of which was not considered seriously by local farmers in former time. Through the dissemination programs, many farmers noticed that the ecological value of forests are very important for them since forests have a contribution to the soil conservation, water supply, flood prevention, carbon storage and climate change (Table 6-12).



Note: N=40.

Figure 6-22: Change in forest values perceived by local households in study area of Gansu



Note: N=40.

Figure 6- 23: Change in forest values perceived by local households in study area of Chongqing

Source: Household interviews and questionnaire surveys in the field research, 2008

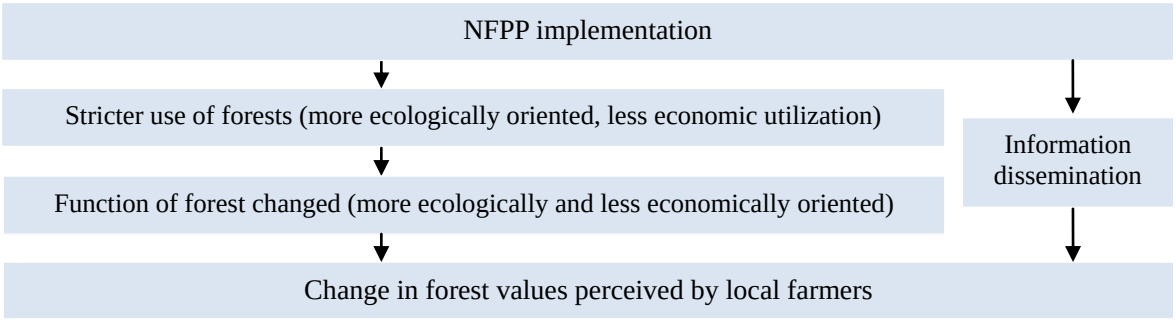


Figure 6-24: Causal chain of the NFPP resulting in change in forest values perceive by local farmers

Therefore, the NFPP implementation changed how local households valued local forests. The change was succeeded through the process of changing the way of local utilization of forests and the direct dissemination of information to local farmers.

Meanwhile, values people hold influence their behaviour (Fischbein 1997). The values household villagers place on local forests will influence their utilization of forests, and forward, the future patterns of forest use. For that reason, a better understanding of forest values is a very important predictive aid of future patterns of forest use in both study areas.

In the end of this chapter, Table 6-13 presents a summary to the analysis above, a matrix of these twelve indicators addressing the impact results of the NFPP implementation on the local forest communities and households in different forest areas, state-owned and collective.

Table 6-12: Change in perceived values of local forests and forest resources in study areas from 1998 to 2007

Value of forests		Gansu (state-owned)				Chongqing (collective owned)			
		1998		2007		1998		2007	
		No. of HHs (N=40)	%	No. of HHs (N=40)	%	No. of HHs (N=40)	%	No. of HHs (N=40)	%
1. Economic value		*116*	*290%*	*29*	*72.5%*	*97*	*242.5%*	*15*	*37.5%*
	Timber	10	25.0%	1	2.5%	14	35.0%	2	5.0%
	Fuel wood	40	100.0%	16	40.0%	38	95.0%	5	12.5%
	NTFPs	17	42.5%	8	20.0%	30	75.0%	8	20.0%
	Medicine plants	21	52.5%	4	10.0%	13	32.5%	0	0.0%
	Job opportunities	28	70.0%	0	0.0%	2	5.0%	0	0.0%
2. Ecological value		*0*	*0.0%*	*40*	*90%*	*2*	*5%*	*43*	*117.5%*
	Soil conservation	0	0.0%	4	10.0%	0	0.0%	10	25.0%
	Water supply	0	0.0%	4	10.0%	0	0.0%	4	10.0%
	Flood/storm protection	0	0.0%	32	70.0%	2	5.0%	28	80.0%
	Climate change/carbon storage	0	0.0%	0	0.0%	0	0.0%	1	2.5%
3. Cultural values		*0*	*0.0%*	*3*	*7.5%*	*10*	*25%*	*22*	*55%*
	Recreation/tourism	0	0.0%	3	7.5%	0	0.0%	8	20.0%
	Cultural belongs/religious	0	0.0%	0	0.0%	8	20.0%	7	17.5%
	Aesthetic values	0	0.0%	0	0.0%	2	5.0%	7	17.5%

Note: Each household was allowed to give more than one value of the local forests. “No of HHs” means the number of households surveyed.

Source: Household interviews and questionnaire surveys in the field research, 2008

Table 6-13: Matrix of indicators for assessing social impacts of the NFPP on local communities and households in study areas (state-, collective forests) during the program implementation (1998-2007)

Category of indicators	SIA variables and indicators		Gansu (State-owned) (N=40)			Chongqing (Collective) (N=40)		
			1998	2007	Diagnose % (+ or -)*	1998	2007	Diagnose % (+ or -)
A. Community population characteristics	A-1: Population size		980	630	- 35.7%	2,500	2,060	-17.6%
	A-2: Percentage of population living under the poverty line		79	30	-62.0%	85	23	-73.0%
B. Community/ institutional arrangements	B-1: Size/structure of local government/rule systems		34	32	-5.9%	34	50	+17.6%
	B-2: Regulations on access to the local forests (formal/informal)		19	11	-36.8%	25	20	-20.0%
		Membership rule **	0	0	0	2	2	0
		Access rule to - timber	0	0	0	1	0	-1
		- NTFPs	2	0	-2	2	1	-1
		- fuel woods	2	0	-2	2	1	-1
		- bamboo shoots	2	0	-2	2	2	0
		- grazing	2	0	-2	2	1	-1
		Forest protection	2	2	0	2	2	0
		Forest fire	0	2	+2	2	2	0
		Penalty of - illegal harvest	2	2	0	2	2	0
		- forest fire	2	1	0	2	2	0
		Reward rule	2	2	0	2	2	0
		Conflict resolution	1	2	+1	2	2	0
		Benefit sharing	2	0	+2	2	1	-1
	B-3: Local economy/industrial diversification		691,375	1,955,293	+182.8%	1,694,986	6,094,232	+295.5%
		Industrial income ***	2.5%	32.3%	+29.8%	17.2%	25.0%	+7.8%
		Agricultural income	25.8%	16.1%	-9.7%	27.3%	13.1%	-14.2%
		Forestry Income	16.3%	9.4%	-6.9%	20.4%	12.8%	-7.6%
		Pastoral income	7.7%	9.7%	+2.0%	3.9%	8.7%	+4.8%
		Construction income	2.2%	13.8%	+11.6%	2.6%	11.6%	+9.0%
		Transportation income	24.3%	5.6%	-18.7%	13.6%	7.9%	-5.7%
		Restaurant/hotel/other services	21.2%	13.1%	-8.1%	15.0%	21.0%	+6.0%

(Table to be continued)

(Table continued)

Category of indicators	SIA variables and indicators		Gansu (State-owned) (N=40)			Chongqing (Collective) (N=40)		
			1998	2007	Diagnose % (+ or -)*	1998	2007	Diagnose % (+ or -)
C. Community infrastructure /public services	C-1: Infrastructure & public services		31	25	-19.3%	33	36	+9.1%
		Transport (No./quality of roads) ****	10	5	-50.5%	9	11	+22.2%
		Education (No./quality of schools, enrollment rate)	11	11	0.0%%	14	16	+14.3%
		Healthcare (No./quality of hospitals)	10	9	-10.0%	10	9	-10.0%
	C-2: Land use patterns							
		Agricultural land (mean) *****	29.7%	13.6%	-16.1%	45.3%	13.8%	-31.5%
		Forest land (mean)	47.9%	62.5%	+14.6%	36.4%	66.3%	+30.0%
		Pastoral land (mean)	0	1.0%	+1.0	3.0%	4.6%	+1.6%
		Homestead (mean)	13.2%	13.9%	+0.8%	13.0%	13.6%	+0.6%
		Public land (mean)	9.2%	9.0%	-0.2%	2.4%	1.8%	-0.6%
D. Individual /family impacts	D-1: Household income structure		3052	9293	+204.5%	4745	17218	262.9%
		Crops farming ******	26.6%	12.6%	-14.0	23.3%	17.0%	-6.3%
		Joint harvesting/transportation	32.8%	0.0%	-32.8	12.6%	0.1%	-12.5%
		NTFPs collection/cultivation	10.1%	17.0%	+6.9%	29.7%	7.3%	-22.4%
		Vegetable/medicine plants	9.4%	4.5%	-4.9%	5.1%	2.2%	-2.9%
		Livestock raising	10.8%	6.0%	-4.8%	12.2%	6.6%	-5.6%
		Fuel wood collection	1.6%	0.0%	-1.6%	0.0%	0.0%	0.0%
		Migration work/business	7.3%	46.2%	+38.9%	15.6%	62.4%	+46.8%
		Handcraft/sale	1.3%	8.8%	+7.5%	1.4%	3.1%	+1.7%
		Remittance	0.0%	4.8%		0.0%	1.3%	+1.3%
	D-2: Household expenditure on alternative energy use		15	326	+2073.3%	170	839	+393.5%
	D-3: Household labor time distribution							
		Crops farming ********	26.1%	20.5%	-5.6%	28.1%	27.8%	-0.3%
		Joint forest harvesting/transportation	34.8%	0.0%	-34.8%	8.9%	0.2%	-8.7%
		NTFP collection/cultivation	6.5%	14.2%	+7.7%	25.6%	13.1%	-12.5%
		Vegetable/medicine plants	6.6%	5.9%	-0.7%	4.0%	2.6%	-1.4%
		Livestock raising	7.4%	8.5%	+1.1%	9.1%	7.5%	-1.6%
		Fuel wood collection	12.0%	4.8%	-7.2%	10.2%	2.3%	-7.9%
		Migration work/business	5.2%	38.5%	+33.3%	11.2%	42.7%	+31.5%
		Handcraft/sale	1.4%	7.6%	+6.2%	3.0%	3.9%	+0.9%

(Table to be continued)

(Table continued)

Category of indicators	SIA variables and indicators		Gansu (State-owned) (N=40)			Chongqing (Collective) (N=40)		
			1998	2007	Diagnose % (+ or -)*	1998	2007	Diagnose % (+ or -)
D. Individual /family impacts	D-4: Local perceptions on public health/safety ********		306	303	-1.0%	325	400	+23.1%
		Opinion of natural environment condition	128	145	+13.3%	140	173	+23.6%
		Perception of public health	131	120	-8.4%	138	160	+15.9%
		Perception of safety to the future	47	38	-19.1%	47	67	+42.6%
	D-5: Forest values perceived by the local people *********							
		Economic value such as - timber	25.0%	2.5%	-22.5%	35.0%	5.0%	-30.0%
		- fuel wood	100.0%	40.0%	-60.0%	95.0%	12.5%	-82.5%
		- NTFPs	42.5%	20.0%	-22.5%	75.0%	20.0%	-55.0%
		- medicine plants	52.5%	10.0%	-42.5%	32.5%	0.0%	-32.5%
		- job opportunities	70.0%	0.0%	-70.0%	5.0%	0.0%	-5.0%
		Ecological values such as - soil conservation	0.0%	10.0%	+10.0%	0.0%	25.0%	+25.0%
		- water supply	0.0%	10.0%	+10.0%	0.0%	10.0%	+10.0%
		- flood/storm protection	0.0%	80.0%	+80.0%	5.0%	70.0%	+65.0%
		- climate change/carbon storage	0.0%	0.0%	0.0%	0.0%	2.5%	+2.5%
		Cultural values such as - recreation/tourism	0.0%	7.5%	+7.5%	0.0%	20.0%	+20.0%
		- cultural belongs/religious	0.0%	0.0%	0.0%	20.0%	17.5%	-2.5%
		- aesthetic values	0.0%	0.0%	0.0%	5.0%	17.5%	+12.5%

Note: *: % (+ or-) means the significant results of increase or decrease in change, the detailed scaling of each variable and indicator see definition of each indicator in the paragraph.

**: Score as "1" when marked as "Yes"; score as "0" when "No".

***: Here it only presents the contribution proportion of income of each community economic/industrial activity to the total.

****: Score "+3" when quality as "Good"; score "+2" when "Adequate"; score "+1" when "Bad".

*****: Here it only presents the proportion of area of each land use pattern to the total land area.

******: Here it only presents the contribution of income of each income generation activity to the total.

*******: Here it only presents the proportion of labour time spent on each income generation activity to the total household labour time.

********: Score "3" with "Highly agree"; score "2" with "Very agree"; score "1" with "Agree"; score "0" with "No significant opinion"; score "-1" with "Disagree"; score "-2" with "Very disagree"; and score "-3" with "Highly disagree".

*********: Here it only presents the proportion of how many people agree with each target value; one person is allowed to select several values of the forests.

Source: Verified from the field research, 2008

7 DIAGNOSIS: COMPARATIVE ANALYSIS AND DISCUSSION

7.1 General remark

In the previous chapter results from two case study areas are presented; causal analysis based on the results is also provided by the causal chains illustrating the cause, the NFPP implementation, and the effects, the social impacts on the level of local communities and the level of households. In this chapter, the *de facto* and potential impacts of the NFPP on local communities and households are discussed and concluded, based on a comparative analysis of the two case study results. The synthetical discussion in this chapter emphasizes the four categories of social change processes and human impacts captured by the measurement of the twelve selected social indicators. With a comprehensive discussion of the case study results, this chapter answers the corresponding research questions inferred from the conceptual framework[152], in order to facilitate a more systematic and extensive study on SIA of the NFPP in the future, and to highlight major inferences pertaining to the level of theory.

Following issues are discussed in this chapter: the key elements of the conceptual model of the SIA for understanding the social impacts of the NFPP; the roles of local strategies and external/internal factors that contribute to the extent of impact results; and the dynamics of *de facto* and potential impacts in the context of local forest-dependent communities. By synthesizing these elements, the chapter aims to predict future impacts of the NFPP on the local communities and households, and thus, to recommend a better implementation of the NFPP for a harmonization of forest management options and the local livelihoods (Chapter 8 extends the discussion on recommendations).

7.2 The *de facto* impacts of the NFPP on local communities and households

7.2.1 Social change processes in the local community

The social change process in local forest-dependent communities is defined as the change process in the social setting of local communities, intended or unintended, resulting from the NFPP implementation (intervention). Because social change processes are set in motion by project activities or policies, and they take place regardless of the social context of society (groups, nations or religions)[153], hence, social change processes can be measured objectively, independent of the local context. Social change processes can lead to other social change processes in the local community. Under certain conditions, depending on the characteristics of the existing community, i.e., the local social setting of the community, and mitigation measures as well as local strategies that are put in place, the social change processes can lead to human impacts which are experienced by local households[154].

[152] See research questions and conceptual framework presented in Chapter 3.7, pages 57-59.

[153] More discussions on definition of social change processes are presented in Chapter 3.3, pages 42-45.

[154] More discussions on human impacts experienced by local households will be presented in Chapter 7.2.2, on page 149.

The *de facto* impacts of the NFPP implementation are the actual impacts, which have been borne by the local forest-dependent communities. The *de facto* impacts of the NFPP are composed of two different level impacts: the social change processes in the local community and the changes experienced and felt by the local households

In this empirical study, the social change processes in local forest-dependent communities are captured through following three divided categories of changes: Category A, changes in the community population characteristics; Category B, changes in the community institutional arrangements; and, Category C, changes in the condition of community infrastructure and public services.[155] Research indicators are selected and analyzed to understand the three categories of social change processes in the local forest-dependent communities, and they are referring to the research questions from one to three, respectively[156]:

Q.1: Changes in population characteristics in the local forest-dependent communities resulting from the NFPP implementation (see page 57)

This research question is answered by analysing the two research indicators: Indicator A-1, changes in the population size; and, Indicator A-2, changes in the percentage of population living under the poverty line[157].

The empirical study has shown that, the logging ban associated with the NFPP implementation has caused increased number of local farmers migrating to cities and towns for jobs to replace the incomes those they lost as loggers in former time. Thereby, the population size in local forest-dependent communities decreased both in Gansu and Chongqing as a result of the NFPP implementation. Meanwhile, the percentage of local population living under the poverty line decreased, since local farmers' migrating for work to cities and towns generated the more income than logging, and thus increased average household income and brought increased incomes for those who were formerly living under the poverty line. Whilst it is possible that other factors may also contribute to the changes in local population characteristics; the causal chain in Figure 6-2 has illustrated the pathways of the NFPP implementation yielding changes in the local population size and the percentage of population under the poverty line. Meanwhile, a result from a target group discussion, which were participated by twelve elder farmers in Taohua Village in Gansu, shows that, more than 78% of them considered the NFPP as the main reason for population changes in that area.

Changes in the community population characteristics are the social change processes in the local forest-dependent community. The magnitude and rate of population change has important implications for other social change processes such as community infrastructure and public services. For instance, decreased population will need fewer amounts of infrastructure and public services, and may be a major determinant of the economic/industrial diversification and land use patterns in local forest-dependent communities. The decrease in the population size may have negative influence on the future development of local communities and the household economy in the long term.

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[155] See conceptual framework of the research, in Figure 3-8 on page 59.

[156] See the research questions presented in Chapter 3.7, on page 57.

[157] The standard of the poverty line for this study is defined in Chapter 4, Methodology; see the footnote on page 62.

Q.2: Changes in institutional arrangements in local forest-dependent communities as the result of the NFPP implementation (see page 57)

This research question is answered by analyzing following three measurable research indicators: Indicator B-1, changes in size and structure of the local government system; Indicator B-2, changes in regulations on access to forests; and, Indicator B-3, changes in local economy/industrial diversification.

The field investigation shows that the number of staff members decreased in the local government in state-owned forest area (Gansu), and increased in the collective forest areas (Chongqing) due to the new establishment of the local NFPP Committee in Chongqing as the result of the NFPP implementation. This implies that the roles of the local government in the forestry sector have been comparatively stronger in collective forest communities and weaker in state-owned forests since the NFPP implementation. The stronger role of the local government in the collective forest sector may attract more budget for subsidies and compensations for the economic loss of the local community and households as the result of the NFPP. But the stronger role of local government may break the internal balance between the customary use and conservation of the local forests as followed by the local people, and create new conflicts. For example, traditional use and customary law may conflict with the NFPP and lead to non-compliance. It is difficult to draw a conclusion as to whether the establishment of the local NFPP Committee and the increased work staff in the local government of collective forests have positive or negative impacts on local forest-dependent communities. Nevertheless, the change in the size/structure of the local government as a social change process certainly will influence the future development of forestry sector and the development of local forest-dependent communities.

Research indicates that, following the logging ban associated with the NFPP implementation, stricter rules and regulations make for less access to timber, NTFPs, fuel woods, bamboo shoots and grazing. Meanwhile, local communities have more responsibilities for the forest fire protection and conflict resolution. Benefit sharing mechanisms in both study areas have been harmed. As a social change process, changes in local regulations for the access to forests might influence future forest use patterns in local communities.

The field research also shows that the NFPP implementation has influenced the local economic and industrial diversification in local forest-dependent communities. The NFPP implementation shifted the local economy from the reliance on local forest resources to the dependence on the industrialization. This has changed the community economic structures which are dependent on joint logging and wood transportation in Gansu and traditional forestry cultivation activities such as *Mu'er* (*Auricularia auricula-judae*) and mushroom cultivation in Chongqing. Chongqing seems to have more options, developing better local strategies for alternative incomes such as tourism and orchard development. Community economic and industrial structure and diversification in Gansu have changed more significantly than in Chongqing.[158]

[158] See more discussions on this issue in Chapter 7.3, reasons and external/internal factors influencing the different extents of social impacts of the NFPP in Gansu and Chongqing, pages of 152-154.

Q.3: Changes in infrastructure and public services in local forest-dependent communities as the result of the NFPP implementation (see page 57)

Following two measurable research indicators are selected and analyzed in order to answer this research question: Indicator C-1, changes in infrastructure and public services; and, Indicator C-2, changes in land use patterns. Three verifiers are selected to measure the changes in infrastructure and public services: condition of transportation facilities and services such as roads; condition of education facilities such as schools; and, condition of health care facilities such as clinics in local communities.

Results from the empirical study indicate that, the NFPP implementation has impacts on infrastructure and public services in local forest-dependent communities. Specifically, local infrastructure and public services including conditions of roads, schools and clinics have worsened in Gansu while improving in Chongqing.

Prior to the NFPP implementation, the government invested generous budgets for new roads, bridges and hospitals in order to facilitate wood harvesting and log transportation in the state-owned forests, benefiting adjacent local communities. When these investments stopped with the NFPP implementation, local community infrastructure and public services in villages connected to state-owned forests suffered. Villages in the collective forests system benefited by compensation from the government and improved economic alternatives as well as investment for the repair and new construction of the roads, in order to facilitate local industrial development, the major local income source that added to government revenues.

Result from the study also reveals that, the NFPP implementation has impacts on the local land-use patterns, by banning logging and increasing plantation and forest cover areas in the surveyed villages of Gansu and Chongqing. Field observation noted that, many formerly cultivated hillsides and sloping lands are planted with new and young trees. The agricultural and forest lands are the two main land-use types in the surveyed villages, occupying nearly 77.0% and 80.8% of the total land, respectively. While the total land area of each village in Gansu and Chongqing has remained unchanged, land use patterns altered since the NFPP implementation. As large areas of agriculture in slope lands were converted into forest lands, total areas of agricultural lands decreased, wheat and corn fields from 29.7% to 13.6 % in Gansu villages, and in Chongqing villages rice paddy fields and rice terraces dropped from 45.3% to 13.8%; while areas of forest lands increased from 47.9% to 62.5% in Gansu and 36.4% to 66.3% in Chongqing.

Changes in local infrastructure and public services are regarded as a social change process in local forest-dependent communities. Changes in community land use patterns have significant meaning to the local economic structure and development, and influence the local household economic and labour contribution, especially in regard to the agricultural farming with its decreased labour contribution and downsized income since 1998.[159]

The changes in the infrastructure and public services in local communities present a dilemma: with available road links people have easy and frequent access to natural forests, increasing

[159] More discussions on household incomes are presented in following Chapter 7.2.2, pages of 149-151.

the use pressure on forests; meanwhile, such road links encourage migration to adjacent towns and cities for labour (*dagong*), reducing dependence on local forest resources. The changes in the infrastructure and public services as a social change process may have important influence on villagers' sense of well-being and satisfaction with their community and their perception of future security.

In summary, social change processes in local forest-dependent communities are sometimes difficult to identify as positive or negative, but they influence the other social change processes, and consequently influence to the behaviour of local individuals and households, of which are defined as human impacts. Clearly identifying these social change processes and recognizing the pathways of their interaction help to understand the human impacts experienced by local households, and to predict the future potential social impacts.

7.2.2 Human impacts on the local households

Human impacts on the local households are the impacts felt or experienced by individuals and families. Human impacts on the local households can be directly resulted from social change processes in social setting of the local community, and also can be indirectly resulted from changes in the biophysical environment of the local community.[160]

In this study, the human impacts on the local household level are defined as Category D, the individual and family impacts, which are measured by following five research indicators: Indicator D-1, household income derivation; Indicator D-2, household expenditure, particularly the increase in alternative energy cost; Indicator D-3, household labour time distribution; Indicator D-4, local perceptions on public health and safety; and, Indicator D-5, values of local forests and forest resources perceived by local households.[161] The empirical study analyzes the above five measurable research indicators in order to answer the following research question:

Q.4: Impacts on individuals and families in local forest-dependent communities as the result of the NFPP implementation (see page 57)

The empirical study shows that, the impacts of the NFPP on individuals and local households are very complex. These human impacts are partly negative and partly positive to their livelihoods: the NFPP negatively impacted household livelihood during the early stage of its implementation, especially before the 2004, but turned out to be positive by 2007. The study has shown that, the household income had seriously decreased from 1998 to 2004 due to the decrease of forest income from logging and transportation in the villages of Maiji and Taohua in Gansu, but the household income has increased again since 2005 as local households found more alternatives for income generation.[162] Local strategies derived by local communities and households played a very important role in coping with the negative impacts and for their better survival.

[160] As illustrated in Figure 3-3, on page 45.

[161] See Table 3-2 and the research conceptual framework presented in Figure 3-8, pages 58-59.

[162] The discussion is already presented in Chapter 6.2, see pages 118-120.

As empirical evidence regarding the increase of household income, the study shows that the annual total household income increased significantly in both Gansu and Chongqing from 1998 to 2007. Average annual income for each household increased from 3,052 to 9,293 Yuan in Gansu, and 4,745 to 17,218 Yuan in Chongqing, with the increase rates of 204.5% and 262.9%, respectively. Chongqing has more significant income increase than that of Gansu.

The result of a target group discussion participated by nine elder farmers in Xinshi Village of Chongqing reveals that, the reasons for income increase are partly due to the increase of market prices for agricultural and forest products as well as livestock, and also the increased prevalence of migration work in towns or cities for alternative livelihood. The local households do not benefit directly from any measurements associated with the NFPP implementation, but indirectly they do so. The contribution of forestry incomes (joint timber harvesting and transportation, NTFPs cultivation/collection, livestock raising and fuel wood collection) became less important to total household income after 1998, and other income sources proved more lucrative. The forestry income ranked as top income both for households in Gansu and Chongqing in 1998, amounting to more than half of total income. After that the proportion of forestry's contribution to total income decreased to only 27.5% in Gansu and 16.2% in Chongqing. The kind of forest cultivation shifted in both areas from *Mu'er* (*Auricularia auricula-judae*) cultivation which consumes great amounts of wood materials and may necessitate the harvesting of the whole tree to *Huajiao* (*Zanthoxylum bungeanum*) cultivation which only collects the fruits without destroying the trees. Crop farming remains still the priority for household income generation since most farmers consider it as the main activity of their daily life. The contribution of migrant work/business income has become the most important to rural household economy, rising to the top rank in both study areas of Gansu and Chongqing, accounting for 46.2% and 62.4% of income, respectively.

When the logging is not allowed, when the local access to forest use is restricted, households of local forest-dependent community have to find alternative income generation activities for their survival and a better livelihood. Migration work is one of the alternatives for their income generation, and this is also one of the local strategies spontaneously taken by locals to compensate with the income loss resulting from the NFPP implementation. Assessment of impacts of the NFPP implementation on local household's income derivation should consider together the local strategies, which have been developed by local households to cope with negative impacts resulted from the initiative of the NFPP. These local strategies are identified and examined in the following sections.[163]

Evidence from the field research shows that, the NFPP implementation directly impacts local household income and work structures, and has led local households to shift from sole dependence on forest resources to new and better paying household income sources. Nevertheless, the stories of individual samples recorded during the field research also reveal that, finding jobs in adjacent towns or cities has been rather difficult for the farmers, especially for those at a low educational level, and who live in remote areas with poor road

[163] As Chapter 8 extends this discussion and suggests the strategies for a better implement the NFPP and for a harmonization between the local livelihood improvement and the forest management options.

connections.[164]

Meanwhile, the NFPP implementation negatively impacted the local families with increased energy costs for cooking and heating by an average of an additional 326 Yuan in Gansu, and an average of 839 Yuan in Chongqing. The traditional energy source of fuel wood consumption by each household dropped dramatically, from an average of about 4,500 kg annually in 1998 to only 600 kg in 2007 in Gansu and in Chongqing from 4,000 kg in 1998 to nearly 200 kg in 2007. Meanwhile, the NFPP implementation positively affected the families by freeing up time once used to collect wood, allowing for the better paying jobs that more than the compensation for the additional energy costs.

Moreover, the field research also shows that the NFPP has resulted in the redistribution of the household labour time. Less time has been spent on forest related activities, which in Gansu that was joint timber harvesting/transportation, and in Chongqing was cultivation of NTFPs. The freed up time has been spent on looking for jobs in adjacent towns or cities, as the NFPP implementation curtailed the farmers' ties to the forests; dramatic changes occurred in the labour structure and labour time distribution of the farmers in both study areas.[165]

Regarding local perceptions on public health and future security, ecological environmental conditions were regarded as improved for Gansu and even more so for Chongqing. Gansu villagers perceived the public health as getting worse, and villagers in Chongqing considered it as getting better. Gansu has become more pessimistic about future and Chongqing more optimistic. In conclusion, the NFPP has had a negative impact on Gansu's perceptions and a positive one on Chongqing's. Results from target group discussions during the field research reveal that, the difference in the perceptions of public health and safety are certainly associated with the different compensation measures, different existing socio-economic situations and different historical development conditions in the two study areas.

The empirical evidence reveals that the NFPP implementation has changed the way that how local households value local forests. Figure 6-22 and Figure 6-23 (on page 139) show the shift from mainly economic values such as fuel wood, job opportunities, timber and NTFPs to ecological values, especially the values of flood/storm protection, of the local forests perceived by households in both areas. Compared with Gansu, local households in Chongqing have a deeper appreciation of ecological and cultural/aesthetic values. Of course, the value change is a complicated long term process and could be influenced by many other factors, not only the NFPP. Therefore, special discussions were also made with local key persons in order to understand the relationship between the value change and the NFPP implementation. Most of them agreed that the restriction on forest use associated with the NFPP implementation has changed the use pattern of local forests; thereby, it has gradually changed the values of forests perceived by local households. Meanwhile, as told by local households, there has been lots of dissemination of information provided by the forest sector regarding the ecological values of the forests since the NFPP. The various dissemination activities organized by local NFPP committees have provided the opportunities for local

[164] See Box 6-1 on page 123; more discussions are also presented in following section 7.3.1.

[165] See the analysis of Indicator D-3, on page 128.

farmers to better learn about the ecological values of local forests. Forest values were partly formed by the ways how the local people use forests, and will affect the ways how they will use forests in the future. A better understanding of the forest values is an important predictive aid of future patterns of the forest use in both study areas.

7.3 External and internal factors influencing the extent of impact results

7.3.1 Introduction

The research indicates that the extent of social impacts of the NFPP implementation differ in state-owned forest area (Gansu) and collective forest area (Chongqing). Referring to the research questions from five to six (on page 57), this section discusses the external/internal factors that may influence the extent of social impacts of the NFPP implementation in local communities in the two study areas. The scoping and profiling the study areas and the investigated villages presented in Chapter 5 have emphasized following different characteristics of the local communities and households[166]: (1) The different forest ownership types, existing socio-economic and cultural backgrounds and the historical forest development conditions in local forest-dependent communities; these three characteristics are regarded as external factors since they are observed at the local community level; and, (2) The household size (working labour), educational level of the house head, and the house distance to local forests; these three characteristics are regarded as internal factors because they are investigated at the local household level. These six external/internal factors influence and differentiate the extent of social impacts of the NFPP on local forest-dependent communities and households in different study areas. Statements in following two sections are regarded as the answers to the research questions of five and six.

7.3.2 The external factors at community level

Forest ownership structure: Gansu, state-owned forest area, and Chongqing, collective forest area, representing two different forest ownership types, have different management systems concerning use rights to the forests and use patterns of the forest.[167] The compensation measures from the government regarding the NFPP implementation in state-owned forest areas are different from those in collective forest areas. For instance, the farmers in collective forest areas (such as Chongqing) receive more subsidies from the government and forest sector according to the forest area they owned as compensation for not-cutting trees, while the farmers in state-owned forest areas (such as Gansu) have less. Hence, the collective forest areas are less negatively impacted by the NFPP in contrast to the state-owned forest areas. Thus, forest ownership structure plays an important role as one of the external factors that differentiate the degree of the social impacts of the NFPP in different local forest-dependent communities.

Existing socio-economic contexts and cultural backgrounds: Gansu and Chongqing present

[166] See Chapter 5 from page 79.

[167] See Chapter 2.2, the forest sector in China, which presents the different development conditions and management options in state-owned and collective forest areas, pages 13-15.

the different socio-economic contexts and cultural backgrounds even though their geographic condition and topographic location are relatively similar. Although Gansu is rich in natural resources, it is one of the economically poorest provinces in Western China (Anon. 2003). Since rural communities and households have a long tradition of using local forest resources for sustenance and economic purpose, implementation of the NFPP forced changes in traditional lifestyle and livelihood activities. But due to the lack of the capital, labour and social resources, the capacity[168] of the local communities and households in Gansu are relatively lower and weaker than in Chongqing to cope with such changes, and to adapt the new lifestyle and livelihood activities.

In contrast, local people in Chongqing have comparatively longer tradition of migrating to work because of the generally convenient traffic conditions in the area that is relatively easy to get jobs with higher income. The generally convenient traffic condition was obtained in Chongqing due to the unique geographic context and socio-economic development conditions in history.[169] Hence, the socio-economic status of local communities and households in Chongqing is comparatively more advanced than in Gansu, and is also advanced than the national average level in China. The capacity of local communities and households in Chongqing is comparatively higher and stronger than in Gansu to cope with the new changes resulting from the NFPP. The NFPP implementation may have more negative impacts on local communities and households in poorer areas since their resilience to negative impacts are lower and weaker. In other words, the local communities and households in poorer areas need stronger and more substantial support from outside when the mitigation measures for the NFPP are considered and provided.

The empirical evidences discussed above have shown that, the existing socio-economic contexts play an important role as one of the external factors that differentiate the extent of the social impacts of the NFPP in local forest-dependent communities.

Forest development history: Gansu and Chongqing have experienced long historical development in terms of the local forest management. Local communities and households in Gansu commonly participated in the joint logging and wood transportation in adjacent forest enterprises before the NFPP in 1998. In Chongqing, the agricultural and forestry reforms since 1978 and prior to 1998 influenced deeply the household activities and forest management options. The "Household Responsibility System" (HRS) and "Contract Responsibility System" (CRS)[170] were very popular from 1985 on: Two systems in collective forest areas stimulated local people's motivation for forest management and allowed them to accumulate practical experiences and knowledge in managing the local forests.

Although the NFPP strictly prevents the logging and harvesting, local communities and households still can use the local forests for cultivation purposes for fruits and other NTFPs, a good example being the local households in collective forest areas which cultivate the

[168] There are many different definitions of "capacity". The capacity here means the abilities, tradtions and attitudes which help ensure that a group of people will support each other, respond to challenges in a constructive manner and innovative (Barrow 2000:69).

[169] See introduction of Chongqing in Chapter 5.3, page 87.

[170] See introduction of the two systems in Chapter 2.2, on page 14.

Huajiao (*Zanthoxylum bungeanum*) and *Mu'er* (*Auricularia auricula-judae*) and receive a high income.[171] Therefore, the discussion on these empirical evidences has shown that, the length of the community's forest development history plays an important role as one of the external factors that differentiate the degree of the social impacts of the NFPP in different local forest-dependent communities.

7.3.3 The internal factors at household and individual level

The household size (working labour): The empirical evidence has shown that, impact results of the NFPP on local households are influenced by household size, especially the number of working labour in the family. The family with bigger household size (e.g., Nanmu Village in Chongqing), especially those with more workers, has relatively lower negative impacts from the NFPP implementation, compared with family with smaller household size (e.g., Taohua Village in Gansu). As confirmed by result of a target group discussion during the field survey, the family with bigger household size obtains a higher possibility and capability to reduce the NFPP negative impacts. This argument needs to be statistically approved in the future research.

Educational level of the house head: Results from questionnaire interviews of eighty households have shown that, impacts of the NFPP on the local households are influenced by the educational level of the house head. The family with the house head possessing higher education level is usually less negatively impacted by the NFPP in terms of the household livelihood.

House distance to the forests: Results from questionnaire interviews of eighty households have also shown that, the distance from homestead of the household to the local forests influences forest use patterns. Household living nearer to the local forests, less than 2 kilometres, suffer more significant negative impacts than those 5 kilometres or more from the forests.[172]

7.4 Potential impacts of the NFPP on the local community and households

Making predictions is one of the important tasks for SIA research. "Potential (negative) impacts" of the NFPP refer to the impacts those have not yet occurred and, therefore have not been measured in the field, but may happen in the future on the local communities and households, as a result of the NFPP implementation.

As the NFPP is continuously implemented, it is important to know the potential impacts of the NFPP in the near future. By synthesizing the *de facto* impacts consist of social change processes in the local communities and the human impacts experienced by the local households, the potential impacts of the NFPP on local communities and households can be predicted. (Potential impacts of the NFPP implementation on local communities and households are illustrated as in Figure 7-1 in the following section.)

[171] As discussed already in Chapter 6; the explanation of the NTFP cultivation species used by locals in study areas is presented as a list in Appendix 4.

[172] See empirical household data presented in Appendix 4.

7.5 Dynamics of *de facto* and potential impacts, local strategies and influencing factors

The study follows a conceptual assumption that, a local forest-dependent community can be seen as a small scale human ecosystem[173]; elements in this small scale human ecosystem influence each other. Dynamic changes and interactions exist between the social change processes in local community and human impacts experienced by local households. The empirical study employed twelve selected social indicators which affect each other to measure in field to understand the social change processes and human impacts. The result from the four categories of the twelve selected social indicators comprises together the *de facto* social impacts of the NFPP implementation.

Empirical study also indicates that, the local strategies are one of the important elements in the social system of local community, and also plays an important role in extent of social impacts of the NFPP implementation. These local strategies are the spontaneous reactions to the changes. As the NFPP has been implemented for almost ten years, the *de facto* impacts of the NFPP implementation should also consider local strategies derived by the local communities and households for their better survival. Because through the indicator measurement, the *de facto* negative impacts of the NFPP captured in the field, might be lessened and mitigated by the *de facto* positive impacts of the NFPP; and the *de facto* positive impacts of the NFPP might have been enhanced and strengthened by taking into account local strategies.

A part from that, research indicates that, the extent of *de facto* social impacts of the NFPP implementation should consider the following external and internal factors: forest ownership types, existing socio-economic conditions, and historical forest development condition in the respective communities, and the household size, especially the number of workers in the family, the educational level of the house head, and distance from the house to the forests for the households. These influencing factors are supposed to be functioning in the dynamic changes in local community as a result of the NFPP implementation.

By understanding the dynamics between the social changes process and human impacts, as well as the influencing factors on the extent of *de facto* impacts, potential impacts of the NFPP on the local communities and households are predictable: Accordingly, recommended planning/management strategies and appropriate mitigation measures fit the local context can be made; and the further implementation of the NFPP might be improved.

Referring to the conceptual framework and the research question nine[174], the dynamics of *de facto* and potential impacts, local strategies and external/internal influence factors are illustrated in Figure 7-1. This model can be regarded as a refined conceptual framework based on the empirical study experience, and it should be tested in future research.

[173] See discussions in Chapter 3.5, on page 47.

[174] See conceptual framework presented in Chapter 3.7 on page 58, and research question nine presented in Chapter 3.8, page 57.

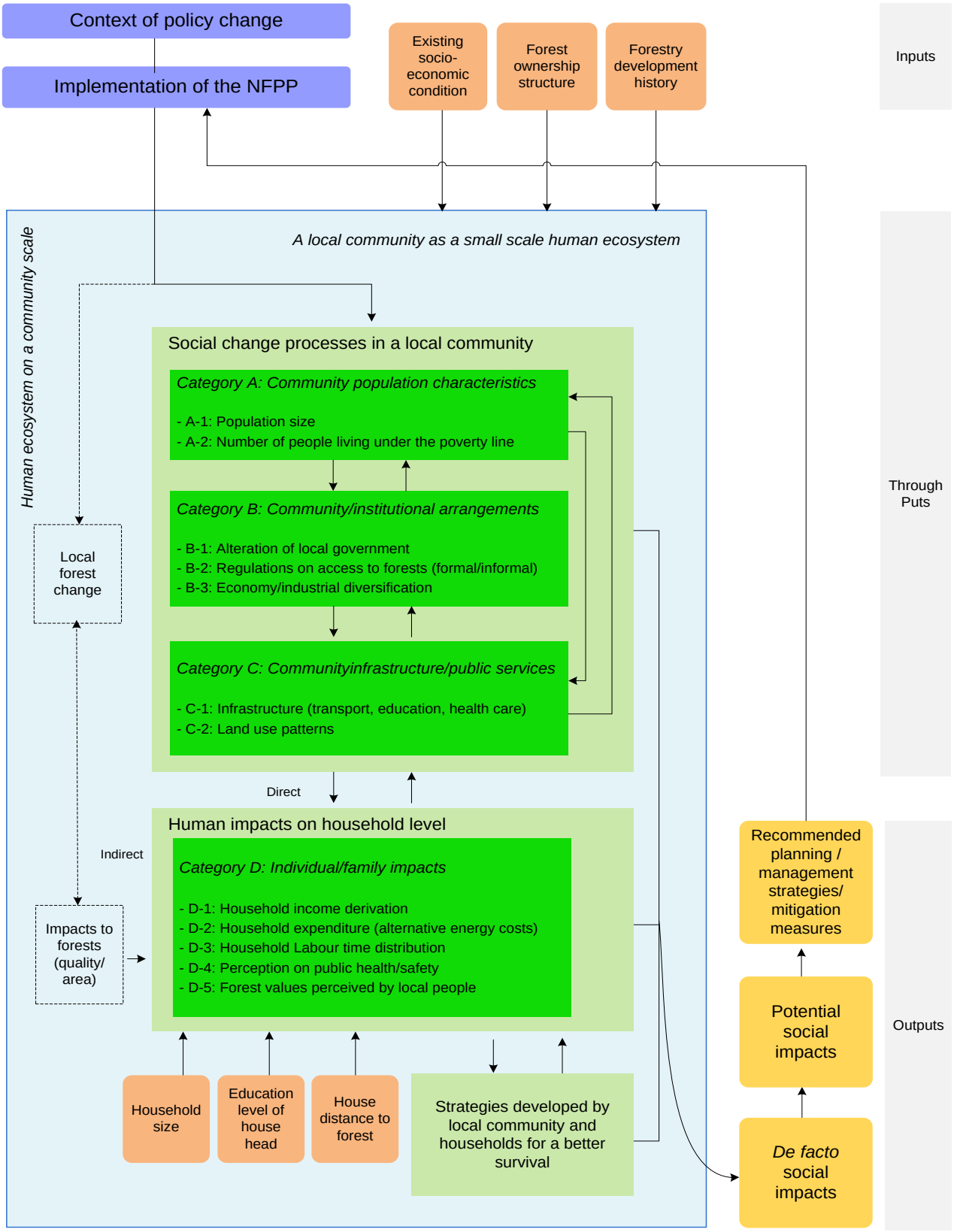

Figure 7-1: Dynamics of *de facto* and potential social impacts, local strategies and influencing factors

Source: from field research, 2007and 2008

8 CONCLUSION AND RECOMMENDATIONS

8.1 General remarks

The target of the final chapter is to recapitulate the individual findings into a more holistic perspective on the nature of social impacts, the social change process in local community and impacts experienced by households, as the result of the NFPP implementation. Scope and limitations of the study are pointed out. Recommendations for a better implementation of the NFPP in future are derived. Recommendations and implications for the future research on SIA practice for forest management are suggested. Methodology employed in current study is critically reviewed; the transferability of the conceptual framework applied to other contexts is intensively discussed, so that SIA can be developed and better serve as an advanced methodology for sustainable management of forests and sustainable development of natural resource management schemes in different regional contexts.

8.2 Recapitulation of major findings and conclusions

China is a large developing country with a transitioning economy along with frequent forest policy changes. The NFPP was not initiated overnight. Severe environmental problems and serious depletion of forest resources as the result of rapid economic growth and population expansion in recent years led to the NFPP as a way for the central government to combat deforestation and to mitigate flooding and droughts. The impacts of the NFPP on local forest-dependent communities and households have significant "side-effects".

Referring to the research questions presented in Chapter 3.7 (see page 57), this empirical study comes to the following conclusions:

(1) Social impacts of the NFPP implementation on the local forest-dependent communities are composed of two different impact levels: the social change processes in the local community and the changes experienced and felt by the local households (human impacts). A local forest-dependent community can be considered as a small scale human ecosystem which consists of a social system (community population, institution, economy, perception and value etc.) and an ecosystem (dominated by forest). Depending on different characteristics of the existing community and mitigation measures (local strategies) that are put in place, the social change processes can lead to different human impacts.

(2) The empirical study indicates the following social change processes in local forest-dependent communities as results of the NFPP: changes to local population characteristics (in terms of decrease in population size and percentage of population living under the poverty line); new institutional arrangements (in terms of changes in size/structure of local government/rule system, changes in regulations on access to forests, and redistribution of local industrial structure and contribution to local economy); and changes in infrastructure and public services (i.e., changes in condition of roads,

schools and hospitals and redistribution of land use patterns) in local forest-dependent communities. This conclusion reflects to the research questions from one to three (see page 57).

(3) A part from the social change processes in communities, the empirical study indicates following impacts experienced by local households (individuals and families) as results of the NFPP implementation: the redistribution of household income and expenditure structure, particularly the increase in household income and alternative energy costs; redistribution of household labour time structure; changes to local perceptions on public health and safety; and changes to values of forests as perceived by local households. This conclusion is referring to the research question four (see page 57).

(4) The extent of social impacts of the NFPP differs between local forest-dependent communities. Forest ownership structure, existing socio-economic context and the length of forest development history in the community are external factors that influence the extent of social impacts of the NFPP on the local communities. In addition to the external factors, internal individual and family factors influence the extent of social impacts of the NFPP implementation on local households. These internal factors include household size, educational level of the house head and house distance to local forests. This conclusion is to answer the research questions of five and six.

(5) The *de facto* impacts of the NFPP should consider local strategies derived by local communities and households as spontaneous reactions to changes for their better survival. The *de facto* negative impacts of the NFPP captured in the field through indicator measurement might be lessened and mitigated by the *de facto* positive impacts of the NFPP; and the *de facto* positive impacts of the NFPP might have been enhanced and strengthened by taking into account local strategies. This conclusion is regarded as the answer to the research question seven.

(6) By synthesizing and analysing the dynamics of *de facto* impacts, influencing factors and local strategies, potential impacts of the NFPP are predictable; further management strategies and mitigation measures which fit to local contexts might be recommended for a harmonization between the local livelihood and forest management options such as the NFPP (more discussion on this issue is presented in section 8.4).

8.3 Scope and limitations of the empirical study

This empirical research follows an exploratory approach. Application of SIA in the forestry field is quite new in China, and there is little information available on the social dimension of the NFPP and advancing the SIA research methodology. Therefore, this exploratory study intends to be served as a basis and a reference for a more systematic and comprehensive study and application of SIA in forestry field in the future.

The insights of the study can be generalized as follows: the case study provides quantitative and qualitative evidence and information on how the NFPP has been implemented in one state-owned forest areas and one collective forest areas in Western China; how it is impacting

the local forest-dependent communities and households in various ways; and, as a further step, what should be done for a better implementation of the NFPP and the improvement of the local livelihood.

In addition, this research provides an empirical case for further methodological research on SIA and helps define and develop more comprehensive and specified indicators for the future SIA research on natural resource development schemes. The conceptual model of SIA may be also referential for the other SIA practices in forest management plans and policy making processes in different regional contexts. A further implication for the future research on the SIA of the NFPP and forestry related projects as well as a critical review to the conceptual framework and methodology of the SIA is discussed in the next Chapter 8.

The current exploratory study on the SIA of the NFPP has the following limitations:

Non-representative for China: Due to the limited sources of material and time, the field research was carried out only in four selected villages in two case study areas, which are located in a state-owned forest area and a collective forest area in Western China, respectively. As the forest areas in the whole country mainly cover North-eastern, North-western and South-western regions, the situation in one forest area may differ from that in another, due to the variation in geographical features and socio-economic development contexts. So, the selected villages would be hardly representative for the diversity of villages in the whole region in particular and the various situations in China in general. Thus, one has to be careful to disseminate the study results for the whole regions and the country. As such, the findings may have limited value to villages in forest areas in other parts of China, let alone other forest resource-dependent communities elsewhere.

Limited case study experience and non-representative for the whole population in study areas: For a comparative analysis, only two case study areas were selected, and only limited numbers of key informants for interview (29 persons), local household samples for questionnaire (80 persons) and farmer representatives for target group discussion (66 persons) were selected and investigated in the study. The empirical results were interpreted and discussed only based on the experiences in these two case study areas; and, the research samples may not represent the whole population in that area, as indicated by the difference in the illiteracy rate of the villages and respondents[175]. As future steps, additional case studies shall be required for the future research to ensure the representativeness of case study findings for the overall areas.

"Snapshot" research perspective instead of ongoing process: Whilst the static "snapshot" research perspective employed in this empirical study has been suited to discover a number of significant social impact results, it poses a major limitation to the current empirical study as it does not allow for direct observations of the social change processes in the local community over different points in time. In fact, the SIA should be a dynamic and an ongoing process of integrating information on potential and real social impacts on decision-making and management practice; it is a also an ongoing process of local people's participation, the process of integrating local people's perceptions, opinions and values all through the time.

[175] As already presented in Table 5-6, page 87 and Table 5-10, page 95.

Although highly desirable, such longitudinal and dynamic research process by far exceeded the material and time resources available for the current empirical study.

Difficult to exclude the impacts resulting from other causes: As in the field research in case study areas, the most difficult point was how to exclude the impacts that have been caused by other projects. For instance, a part from the NFPP, there were also some other projects and programs implemented in the study areas, such as the Program of Conversion of Sloping Land to Forests (PCSLF)[176] and afforestation programs supported by NGOs. Therefore, an interpretation and discussion on the "attribution gap"[177] is necessary in the beginning of the research, to understand the real impacts of the NFPP and overall impacts and changes ever occurred in the local community, "*because there is no community that is isolated from the external environment*" (Barrow 2000). It would be recommendable that, a control study may be conducted in communities which are not covered by the NFPP implementation; a comparative analysis of the results from impacted community and the control community would be helpful to identify the real impacts of the NFPP. While doing a control study, a comprehensive understanding of the local specific contexts would be the priority of the future research focus.

Limitation with qualitative approach: In order to get data that is more statistically reliable, and to make the study results more precise and comparable with another case all through time, it is required that the SIA should be quantitative-oriented. However, this empirical study employed both quantitative and qualitative research approaches. Complementary to the quantitative approach, methods of qualitative data collection associated with scoping and description of the local contexts were employed to especially understand the opinions and perceptions of the local farmers. Therefore, the impreciseness associated with the quantitative research methods may be also created in this empirical research. For instance, when through a semi-structured interview and group discussion, local people are asked about their opinions and perceptions concerning the local forests and the NFPP. It is not easy for the investigators to take the perspective of the people correctly and objectively. Sometime the information might be subjective.[178]

8.4 Recommendation for future policy implementation

As the NFPP continues to be implemented, recommendations for its improved application are necessary, valuable, and relevant for future forest policies, projects and programs in China. Specific strategies should fit local unique contexts to mitigate negative social impacts and support positive social impacts in order to achieve a harmonization between the NFPP, its goal of local community development, and the local livelihood improvement in different regional contexts. This is also regarded as the answer to the research question eight (see page 57).

Coordination of various interest groups, governments, farmer groups: There are different

[176] See footnote on page 34.

[177] More discussions on attribution gap are presented in Chapter 4.6 and Chapter 8.5, respectively.

[178] Chapter 8 discusses details on the criticism of the qualitative approach.

agencies at different levels involved in the NFPP. Comprehensive coordination would enable them to work together to ensure the accomplishment of the NFPP. Continuous development of the local community and maintenance of the sustainable livelihoods of farmers would contribute to sustainable management of forests in Western China in the long run. These different agencies would include:

Farmer groups: In order to enable effective cooperation among farmers and other stakeholders it is necessary for individual farmers to form and consolidate the formal or informal groups that would work together on production and post-production, marketing and employment information. This would enhance and improve the livelihood of individual farmers and increase the capacity to find more market and job opportunities. A farmer group should be flexible and function either as a profitable or non-profitable group, while all the members should work towards agreements. Rules, selection of responsible leaders and a reward system should be created to encourage one group to co-operate with another for achieving common goals.

Governments: Long-term policy support from the central government is definitely needed to mobilize the farmers. Both direct and indirect policy support such as financial subsidies for recruiting, healthcare and education would give significant incentives for the farmers to commit to the NFPP project. Stability is necessary and important to provide security to the farmers. The profitability of the NFPP and the access rights to the forests and taxation regimes should be guaranteed and kept stable. The NFPP stability in policy and regulations would elicit farmers trust and increased confidence in their future.

As with the preferential policies in China to attract foreign investment and to attract investment from the coast to Western China, it is also necessary to set up a package of preferential policies to address the needs of farmers affected by the NFPP in state-owned and collective forest areas. The main needs are identified as technology transfer, market information capacity building, funding and establishment of facilities. The package should cover extension services, access to market and market information, access to credit and low interest loan, special regulations on taxation and improvement of the basic infrastructures. More incentives should be given to the farmers in this way as it would result in better living conditions for the farmers and improve the environment.

The local governments at province, district, county and township level are responsible for the implementation of the NFPP. They should naturally ensure the smooth continuation of the progress and realization of achievements. They should also provide market information and job opportunities to the farmers and strengthen the forestry sector and its organizations for the farmers. In this case, the local information flow should ensure the budget allocations for information services from the top-level to the local level as required.

Government agencies: Forestry cannot be considered in isolation from other land uses and must be fully integrated into land-use planning. Land use planning can be better developed by coordinating the forestry sector, land-use sector, and other government agencies and organizations. It is necessary to develop a land-use plan at the county level in accordance with various types of land-use in order to address and resolve conflicts, such as conflicts

between livestock grazing and forest protection. Giving the appropriate technical support to farmers affected by the NFPP, it would reduce the negative impact of the NFPP to the farmers' livelihood, and help them mitigate or find alternatives to improve their living conditions. The NFPP as a dynamic process will need to face different problems arising during its implementation, requiring monitoring systems to project activities and watch for problems in the whole dynamic process of the NFPP. This can be done by the government agencies at various levels.

NGOs: There are many NGOs, both national and international, working on either rural and/or mountainous area developments. Some are engaged in farmers' empowerment and capacity-building while others concentrate on land-use planning, agricultural and forestry products market analysis and development, and livelihood generation. There exists significant potential to cooperate with them to address the real bottlenecks in the development of mountainous areas covered by the NFPP. So far there are few NGOs involved in implementation of the study areas. However, the consolidation of function of NGOs would be helpful to build the farmers' capacity[179] in management of forests and products marketing.

Cooperation of various partners and benefit sharing: Good cooperation between stakeholders can reduce conflicts and allow them to work harmoniously and synergistically to achieve the common goal. Organizations such as private sector companies, research institutions, and consultant agencies could be good partners to aid farmers to work in an integrated manner. It is necessary for the farmer groups to cooperate with those stakeholders to set up different kinds of partnerships or alliances, so farmers could be more competitive and have the capacity to avoid or to reduce the negative impacts of the NFPP and ensure their sustainable livelihood in the near future. Options selected must have long-term financial and economic sustainability. In this case, commercial timber plantations and trees in the farming systems must play a role in the NFPP for sustainable management of natural forests that are planned and monitored with appropriate standards. Institutions and agencies in charge of forest management must raise technical standards and provide structures that are conducive to the outputs sought.

Integration of various systems: A better implementation of the NFPP requires an integration of various systems which are emphasized and addressed below:

Information system: It is essential to set up the documentation centre and build a system to share information, especially information on markets and job opportunities. This could be included in the administration system of farmer groups or extension services from the government agencies that would ensure high transparency of data sharing, providing information useful for individuals and farmer groups in decision making on better livelihood alternatives.

Communication system: Communication system among the farmers would be a practical tool for sharing ideas and taking necessary responsive actions in time.

[179] Farmers' capacity here is defined as the ability of an individual farmer to achieve different combination of performance elements, and to define the freedom to choose the life preferred. If refers to the five types of capitals as human capital, social capital, physical capital and financial capital, Sen, 1993.

Alternative resource control system: Another practical tool is to recognize and support "bottom-up" alternative resource control systems such as de-concentration, decentralization, and co-management with government agencies, local communities, the private sector, NGOs and others, closely coordinating technical training with the timing and needs of institutional change and development for locally responsible resource management agencies, and strengthening systems for monitoring resource management and auditing of institutional performance.

Monitoring and evaluation system: Data collection, impact monitoring and evaluation (particularly of socio-economic factors) and independent SIA researches should be strengthened at project, provincial, and national levels where they are currently less emphasized. This is needed to evaluate the impacts of forest projects and forest policy innovations on the development of local community and the livelihood of rural farmers.

In summary, the NFPP has called for improvement of the natural environment as promoted by the central government. Forestry administrations and local governments at various levels are implementing the NFPP and some other institutions, government agencies as well as the private sector organizations are involved in the implementation. Different stakeholders have different objectives in the dynamic process of the NFPP. Since the farmers are the stakeholders most directly affected of all the groups in society, fairness dictates that farmers should not be the sole group to carry the risks. Instead, it is necessary for all stakeholders to share the risks so as to reduce them and ensure the livelihood for the affected farmers. Only when both coordination and cooperation of the various stakeholders are strengthened and the information system, communication system and alternative resources control system, monitoring and evaluation system for the NFPP implementation are ensured, the negative impacts of the NFPP implementation might be reduced. It is possible for the farmers to get alternative benefits from the implementation of the NFPP and protect their property rights, subsequently leading to the successful implementation of the NFPP and improving the livelihood of rural households.

Despite the recommendations above are given, "*Social Impact Assessment is less likely to deliver clear, concise, relatively straightforward recommendations than Environmental Impact Assessment, because social issues can be complex and difficult to address*" (Little and Krannich 1988:21).

8.5 Relationship between theory and findings

Firstly, from the practical point of view, when the SIA is applied in forestry policies, projects, and programs, a small local forest-dependent community is the best measurement unit for understanding of the social impacts, because this is the level at which the costs and benefits of change are felt most strongly and acutely. Since village farmers depend on one or a few natural resources (such as forests) for their livelihood, they are especially vulnerable to the project impacts. Since local forest-dependent communities can be considered as a small scale "human ecosystem", a good SIA considers the specific characteristics and unique elements of the local forest communities and households as a whole. The accurate conceptualization of

the social impacts (the right scale of social indicators and the conceptual framework) is a warranty for success of SIA.

Secondly, the conceptual model based on the multiple concepts of "Human ecology" and "Functional evaluation" has proved a useful theoretical support for the SIA conceptualization, because it considers the unique characteristics of the local forest-dependent community. The sole concept of either "Human ecology" or "Functional evaluation" could not support the SIA conceptualization appropriately since the SIA is the multi-disciplinary research field related to economic, natural and social science as well as anthropology. The key elements of a local community offer the theoretical reference for the social indicator selection, and the interactions and connections between these elements provide the strong basis for the conceptual framework of the SIA. The purpose of the SIA in a local community is to understand how these key elements in the local community vary, and how such varied elements influence to each other, and in turn create new changes.

The conceptual framework/model based on the multi-theories and developed in this empirical research might have two potential applications: (1) The model can be employed as an organizing framework for SIAs associated with forest management plans at the level of a local forest-dependent community (village). The model may serve as a guide to capture the right scale of potential social impacts of a management style. For example, change in forest use policy such as the NFPP (a shift from logging to conservation) may impact a range of social institutional arrangements. (2) The model might serve as a guide for the development of social indicators for SIAs in a small scale of forest-dependent local communities. Such a set of the SIA indicators are not only the biophysical indicators which forest managers already employ, but also the social indicators to guide forest policy decision-making and to monitor the effects of on-the-ground forest management actions on the local communities.

The conceptual framework/model explains some important characteristics of the social impacts in the local community. For instance, change has a way of creating other changes. Social impacts should be considered as the result of social change processes in the local community and the human impacts as directly experienced by the local individuals and families. Hence, social impacts are not static, rather systematic, dynamic and adaptive to the new changes. When the systematic conceptual framework is well elaborated, *de facto* impacts can be measured in the field, and the potential impacts of the forest management interventions can be predicted.

Moreover, the conceptual model based on multiple theories and concepts also indicates that, social impacts of the forest management interventions are context-dependent. The same forest project (program) may produce different social impact results where the socio-economic conditions are different. Poorer communities and households with lower capacities of capital, labour, social resources, might have less ability and resilience to adapt to the new changes and to mitigate the negative impacts from projects. Some factors such as forest ownership structure, existing socio-economic conditions and the length and condition of the community's forest development history are influential factors that might differentiate the degree of social impacts of the forest projects in an area. The assessment process should consider the evaluation of the actual social impacts of the forest projects which have been

implemented for a longer time (e.g., more than 2-3 years), along with the contribution of the local strategies derived by the local communities and households for the mitigation of the negative impacts and for their better survival.

Finally, a combination of quantitative and qualitative research approaches serves for a better SIA. Traditional SIA suggests the qualitative research approach because SIA was developed primarily within the discipline of sociology and related sub-fields where qualitative research applies. Qualitative researchers tend to espouse an approach in which theory and empirical investigation are interwoven. In this empirical study, the multi-theories and concepts only provide a framework for the researcher to cope with the unstructured complexity of social reality and so render it manageable, leaving space for the further development of theories and categories which are meaningful to the research objectives. The qualitative investigation can have a practical pay-off.

8.6 A critical review of methodology and implications for SIA research

Due to the short history of the SIA development and the complexity of social reality, the SIA as a research field needs to be further developed. Enlightened from the empirical case study experiences, several implications can be generalized for a future development and a better application of the SIA in the forestry field. These implications are summarized based on the critical review of the SIA methodology, which includes the theoretical base of the SIA (as already discussed in previous section 8.5), its conceptual model and framework as well as the quantitative and qualitative approach associated with data collection methods employed in the field. These three essences contribute to the preciseness of a SIA result.

Even the qualitative methods have been employed by social scientists for many years, many SIA scholars criticize it as imprecise. There are three central difficulties of the qualitative approach in the empirical research: (1) The ability of the investigator to see through other people's eyes and to interpret events from their point of view; (2) The relationship between theory and research in the qualitative tradition; and (3) The extent to which qualitative research deriving from case study can be generalized. The qualitative approach in the empirical research causes an uneasiness about the extent to which the research findings are capable of generalization beyond the confines of the particular case. One can doubt, how representative case study findings are when applied to all members of the population from where the case studies were selected; and how representative are the findings drawn from the study of a particular local community.

Overcoming theses difficulties is central to obtaining an accurate qualitative measurement that augments the quantitative one. Meanwhile, the contemporary SIA practitioners emphasize that the SIA should rely more on the clear, concise, simple and quantitative results. Both forms of research have structural deficits when they are applied separately in a SIA research.

In this empirical study, the overall research approach applied was quantitative, but also involved the application of research methods for the collection of qualitative data such as the

individual experiences of the local household concerning the NFPP. The combination of the quantitative and qualitative research approach applied in the SIA reduces the redundant and complicated sociological data, and improves the interpretation context. The combined quantitative and qualitative SIA research gains in importance, validating and generalising the results as well as neutralising the researcher's role.

Nevertheless, the theoretical assumption that "the local community can be seen a small scale human ecosystem" is philosophical, ideological and epistemological. In the real social world it is much more complicated. The changes in the local communities are very complex. It is not reasonable to say that the social change in one community is solely the result of one program or project. There is always the "attribution gap" between direct benefits of a project and overall development outcomes when a project is evaluated. But the SIA, "*makes a much greater contribution to learn both in the projects and in the whole organization*" (Kuby 2000:4).

There are several limitations and still steps ahead for the future researches and applications on SIA of forest projects:

- The future research and application on SIA of forest projects should increase the amount of the respondent samples, and extend the case study areas for data collection in order to avoid the results that are too subjective.

- The SIA of forest projects should standardize the measurement scales and units, in order to get more precise results for an explicit review of the performance of a SIA through time, and to compare one SIA with another easily.

- More skilled and experienced SIA practitioners are required for objective SIA results. A SIA is better conducted by a team which combines practitioners who are expertise from multi-disciplinary fields, not only forestry, among others, but also sociology, economy and anthropology.

- The future SIA in forestry should consider the socio-economic settings and cultural identities when the social indicators are selected and employed in the different regional contexts.

- The future SIA process should include the evaluation process or ex-post audit studies that look back to check whether the SIA was accurate, whether procedure was cost-effective, and recommendations were acted upon.

- The future SIA should integrate impact assessments in forest management planning and the forest policy making process in a way that includes the cultural impact assessments, health impact assessments, and strategic environmental planning and so on, for a comprehensive picture of the real impacts.

In China, the contemporary applications of SIA are mostly qualitative since the quantitative approach does not reveal social indicators concerning people's behaviour, perceptions, opinions, experiences and values. The most fruitful empirical research combines quantitative and qualitative approaches and methods for the data collection and analysis to ensure a more

precise and reliable results. Meanwhile, there is no well-developed theory that can solely support the SIA; a multiple-theories-based conceptual framework is necessary and important to integrate these individual social indicators to support the conceptualization of social impacts according to the specific local contexts. Moreover, an interpretation and discussion on the "attribution gap" is always necessary to better understand the relationship between the target project and the real impacts which caused by the target project.

It is believed that the SIA has great potential for future forestry development and management plans. With the growing interest in more comprehensive and integrated approaches to SIA, the methodologies of the SIA need to be further improved. The multiple-theories-based conceptual framework of human ecosystem and the quantitative-quantitative combined approach employed in this research reveals that a local forest-dependent community can be used as a small scale of the human ecosystem unit to understand the social impacts from the forest development plan on the local level, and the importance of placing a priority on local context-dependent quantitative and qualitative indicators, considering socio-economic and cultural settings when a SIA applied in forestry program in different regional contexts.

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APPENDICES

List of appendices

Appendix 1: Some data and background information available in literature

Appendix 1-1: Key events in the history of Environmental and Social Impact Assessment

Year	Event
1970	Passage of NEPA (last day of 1969)
1970	1st Earth Day-April 22nd
1970	Suit filed against Alyeska Pipeline Company and department of the Interior over the EIS prepared for the permit allowing construction of the Trans-Alaska Pipeline
1970-1973	Initial attempts to prepare EISs by the U.S. Army Corps of Engineers
1970-1976	Courts clarify the requirements of EIA and SIA
1971-1976	Expansion of NEPA style legislation into 23 U.S. States
1973	CEQ issued draft guidelines for the preparation of EISs
1973	EARP established in Canada (amended in 1977)
1974	Beginning of Berger inquiry regarding the proposed Mackenzie Valley Pipelines from Beaufort Sea
1974	EDRA-1 meet in Milwaukee, Wisconsin-first academic/professional meeting on EIA
1978	Final CEQ Guidelines for preparation of EISs
1980	*EIA Review*- first issue
1981	IAIA founded in Toronto at the 1981 meeting of the American Association for the Advancement of Science (AAAS)
1982	First International SIA Conference in Vancouver, B.C.
1983	Most U.S. federal agencies develop regulations for environmental and social impact assessment
1986	CEQ issues updated EIA regulations
1986	World Bank requires EIA for all funded projects
1987	*Our Common Future* (the Brundtland Commission report published)
1989	European Economic Community requires EIA for member countries
1992	Earth Summit in Rio de Janeiro, Brazil
1993	U.S. Council on Environmental Quality considers Social Impact Assessment Guidelines and Principles in EIA procedures
1994	Environmental Assessment Summit in Quebec City, Canada
1996	United Nations Environmental Program (UNEP) issues EIA "Best Practices"
1999	World Bank circulates draft guidelines for SIA
2003	IAIA issues the new Guidelines and Principles for SIA

Source: Burdge 2003

Appendix 1-2: Basic principles of SIA

1. Identify the main features of the proposed development project, program, or policy.
2. Identify the types and numbers of people involved.
3. Identify data sources: use published scientific literature, secondary data and primary data from the affected area.
4. Plan for gaps in the data.
5. Identify the impacts the proposed development will have on various segments on the population.
6. Involve the public: identify and involve all the potentially affected groups and individuals.
7. Analyse impact equity: identify who are "winners" and who are "losers" and emphasize the vulnerability of under-represented groups.
8. Focus the assessment: deal with the issues and concerns that really count, not those that are easy to handle.
9. Identify methods and assumptions and define significance in advance: define how the SIA was conducted, what assumptions were used and how significance was selected.
10. Provide feedback on social impacts to project planners and identify problems that can be solved with changes to the proposed action or alternatives.
11. Establish monitoring and mitigation programs: manage uncertainty by monitoring and mitigating adverse impacts.
12. Make development more socially sound.

Source: Seebohm, 1997 (Figure 1, Pp.239) in Barrow, 2000

Appendix 1-3: Basic social impact factors for evaluation of forestry projects in China

Socio-economics:

1. Regional economic development
2. Social employment
3. Social (income) distribution
4. Technological development and dissemination
5. Changes in income level
6. Social benefit of energy saving
7. Social benefit of time saving
8. Marketing competition capability

Ecological environment:

9. Forest cover rate
10. Drinking water supply
11. Conservation of wild plants and animals
12. Efficient Utilization of forests and forest lands as well as other natural resources
13. Self-restraint the water resource and purify the water quality
14. Grassland preservation
15. Prevention of soil erosion
16. Air quality
17. Tourism (National forest park and landscape)

Other social factors

18. National security
19. Social welfare
20. Minority ethnic groups
21. Medical treatments and sanitation
22. Culture and education
23. Population
24. Infrastructure
25. Socialized (Public) services
26. Leisure and entertainment
27. Disaster reduction and prevention
28. Governmental support
29. Public participation
30. Social order

Source: Li et al., 2003

Appendix 1-4: Main social impact factors of evaluation of the NFPP (in collective forest areas)

Socio-economics:
1. Regional economic development
2. Social employment
3. Social (income) distribution
4. Technological development and dissemination
Ecological environment:
5. Drinking water supply
6. Conservation of wild plants and animals
7. Utilization of forests and forest lands
8. Self-preservation of the water resource and purify the water quality
9. Prevention of soil erosion
10. Air quality
11. Tourism and health
Other social factors
12. Social welfare
13. Medical treatments and sanitation
14. Culture and education
15. Population
16. Infrastructure
17. Socialized (Public) services
18. Social order

Source: Li et al., 2003

Appendix 1-5: Social change factors (indicators) for assessing the social impact issued by IAIA, 2003

Category	Social change factors (indicators)
Socio-economics	1. People's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis; 2. Their health and well being – health is a state of complete physical, mental, social and spiritual well being and not merely the absence of disease or infirmity; 3. Their personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties; **4.** Their community – its cohesion, stability, character, services and facilities;
Ecological environment	5. Their environment – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
Other social factors	6. Their culture – that is, their shared beliefs, customs, values and language or dialect; 7. Their political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratization that is taking place, and the resources provided for this purpose; 8. Their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

Source: IAIA, 2003

Appendix 1-6: SIA indicators (the current list of twenty eight) presented by Burdge, 2004

Level	SIA indicators
Population Impacts	1. Population Change 2. Influx or out flux of temporary workers 3. Presence of seasonal (leisure) residents 4. Relocation of individuals and families 5. Dissimilarity in age, gender, racial or ethnic composition
Community/institutional Arrangements	6. Formation of attitudes toward the project 7. Interest group activity 8. Alternation in size and structure of local government 9. Presence of planning and zoning activity 10. Industrial diversification 11. Living/ family wage 12. Enhanced economic inequities 13. Change in employment equity of minority groups **14.** Changing in occupational opportunities
Communities in Transition (Conflicts between local residents and newcomers)	15. Presence of an outside agency 16. Inter-organizational cooperation 17. Introduction of new social classes 18. Change in the commercial/ industrial focus of the community **19.** Presence of weekend residents (recreational)
Individual and Family Level Impacts	20. Disruption in daily living and movement patterns 21. Dissimilarity in religious practices 22. Alternation in family structure 23. Disruption in social networks 24. Perceptions of public health and safety **25.** Change in leisure opportunities
Community Infrastructure Needs	26. Change in community infrastructure 27. Land acquisition and disposal *28.* Effects on known cultural, historical, sacred and archaeological resource

Source: Burdge, 2004

Appendix 1-7: Key components of Marchlis' human ecological model (1997)

Critical Resources:

Natural resources

Energy: is the ability to do work or create heat. Energy is a critical natural resource and its influence on social system is well documented (Rosa et al. 1988). As Cottrell (1955) noted, the energy available to humans "limits what we can do, and influences what we will do". Energy flows vary by type of source (solar, nuclear, wood) as well as quality and flow.

Land: includes terrestrial surface, subsoil, and underground features. It can be characterized by ownership patterns (public or private), cover (vegetation or plant community types), use (such as agricultural, forestry, urban), and economic value. Changes in land use often can be measured in hectares/land cover – land use type. Land ownership powerfully influences many social institutions (sustenance and commerce are examples), and changes in land use often are reflected in altered hierarchies of wealth, power, and territory through shifts in land tenure and property rights.

Water: includes surface, subsurface, and marine supplies.

Materials: includes basic products largely derived from natural resources. E.g., fertilizers, dimension lumber (wood), silver and other minerals, plastic and glass, concrete, cocaine, and denim. The variety of materials used by human ecosystems varies by culture, stage of economic development, and consumption patterns.

Nutrients: include the full range of food resources used by a human population.

Flora and fauna: both are critical resources beyond their function as nutrient and material sources; a wide range of flora has ecological, sociocultural, and economic value. Plants are vital sources of pharmacopeias (Wilson 1992), myth (the cedars of Lebanon and the redwoods of California are examples), and status (the American lawn; see Bormann et al. 1993). Fauna, including domesticate livestock, pets, feral, animals and wildlife, have significant economic value through activities as hunting, bird-watching, pet keeping, and in some cultures the production of aphrodisiacs. Flora and fauna can be valued biologically (such as species richness, number of endemic species, population size, genetic diversity), economically (dollar value per bushel, board foot, pelt, head, horn, or hoof.), or culturally (proportion of citizens interested in preserving a species). Changes in flora and fauna, such as the threat of extinction or overpopulation, can lead to changes in nutrient supplies, myth, law, sustenance (particularly, wildlife management and farming practices), and social norms toward the natural world.

Socioeconomic Resources

Information: is a necessary supply for any biophysical or social system. Information flow (and its potential feedback) is central to general systems theory (Bertalanffy 1968) sociobiology (Wilson 1975, 1978) and human ecology (Burch and DeLuca 1984; Hawley 1950). Information may be coded and transmitted in numerous ways: genes, "body language", oral traditions, electronic (digital data), print (local weeklies, national dailies, new magazines), film, radio and television. It can be measured by both transmission rates (such as amount of local radio programming) and consumption patterns (such as newspaper circulation rates). Information flow can significantly alter numerous components of social systems such as educational institutions or hierarchies of knowledge. Its impact on other natural resources is also substantial (e.g., the importance of maps in land management).

Population: includes both the number of individuals and the number of social groups and cohorts within a social system. Population as a socioeconomic resource includes the consumption impacts of people, as well as their

creative actions (accreting knowledge, engaging in sexual behavior, providing labor, and so forth). Human population growth is a dominant factor influencing much of human ecology (Hawley 1986) and social systems (Durkheim 1933), both historically (Turner et al. 1990) and within contemporary nation-states, regions, and cities. Population growth can be measured by natural increases (births over deaths/year) as well as migration flows. While population can act as an ecosystem stressor, it also is a supply source for many critical components within human ecosystems such as labor, information (including genetic code), and social institutions (Geertz 1963).

Labor: has many definitions; in the human ecosystem model, it is defined as the individual's capacity for work (economists sometimes label this as labor power; Thompson 1983). Applied to raw materials and machinery, labor can create commodities and is a critical socioeconomic resource. *There are many measures: labor time* needed to create a unit of economic value (hrs/$100 value), labor value (measured in real wages), labor output (units of production per worker or hour labor), or surplus labor capacity (unemployment rate) are examples.

Capital: can have a range of meanings. In this model, capital is defined as the economic instruments of production; that is, financial resources (money or credit supply), technological tools (machinery), and resource values (such as underground oil). Capital is often measured in dollar values. Changes in capital, either in its mix of sources (a new processing plant or mill) or output (a reduction in profits earned by the plant or mill), can alter social institutions as well as hierarchies of wealth, class identities, and other features of the human social system.

Cultural Resources

Organization: in this model, organization is treated as one of the cultural resources, for it provides the structure flexibility needed to create and sustain human social systems. That is, the special ability of humans to create numerous and complex organizational forms is a necessary skill in interacting with nature and society (Wilson 1978). There is demonstrated wide variation among cultures in how their generic organizing skills are employed. For instance, residents are willing to create continually new organizations to deal with collective issues: building a water supply system (irrigation districts), managing education (school boards), caring for the poor (welfare societies), and so forth. Organization can be measured by its diversity (the range of organizational types), intensity (the number of organizations), or saturation (the percentage of the population that claims membership). Organization is critical to natural resource management; ecosystem management itself is an experiment in new ways of organizing the relations between human and nonhuman domains.

Beliefs: are statements about reality that are accepted by an individual as true (Boudon and bourricaud 1989; Theodorson and Theodorson 1969); residents may have the belief that forests are being overcut, that water quality is low, or that contain salmon stocks may not be endangered. Beliefs differ from values, which are opinions about the desirability of a condition. Beliefs arise from many sources: personal observation, mass media, tradition, ideologies, testimony of others, faith, logic, and science. Beliefs are crucial to human ecosystem functioning, for they supply a set of "social facts" (Durkheim 1938) that individuals, social groups, and organizations use in interacting with the world. Hence, environmental interest groups and industry associations rely on a public set of beliefs concerning environment crises (which may or may not be factual) to energize and increase their membership. Beliefs can be measured by their ideological content (liberal or conservative), intensity (the proportion of a population that feels strongly about a belief), and public acceptance (the proportion of a population that shares a similar belief). As beliefs change, social institutions often are forced to respond. For instance, the changing public beliefs concerning the safety of nuclear power has led to a decline in nuclear power production in many countries in the world (Dunlap *et al*. 1993).

Myths: to the human ecologist, myths are narrative account of the sacred in a society; they legitimate social arrangements (Malinowski 1948) and explain collective experiences (Burch 1971). Hence, myths are an important supply variable because they provide reasons and purpose for human action. Myths are critical to human ecosystems as guides to appropriate and predictable behavior (witness Smoky Bear's admonition about fire); they give meaning to and rationale for a wide range of social institutions and social ordering mechanisms. For example, indigenous tribal groups simultaneously called on traditional myths to legitimate their role as temporary stewards of communal land (Worster 1992). Myths operate at various scales: national, community, clay and so on. Myths are difficult, but not impossible to measure: festivals, symbols, and legends all are indicators of myth supply. A change in myth (such as reduced perception of community self-reliance) can impact social institutions (such as faith) and a variety of social norms as well as resource use (such as wilderness)

Social Institutions

Health (medicine): the health care institution encompasses the full range of organizations and activities that deal with the health needs of a human ecosystem. Health care institutions often are measured by capacity (the number of doctors or hospitals per 1,000 populations) or outcomes (such as infant mortality rates). In rural communities, primary care (personal and family health maintenance, outpatient activities by general practitioners) often is available locally; secondary care (such as services of specialists) and tertiary care (such as hospital procedures involving surgery [Rodwin 1984]) often are provided on a regional basis. Hence, relatively small changes in the health institution (a doctor's retirement, the closing of a pharmacy) may have direct and indirect effects that ripple through the social system.

Justice (law): the collective problem of justice faces all human social systems; its role in human ecosystems is critical. Tow forms are central: distribution justice (who should get what, such as property rights [Rawls 1971]) and corrective justice (how formal norms should be enforced, such as rules for punishment [Runciman 1966]). The legal system can be measured both by its practitioners (such as the number of lawyers or judges/1,000 population) and its performance (number of trials or convictions). The contemporary legal system plays an important role in ecosystem management – the courts influencing distributive justice through timber sale appeals and injunctions, and meeting punishment for resource crimes (such as poaching). Change in legal institutions, such as new procedures for appeal or new laws (the revision of the Endangered Species Act is an example) can dramatically and directly impact the use of natural resources, the development of capital, and other components of the human ecosystem.

Faith (religion): to the human ecologist, religion as an institution has two components: (1) its social function as a system of organizations and ritual that bind people together into social groups (Durkheim 1938) and (2) a coherent system of beliefs and myths (Weber 1930). Both are critical to human ecosystem functioning. Religion, like other social institutions, can be measured by diversity (range of religious practices), capacity (number of churches), or participation (percentage of the population claiming membership). Religion impacts the social system in many ways, altering social cycles (religious holidays), providing identity for both caste and clan, and influencing beliefs and myths. A change in faith (such as increased demands after a natural disaster) can have significant bearing on how effectively social systems will adapt to new ecological and socioeconomic conditions.

Commerce (business and industry): all societies require a system for exchanging goods and services, and the institution of commerce is central to this exchange (Durkheim 1933). Commerce includes not only the exchange medium, but the organizations that manage exchange such as banks, markets, warehouses, and retail outlets.

Modern industrialized societies (including their rural regions) rely on a mix of exchange styles; the typical U.S. rural community usually conducts its commerce through a mix of cash, credit, and barter (Marchlis and Burch 1983). Commerce can be measured as capacity (such as the percentage of production capacity utilized, or the number of banks) or as a flow (the number of transactions, or the dollar value of a gross regional or local product). Commerce in rural areas, particularly in the West, is largely dependent on local natural resources (be it water, energy, timber, scenic or other values [West 1982]). A change in commerce can create a cascading set of impacts on other social institutions (such as sustenance), the social order (shifts in wealth or power), social cycles (as in a recession), and critical resources (such as land or labor).

Education (schools): individual humans are born into the world sorely lacking in the knowledge needed to survive, adapt, and interact with others. Hence, education (the transmission of knowledge from one generation to younger generation) is a ubiquitous collective challenge. While significant learning takes place in the home and on the streets, the educational institution functions largely through the school system, which includes public and private schools, teachers, school boards, and parent organizations (Bidwell and Friedkin 1988). Education can be measured as density (teacher/student ratios), and input (dollars expended per student) and an output (percentage of high school seniors graduation). Changes in the educational system directly impact other components of the social system (such as the timing of leisure activities, distribution of knowledge, availability of skilled labor). Dramatic changes in the institution (such as school consolidation) can have significant effects on the entire human ecosystem.

Government (politics): the political subsystem is at once a central component of human ecosystems and a result of numerous other components (such as organization, myths, and legal institutions [Shell 1969]). Politics as an institution is a collective solution to the need for decision making at scales larger than clan or caste. It includes the modes of interaction between political units (such as states and counties), the processes of decision making within political units (such as elections and legislative action), and the participation of residents in political action (campaigns, party activity, referendum, and so forth). Government can be measured by its resources (such as tax receipt, authorized expenditures and employees) or its actions (laws passed, hearing held, and so forth). As governments at several scales control critical natural resources (such as the federal government's forestland), change in government action or process (revision to the Endangered Species Act), can have a significant influence on human ecosystems.

Sustenance (agriculture and resource management): the provision of sustenance (food, potable, water, energy, shelter, and other critical resources) is a central and collective challenge facing all social systems (Hawley 1950). The management of that challenge and production of necessary supplies require agricultural and resource management institutions of some complexity (Field and Burch 1988). Irrigation districts, farmer's cooperatives, timber companies, tree farm associations, extension offices, federal management agencies, and environmentally oriented interest groups are all components of the sustenance institution. Measures include organizational capacity (number of agents/farm, acres in production), output (measured in dollar values or crop tonnage), and range of sustenance products (number of crops or timber types). As agriculture and resource management are the chief methods for transforming critical resources into necessary social system supplies, their importance to human ecosystem functioning is key. Changes in production, efficiency, or distribution can have effects throughout human ecosystems.

Social Order

Identity: one of the key ways that social systems maintain coherence and the ability to function is through the use of identity. Several forms of identity are critical to human ecosystems. *Age* is important, for much of human

activity is age-dependent (Eisenstadt 1956): certain occupations are often specialized by age (such as mining is mainly for the young); *Gender* (the socially constructed masculine and feminine roles) is important, both for its crucial impact on social norms and for its differential effects on social institutions – women and men having different access to capital, health care, wealth, power, and other features of the social system (Weitz 1977). *Class* is important, though its definition is problematic (Abercrombie et al. 1988). Some social scientists define class in purely economic terms (based on occupation or income); others include socio-cultural concerns (such as education or social norms); *Clan* (the extended family or tribal group) is crucial, both as a predictor of interaction (most recreation, for example, takes place with family members) and as a source of support. Clans routinely provide health care, financially assistance, and even natural resources (such as food or other supplies) to members in need. These identities can be measured in terms of diversity (the range of ethnic or age groups in a community) and distribution (the proportion of non-Caucasians within a population, the ratio of working-age individuals to dependents). Change in identity usually impact social systems through an alteration in social norms; an influx of young people, women, minority groups, and blue-collar workers leads to shifts in what is expected as well as what people do; these shifts further alter the human ecosystem.

Social norms: norms are rules for behavior, what Abercrombie et al. (1988) called the "guidelines for social action." *Informal norms* are administered through community or social group disapproval: Deviation from the norm is noticed, but sanctions are slight. Speaking too loud in a museum or too soft at a football game are examples (as are norms for behavior in campgrounds, along trails, or on fishing boats). The full range of etiquettes for eating, socializing, courtship and so forth also are informal norms. *Formal norms* are more serious and institutionalized; they usually are codified in laws that not only prohibit certain actions but proscribe punishments for breaking such norms (Wrong 1994). Misdemeanor and felony laws are examples. Sometimes a community's informal norms may conflict with its formal (legal) norms. The results are "folk crimes", that is, activities that are not against the law but considered harmful by the population. Some kinds of wildlife poaching or illegal woodcutting are folk crimes (Scialfa 1992). Norms can be measured by both their adherence (the proportion of a population following a social convention, such as marriage before childbirth) and deviance (the number of felonies per capita). Changes in social norms can impact social institutions (divorce directly impacts health and justice for women) and alter resource use.

Hierarchy: an important mechanism for social differentiation and for managing the social order is hierarchy. In almost all social systems, hierarchy is common; inequality of access is a consistent fact across communities, regions, nations, and civilizations. Five socio-cultural hierarchies seem critical to ecosystem functioning: *wealth, power, status, knowledge and territory*.

Wealth is access to material resources, in the form of natural resources, capital (money), and credit. The distribution of wealth is a central feature of social inequality and has human ecosystem impacts; the rich have more life opportunities than the poor. *Power* is the ability to alter the behavior of others, either by coercion or deference (Mann 1984; Wrong 1988). The powerful (often elites with political or economic power) can have access to resources denied to the powerless; an example is politician who make land use decisions and personally profit from these decisions at the expense of other residents. *Status* is access to honor and prestige (Goode 1978); Lenski 1984); it is the relative position of an individual (or group) on an informal hierarchy of social worth. Cultures may vary as to whom is granted high status (for example, teachers are given high status in China, modest status in the United States). Status is distributed unequally, even within small communities, and high-status individuals (such as ministers) may not necessarily have access to wealth or power.

Knowledge is access to specialized information (technical, scientific, religious, and so forth); not all within a social system have such access. Knowledge provides advantages in terms of access to critical resources and the

services of social institutions. *Territory* is access to property rights (such as land tenure and water rights). Hierarchies of territory are created when some have strong land tenure (large areas with secure ownership) and others weak tenure or are landless. This can vary by region. For example, in the arid U.S. West, water rights (granted by historical priority) may be especially critical, as it is water that limits development (Reisner 1986).

These critical hierarchies can be measure in several ways. Wealth can be measured by indicators such as the range of incomes or the proportion of the population that is below the poverty line. The distribution of power can be indirectly measured by certain decision making activities, such as elections. It also can be measured by levels of domination and subordination – the persistence of spousal abuse, "glass ceilings" faced by women workers, and the relationship between timber workers and company executives. Status can be measured by public polling techniques that capture public opinion; knowledge can be indicated by educational attainment. Territory can be measured by ownership patterns, the distribution of land by size (that is, the proportion of landholders with large areas), or the distribution of water rights (by acre-feet). Changes in hierarchies, by altering who has access to critical resources and social institutions, can dramatically alter the human ecosystem.

Appendix 1-8: Definition on each setting in "Function evaluation" (de Goots 1992)

The biophysical setting

The biophysical system comprises many environmental functions that provide goods and services that can be utilized by human society. Whether all of these functions are actually utilized is dependent on the social, economic and cultural "behavior" of the society concerned, its state of development and technical knowledge and so on. It is not necessary for all of the identified functions of an ecosystem to be used. Furthermore, ecosystem may possess functions that are not as yet identified – this is one of the primary arguments in support of biodiversity protection. Combining the clear but somewhat simplified classification of Rudolf de Groot (1992) and the theoretically more appropriate classification of Wouter de Groot (1992), four categories of environmental functions can be distinguished: *production, processing and regulation*, *carrying*, and *signification functions*.

Production functions relate to the ability of the natural environment to generate useful products for people and society. A distinction is made between natural production functions and nature-based human production functions. Natural production functions include products that the natural environment largely produces on its own, that is, without human input other than humans being harvesters (hunting and gathering). Products can be produced over a short term (such as firewood, fruit, stream water, ocean fisheries) or over a long time period (e.g., oil, minerals, fossil groundwater). Those in the first category are often referred to as renewable resources, while those in the latter are considered non-renewable. The logging of old-growth forests for lumber or pulp would be renewable if undertaken on a sustainable yield basis, or would be arguably non-renewable if done by clear-cutting operations with little or no generation of native forests. Nature-based human production functions related to the production of biological (animal or plant) products by the biophysical environment in ways that involve active management and inputs by people. Examples here include most agricultural and horticultural activities, forestry plantations and managed forests, and fish ponds (aquaculture and mariculture).

Processing and regulation functions (or maintenance functions or resilience capability of nature) relate to the maintenance of ecosystem support systems. The interactions between biotic and abiotic components result in complex processes that influence the conditions for maintenance of life support systems. These functions are often not recognized until they are disturbed. They refer to the ability of the ecosystem to maintain or restore dynamic equilibrium within the system, or in other linked ecosystems through physical, biological and chemical processes and interactions. Processing functions often undo the harm caused by human activities or reduce the risk to humans. Such functions include the sequestration of carbon dioxide, the dilution of pollutants and the active chemical transformation of harmful substances such as organic waste. Examples of regulation functions are maintenance of groundwater levels, maintenance of biological diversity, protection against natural forces (coastal protection by mangroves) and protection against harmful cosmic radiation (ozone shield). Water storage in wetland is an example of a regulation function for river flow regulation.

Carrying functions are related to space or to a substrate that is suitable for certain activities and for which there may be a demand. The availability of space, together with a particular set of environmental conditions associated with that space, makes an area more or less suitable to perform certain functions for people. Examples include suitability of an area for human habitation and settlement, nature conservation areas, areas for nature-based recreation (such as mountain climbing, bushwalking, skiing or beach tourism), waterways for navigation and sites for energy conversion (such as hydropower reservoirs).

Signification functions involve the social values that are ascribed to nature itself (natural heritage values) and to other features of the landscape, including the human constructed landscape (cultural heritage values). Nature

provides opportunities for spiritual enrichment, aesthetic employment, cognitive development (contemplation, meditation) and recreation. Different from the provision of physical space as in carrying functions, these functions refer to the meaning (significance) associated with the biophysical environment. The world's largest economic sector, tourism, is largely based on this function – that is, human appreciation of nature and landscape. Examples include aesthetic information (scenery, landscape), spiritual and religious information (religious and scared sites), psychological information (emotional attachment, nostalgic attachment to place), historic information (historic and archaeological elements), cultural and artistic information (inspiration for folklore, music, dance, art) and educational and scientific information (natural science classes, research, environmental indicators).

The difference between the "classical" approach to describe nature in terms of natural resources (water, soil, forest and so on) and function evaluation is that the latter provide much more insight into the multifunctionality of resources. For example, instead of just describing the resource, "water", function evaluation provides insight into the multiple functions of water, such as production function for agriculture, carrying function for shipping and recreation, regulation function to counterbalance seawater intrusion, and signification function for science or religious groups or nature-based tourism. When the functions are recognized, the relevant units of measurement can be identified and decision making can be based on a more profound understanding of the role that the biophysical environment plays for human society. It is important to realize that many functions can occur simultaneously (see the sample for water, above), but that with human intervention these functions may become mutually exclusive. The creation of a dam to enhance water storage in a river basin will block the pathway for migratory fish as well as for long river water transport. Intensive exploitation of freshwater for agricultural productivity will reduce or exclude other functions such as shipping, balancing the intrusion of seawater and maintenance of downstream wetlands.

The social setting

The social setting creates the demand for environmental goods and services. The existence of goods and services that are derived from environmental functions is what determines the perceived value of those functions for humanity. This perceived value is also related to what is socially valued in that society, which in turn, is related to the culture of that society, the level of technology and so on. Three broad categories of values can be distinguished: social values, economic values and ecological values.

Social values refer to the quality of life in general and can be expressed in many different units, depending on the social context and cultural background of the situation/society (corresponding to the processing of regulation function and significant function). Some examples are health and safety (expressed as prevalence of diseases or number of people protected from forces of nature), housing and living conditions, space for settlement, the value of the environment as a source of food (or in-kind income) in subsistence economies, and religious and cultural values.

The *economic value* of an environmental production function refers to the monetary value of the goods and services that are provided. It can be expressed as a monetary value assigned to individual economic activities (agriculture, industries, fisheries, construction), to household income (as an overall indicator on the financial conditions of the population) or to per capita gross regional or domestic products, as an overall indicator for the income of the society as a whole.

Ecological values refer to the value that society places on or derives from the maintenance of the earth's life support systems (particularly the processing and regulation functions). They come in two forms. Temporal ecological values are the potential future benefits that can be derived from biological diversity (genetic, species

and ecosystem diversity) and key ecological processes that maintain the world's life support systems for future generations. The appropriate way to express these values is highly debated. A simple, regularly used measure is the proportion of endemic species (that is, only locally occurring species) as a measure for uniqueness of the area. Other measures try to indicate the "naturalness" of an area, that is, the level at which natural processes can still structure and maintain the environment and its functions. Spatial ecological values involve the interactions ecosystems have with other systems, and thus perform functions for the maintenance of other systems. Coastal lagoons and mangroves that serve as breeding grounds for marine fish provide a good example. The ecological value of the mangroves is the support they provide for economic activity elsewhere: without mangroves there would be fewer fish. Other examples are wintering areas for migratory birds, or flood plains that recharge groundwater aquifers for neighboring dry lands or act as a silt trap that prevents downstream rivers and reservoirs from silting up.

These values are not mutually exclusive, since functions cannot always be unequivocally assigned an economic a social value. For example, the suitability of a certain area for a traditional crop (production function) can be valued in economic terms (e.g., income, employment, subsistence) as well as social terms (e.g., cultural, preservation), or even in ecological terms (e.g., the use of a traditional and unique variety of salt-resistant rice that merits being maintained in a seed bank for future uses). It is important to realize that values differ for different (groups of) individuals in a society. Therefore the identification of values should include the views and opinions of different (groups of) individuals.

Appendix 2: Supplementary material and material information used in research

Appendix 2-1: Sample tables defining social variables/indicators and methods for measurements in field

Sample table 1: Change in population size in the community

	Population in 1998	Population in 2007	Difference (+ or -)	% Change
Number of people				

Sample table 2: Change in the number of people living under the poverty line

	% in 1998	In 2007	Difference (+ or -)	% Change
Percentage of people under the poverty line				

Sample table 3: Change in size/structure of local government/rule systems

Year / Position		1998	2007	Difference % (+ or -)	% Change
Communist Party Commitee					
	Membership				
	Youth Union				
	Women Union				
	Possemen (trainband)				
Village Committee					
	Membership				
	Family planning group				
	Village affair group				
	Financial monitoring group				
	Security group				
	Conflict management group				
Farmer Association					
	Membership				
	Fruit grower association				
	Culturist association				
	Crops association				
Local NFPP Committee					
	Membership				
	Forest stewardship				
	Forest fire				
Total					

*Note: In this table, the number of full-time equivalent persons presently and previously employed by town or county government will be entered; if the local government under study does not have full time persons in these positions, but contracts for these services, indicate the approximate full-time equivalent positions contracted for village/community activities.

Sample table 4: Changes in the local legislations for the access to forests

Regulation categories		1998	2007	Difference (+ or -)	% Change
1. Membership claim		Yes/no	Yes/no		
2. Access rule to					
	-Timbers				
	-NTFPs				
	-Fuelwoods				
	-Bamboo shoots				

	- Grazing				
3. Protection					
4. Forest fire					
5. Penalty of					
	-illegal harvest				
	-forest fire				
6. Reward rule					
7.Conflict resolution					
8.Benefit sharing					
TOTAL					

*: Score "+1" when marked as "Yes"; score "0" when "No".

Sample table 5: Local economy/industrial diversification

Year / Category of economic activities	Number/sort in 1998	Number/sort in 2007	Number difference (+ or -)	% Change
1.Industrial income				
2.Agriculture income				
3.Forestry income				
4.Pastoral income				
5.Construction income				
6. Transportation				
7.Restaurant/hotel				
8. Services				
9. Others				
Total				

Sample table 6: Change in the community infrastructure and public services

Items	1998		2007		Number difference (+or -)	% Change
	Situation	Score	Situation	Score		
1.Transport condition						
Road						
Number						
Quality						
2.Education condition						
School						
Number						
Quality						
Enrollment rate						
3.Healthcare condition						
Clinic						
Number						
Quality						
TOTAL						

Note: Score "+1" when marked as "good"; Score "0" when "Adequate"; Score "-1" when "Bad"

Sample table 7: Change in land use pattern in the community

Year / Land use pattern	1998		2007		Area difference (+ or -)	% Change
	Area	%	Area	%		
1. Agricultural lands						
Wheat/corn						
Paddy rise						
Terrace						
2. Forest lands						
Natural forest						

	Plantation						
	Barren forestland						
	Rocky area						
3. Pastoral land							
4. Homestead							
5. Public land							
TOTAL							

Sample table 8: Change in household income derivation

Year / HH income sources	Income in 1998	Income in 2007	difference (+ or -)	% Change
Crops Farming				
Joint Harvesting/Transportation				
NTFP Collection/Cultivation				
Vegetable/Medicine Plants				
Livestock Raising				
Fuel Wood Collection				
Migrant Work/ Business				
Handcraft/Sale				
Remittance				
TOTAL				

Sample table 9: Change in household expenditure (alternative energy costs)

Year / HH expenditure item	Expense in 1998	Expense in 2007	difference (+ or -)	% Change
Agricultural activities				
Culturist activities/NTFPs Cultivation				
Tourism				
Education				
Medical treatment				
Living expenditures				
Alternative energy use				
TOTAL				

Sample table 10: Household labor time distribution

Year / HH income sources	Time distribution in 1998	so in 2007	difference (+ or -)	% Change
Crops Farming				
Joint Harvesting/Transportation				
NTFP Collection/Cultivation				
Vegetable/Medicine Plants				
Livestock Raising				
Fuel Wood Collection				
Migrant Work/ Business				
Handcraft/Sale				
TOTAL				

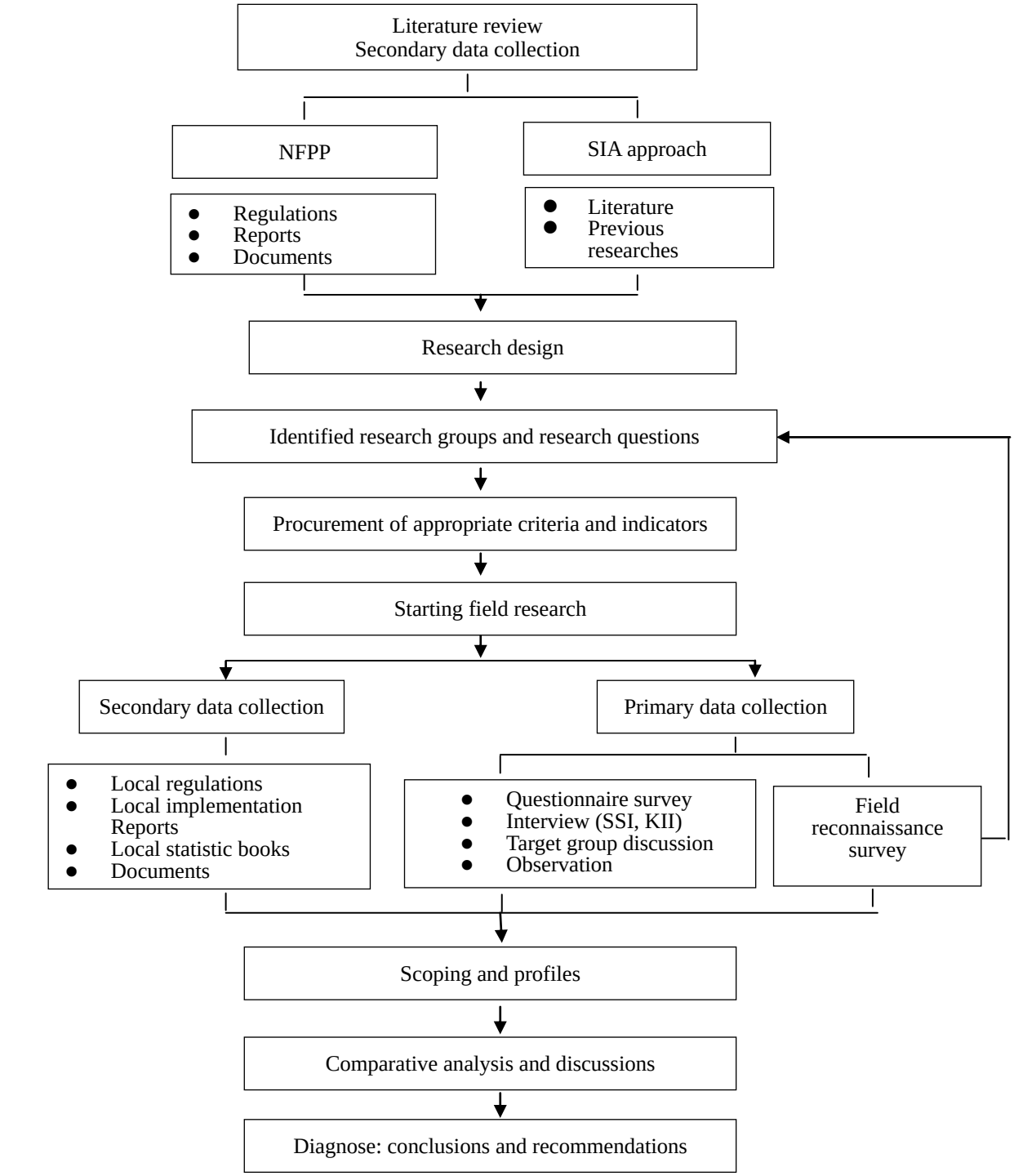
Sample table 11: Change in local perceptions on health and safety

Year / Verifiers	1998		2007		Differ. (+or -)	% Change
	Situation	Score	Situation	Score		
Opinion of natural environment condition						
Perception of public health						
Perception of safety to the future						
TOTAL						

Sample table 12: Change in local values of the forest and forest resources

Year / Value of forests	1998		2007		Area difference (+ or -)	% Change
	Number	%	Number	%		
1. Economic value						
Timber						
Fuel wood						
NTFPs						
Medicine plants						
Job opportunities						
2. Ecological value						
Soil conservation						
Water supply						
Flood/storm protection						
Climate change/carbon storage						
3. Cultural values						
Recreation/tourism						
Cultural belongs/religious						
Aesthetic values						
TOTAL						

Appendix 2-2: Research procedure designed for the empirical study



Note: SSI is the abbreviation for the Semi-Structured Interview;
KII is the abbreviation for the Key Informant Interview.

Source: Field research, 2007

Appendix 2-3: Selected social indicators and verifiers, the unit and level of measurement, and data collection methods

Category of indicators	Social indicators and verifiers		Units/measures	Level of measurement	Data collection methods
A. Community population characteristics	A-1: Population size		Number of the people (capita)	Scale	Secondary data & key informant interview at village level
	A-2: Number of people under the poverty line		Number of the people (capita)	Scale	Key informant interview at village level
B. Community/ institutional arrangements	B-1: Size/structure of local government/rule systems		Number of the staff; figure illustration of government structure	Scale & nominal	Key informant interview & group discussion at village level;
	B-2: Regulations on access to local forests (formal/informal)				
		Membership rule	Description of content of rules, and status of rules (formal/informal); indication of the change status of the rules whether they are existed or not existed before and after the NFPP (yes/no)	Qualitative& Quantitative (nominal &ordinal)	Key informant interview & group discussion at village level
		Access rule to - timber			
		- NTFPs			
		- fuel woods			
		- bamboo shoots			
		- grazing			
		Forest protection			
		Forest fire			
		Penalty of - illegal harvest			
		- forest fire			
		Reward rule			
		Conflict resolution			
		Benefit sharing			
	B-3: Local economy/industrial diversification				
		Industrial income	Yuan/village; proportion to total income	Scale &nominal	Key informant interview & group discussion at village level
		Agricultural income			
		Forestry Income			
		Pastoral income			
		Construction income			
		Transportation income			
		Restaurant/hotel/other services			

(Table continued)

C. Community infrastructure/ public services	C-1: Infrastructure & public services				
		Transport (No./quality of roads	Number/quality of the road	Qualitative&Quantitative (scale& ordinal)	Key informant interview & group discussion at village level
		Education (No./quality of schools, enrolment rate)	Number/quality of the school; number/percentage of students registered in school		
		Healthcare (No./quality of hospitals)	Number/quality of the hospital		
	C-2: Land use patterns				
		Agricultural land (mean)	Ha/village; proportion to total land area	Scale	Participatory village mapping; key informant interview & group discussion at village level
		Forest land (mean)			
		Pastoral land (mean)			
		Homestead (mean)			
		Public land (mean)			
D. Individual and family impacts	D-1: Household income structure				
		Crops farming	Yuan/HH; proportion to total income	Scale	Questionnaire survey & HH interview at HH level
		Joint harvesting/transportation			
		NTFPs collection/cultivation			
		Vegetable/medicine plants			
		Livestock raising			
		Fuel wood collection			
		Migration work/business			
		Handcraft/sale			
		Remittance			
	D-2: Household expenditure on alternative energy use		Yuan/HH; proportion to total expenditure	Scale	Questionnaire survey & HH interview at HH level
	D-3: Household labor time distribution				
		Crops farming	Days/year; proportion to total labor time	Scale	Questionnaire survey & HH interview at HH level
		Joint forest harvesting/transportation			
		NTFP collection/cultivation			
		Vegetable/medicine plants			
		Livestock raising			
		Fuel wood collection			
		Migration work/business			
		Handcraft/sale			

(Table continued)

D. Individual and family impacts	D-4: Local perceptions on public health/safety				
		Opinion of natural environment condition	"Highly positive"(+3); "very positive"(+2); "positive"(+1); "adequate"(0); "negative"(-1); "very negative"(-2); and "highly negative"(-3)	Qualitative& Quantitative (ordinal)	Questionnaire survey & HH interview at HH level
		Perception of public health			
		Perception of safety to the future			
	D-5: Values of the local forests perceived by local people				
		Economic values as - timber	Percentage of the HHs agree the value	Scale& ordinal	Questionnaire survey & HH interview & group discussion at HH level
		- fuel wood			
		- NTFPs			
		- medicine plants			
		- job opportunities			
		Ecological values as -soil conservation			
		- water supply			
		- flood/storm protection			
		- climate change/carbon storage			
		Cultural values as - recreation/tourism			
		- cultural belongs/religious			
		- aesthetic values			

Source: Verified from the field research, 2007

Appendix 3: Questionnaires used in the field surveys

Appendix 3-1: Questionnaire for community level survey and interview

A. Basic information of the local community investigated:

Province	Municipality	County (district)	Town		Village
Name of interviewee:	Gender:	Ethnic:	Age:	Education:	Tel:
Area of state-owned forest:	Area of collective forest:		Covered by NFPP?:		Since when?:
Management area:	Subsidy for NFPP:	Area of new plantation:		Subsidy for new plantation:	
Distance of the village to nearest county:			Distance to the nearest road:		
Telephone accessed in the while village (Capita/household):	Electricity accessed (Capita/household):		Pipe water accessed (Capita/household):		
Distance to the nearest river:		Main traffic roads (No. and condition):			
Bridge (No. and condition):		Hospital (No., condition and distance):			
School (No., condition and distance):			Name of interviewer:		Date:

B. Indicator system

1. Population/demographic impacts

1.1. Population change

		1998	2007			1998	2007
Village population (Capita)				Education status:			
Female population (Capita)					Illiterate (Capita)		
Total household number (HH)					Primary school (Capita)		
Population under the poverty line (Capita)					Middle school (Capita)		
Minority group people (Capita)					High school (Capita)		
Population age distribution:					Higher educated (Capita)		
	≤20 years old (Capita)			Village annual average income (Yuan/year)			
	≥55 years old (Capita)			Population birthrate/death rate			

1.2Migration/relocation situation of individual/family (location and subsidy)

		1998	2007
Out migration work and self-support work (Capita)			
Local industrial work (Capita)			
Out immigrants/relocated population (HH/capita)			
	Under poverty line (Capita)		
	Elder (Capita)		
	Minority people (Capita)		
Time of migration/relocation			

2. Community institutional/organizational arrangements

2. 1 Alteration in the size and structure of local government/rule systems (Table 1)

	1998	2007
Name of the organization		
Size (number of staff)		
Organization structure (attached figure)		
Function		

(Table 2)

	1998	2007		1998	2007
Law/regulation (Capita)			Public sector (Capita)		
Engineer (Capita)			Financial sector (Capita)		
Executive management (Capita)			Coordination (Capita)		
Monitoring (Capita)					
Planning (Capita)			Total		

2.2 Forestry related religious/cultural organizations and activities (also mentioned in the open-questions in the end of the questionnaire)

	1998	2007
Religious group/organization (No./sort)		
Religious activities (how presents/how many people participate)		
Local temple/church (No./condition)		
Religious people/member of people belong to the local cultural organization or regularly attend the cultural activities (Capita)		

2.3 Legislations for the use and the access to the local forests and forest resources

	1998	2007
Formal legislation (No./Content)		
Informal legislation (customary law, local punishment, etc.)		

2.4 Local economic/industrial diversification

	1998			2007		
	Number of industrial company	Output (Yuan)	Number of Practitioner	Number of industrial company	Output (Yuan)	Number of Practitioner
Industrial production and processing						
Agriculture						
Forestry (NTFP processing)						
Culturing and cultivation						
Construction and out migration work						
Trade						
Financial, Insurance and real estate						
Services						
Public traffic/communication						
Hospital						
Others						
Total						

3 Community infrastructure/public services and land use

3. 1 Change in community infrastructure

	1998		2007	
	Number of unit	Condition	Number of unit	Condition
Hospital				
Clinic/medical station				
Permanent doctor/medical person				
Middle school				
Primary school				
Access to pipe water				
Waste water treatment facilities				
Access to electricity				
Access to telephone/mobile				
Public traffic/bus				
Traffic road				
Bridge				
Market				
Hotel/hostel/accommodation services				
Restaurant				
Store/shop				
Gas station				
Others				
Total				

3.2 Change in the land use patterns

		1998		2007	
		Area (mu)	Condition	Area (mu)	Condition
Village total area					
Agricultural area					
Forest area					
	New plantation				
	Survive rate				
Barren/rocky area					
Homestead					
Public land					
NFPP covered area					
	Commercial forest area		m3/year		
	Subsistence use forest area		m3/year		
	Fuel wood area		m3/year		
	NTFPs area		Yuan/year		
NFPP non-covered area					
	Commercial forest area		m3/year		
	Subsistence use forest area		m3/year		
	Fuel wood area		m3/year		
	NTFPs area		Yuan/year		

C. Open questions:

1. Do you think the impacts of the NFPP on the local community are: a. very significant; b. significant; c. general; d. little; e. very little; f. nothing
Are the impacts of the NFPP positive or negative? Why?

2. Which use rights do the local community and households have regarding the local forest use? Are there any changes in these forest use patterns and use rights (before and after the NFPP)?

3. Are there any forest-related local cultural activities, traditional customs, religious beliefs and taboos existing in the local community (or used by the individual household families)? Are there any changes because of the implementation of the NFPP (after the NFPP)?

4. Are they any relevant household livelihood alternative measures supported by the government (for instance, reduce the dependence on local forests for economic income)? Do you have any suggestions for household livelihood alternatives, how do these alternatives rank according to the importance to livelihood, and why? (For instance, to offer the small credits to develop the family culturing and cultivation activities; to offer the well-bred seedlings to develop the economic forests; to provide and widen the technical services, to offer more technical training opportunities for the local households; to provide the market information and to help the marketing of the local products; to provide the alternative employment opportunities and employment information; etc.)

5. How do the local community and households involve and participate in the NFPP and NFPP related activities (the way of participation and the main hindrances, difficulties)?

6. How the current forest management patterns look like in the local community? What are the advantages and disadvantages, and how to improve?

Appendix 3-2: Questionnaire for household level survey and interview

1. Basic information of the household investigated:

Province:	Municipality:	County (district):		Town:	Village:
Name of interviewee:	Gender:	Ethnic:	Age:	Education:	Tel:
Covered by the NFPP (state-owned or collective)?					
Coverd area:		Since when?:		Resident time in village:	
Name of interviewer:		Date of interview:			

1.1 Basic information of the household family (comparison between the situation before and after the NFPP)

Family member	Gender	Age	Education	Primary occupation (present/before)	Secondary occupation (present/before)	Third occupation (present/before)	Total annual income

1.2 Information of Family possession

House area:	For production purpose:	House structure: 1. Wood 2. Blick 3. Concrete Others	
Wood for construc m3	Construction time:	Construction cost: Yuan	Distance of the house to nearest road:
Distance to forests:	Distance to clinic:		Distance to nearest market:
Access to electricity, pipe water, telephone?:	Main traffic tool: 1. Walk 2. Bicycle 3. Tractor 4. Bus 5. 6. Motor cycle 7. Tricycle 8. Walk & bicycle 9. Bicycle & b 10. Walk & car 11. Walk & tricycle 12.Others		
Land resource possessed(mu):	Agricultural land (mu):		Forest land (mu):
There into, 1. Wood forest (mu): 3. Bamboo (mu): 5. Wood forest & fuel wood (mu): 6. Economic forest & fuel wood (mu):	2. Economic forest (mu 4. Fuel wood (mu		Are they natural forests? (Yes/no) Covered by the NFPP? (Yes/no)
Other fixed assets in the family:			
(1) Consumption type facilities: 1. Television 2. Telephone 3. Refrigerator 4. Motorcycle 5. Bicycle 6. Others			
(2) Production type facilities: 1. Tractor 2. Car/vehicle 3. Processing facilities 4. Others			
Energy resource use: 1. Fuel wood 2. Coal 3. Gas 4. Stalk/straw/biomass 5. Others			

2. Forest use

	2.1 Covered by the NFPP		2.2 Non-covered by the NFPP	
Wood for commercial purpose (m3/year)	1998	2007	1998	2007
Wood for sustenance (m3/year)				
Fuel wood (kg/year)				
NTFPs (Yuan/year)				

3. Household income and expenditure

	1998	2007
3.1 Household income (Yuan/year) (Total)		
Agricultural income (Total)		

1. Crops farming		
2. Vegetables		
3.		
Forestry income (Total)		
1. Joint harvesting and transportation		
2. NTFPs collection and cultivation		
3. Medicine plants collection and cultivation		
4. Fuel wood collection		
5.		
6.		
Culturing and cultivation (Total)		
1. Livestock raising		
2.		
3.		
4.		
Migration work/business (Total)		
1.		
2.		
3.		
Other incomes (Handcraft/sale/remittance) (Total)		
1.		
2.		
3.		
3.2 Household expenditure (Yuan/year) (Total)		
Expenditure for agriculture input (Total)		
1.		
2.		
3.		
Expenditure for forestry input (Total)		
1.		
2.		
3.		
Culturing and cultivation/livestock raising (Total)		
1.		
2.		
3.		
Education expenditure (Total)		
1. Schooling		
2. Technical training		
3.		
Medical expenditure (Total)		
Tourism (Total)		
Alternative energy use (Total)		
1.		
2.		
Othere expenditure (Total)		
1.		
2.		
3.		

4. Household labor time distribution

4.1 Household labor time distribution in household activities (Day/year)	1998	2007
1. Crops farming		
2. Joint harvesting and transportation		

3. NTFPs collection and cultivation		
4. Vegetable/medicine plant		
5. Livestock raising, pasturing		
6. Fuel wood collection		
7. Migration work/business/labor output		
8. Handcraft/sale		
9. Others		
TOTAL		

Open-end questions regarding the opinions of the households related to the NFPP:

(The following questions lists are for the open-questionnaire interviews. The investigated households are required not only to select the answer given by the interviewer, but also to answer why and how. Detailed descriptions and examples are welcome.)

5. The perceptions of the local households concerning the public health and safety

5.1. You feel that the surrounding natural environment has been deteriorated, the natural disasters have been increased and the environmental pollution has been more serious than before, since the NFPP implementation?

1. "Highly disagree"
2. "Very much disagree"
3. "Disagree"
4. "Not very much significant"
5. "Agree"
6. "Very much agree"
7. "Highly agree"

Examples required: for instance, the concrete cases of the natural disasters, environmental pollutions in recent years before and after the NFPP.

5.2 You feel that since the NFPP the people around you (including your family members) have been getting more illnesses, and their health condition has been worse?

1. "Highly disagree"
2. "Very much disagree"
3. "Disagree"
4. "Not very much significant"
5. "Agree"
6. "Very much agree"
7. "Highly agree"

Examples required:

5.3 You do not feel the safety to the future life, and you do not know how your future will be?

1. "Highly disagree"
2. "Very much disagree"
3. "Disagree"
4. "Not very much significant"
5. "Agree"
6. "Very much agree"
7. "Highly agree"

Why?

5.4 Recently you have the plan that you want to move out from here to somewhere outside of the village?

1. "Highly disagree"
2. "Very much disagree"
3. "Disagree"

4. “Not very much significant”
5. “Agree”
6. “Very much agree”
7. “Highly agree”

Why do you have such plan? Is that related to the NFPP? Where will you plan to go? What about your previous opinion before the NFPP implementation?

6. The local values of the forest and forest resources perceived by the local households

6.1 The local forests are the important resources for your income, employment and so on?

1. “Highly agree”
2. “Very much agree”
3. “Agree”
4. “Not very much significant”
5. “Disagree”
6. “Very much disagree”
7. “Highly disagree”

Examples as：

6.2 Apart from the economic value, the local forests also have important contribution to the natural environment, for instance, the flood/storm protection, climate change/carbon storage, etc…

1. “Highly agree”
2. “Very much agree”
3. “Agree”
4. “Not very much significant”
5. “Disagree”
6. “Very much disagree”
7. “Highly disagree”

Examples as:

6.3 Illegal logging and over harvesting will seriously destroy the local forest and forest resources?

1. “Highly agree”
2. “Very much agree”
3. “Agree”
4. “Not very much significant”
5. “Disagree”
6. “Very much disagree”
7. “Highly disagree”

6.4 You do not think that the illegal logging is the right way to help people to get rid of the poverty and become the richer?

1. “Highly agree”
2. “Very much agree”
3. “Agree”
4. “Not very much significant”
5. “Disagree”
6. “Very much disagree”
7. “Highly disagree”

6.5 You think that the NFPP and its related activities/regulations are corresponding/harmonizing to the local cultural believes and traditions?

1. “Highly agree”
2. “Very much agree”
3. “Agree”
4. “Not very much significant”
5. “Disagree”
6. “Very much disagree”
7. “Highly disagree”

Why? Examples as:

6.6 You expect that the NFPP will be beneficial to the livelihood and welfare of you and your future generations?

1. "Highly agree"
2. "Very much agree"
3. "Agree"
4. "Not very much significant"
5. "Disagree"
6. "Very much disagree"
7. "Highly disagree"

Why? Examples as:

6.7 You think that it is everybody's responsibility to take care of the local forest and forest resources, so as to enable to facilitated the sustainable utilization of the local forest and forest resources, and to derive the more benefits for our children and future generations?

1. "Highly agree"
2. "Very much agree"
3. "Agree"
4. "Not very much significant"
5. "Disagree"
6. "Very much disagree"
7. "Highly disagree"

Why?

7. Other questions

7.1 Do you know the NFPP? How did you know and understand the NFPP?

7.2 Were you willing to join the NFPP?

7.3 Are there any livelihood alternatives supported by the government or local forest sector since after the NFPP? How do you feel these alternative measures? Are they really helpful?

7.4 Do you have special utilization manners (or special local knowledge) regarding the use of local forests and forest resources? Do you know any local cultural activities, traditional costumes, religious beliefs and taboos related to the forest held by your family, your neighbors, or existing in the local villages and communities? Are there any changes of the traditions because of the implementation of the NFPP (after the NFPP)?

7.5 In general, do you think that the impacts of the NFPP on you, your family and the local community are positive or negative? Why?

7.6Are you satisfied with your current life and livelihood situation?

7.7 Do you think what are the main reasons causing the poverty? (More answers are welcome)

7.8 How do you usually get the information? (Multi-choices)

1. Radio/ TV
2. Newspaper
3. Forest workers/ village staffs
4. Neighbors/ friends/ relatives
5. Others

Appendix 4: Part of the data collected in the field

Appendix 4-1: List of experts and key informants consulted during the field survey (collecting the information above or at the community level)

Name of the expert/key informant	Date of the interview	Function of the expert/key informant	Subjects discussed
Li, Nuyun	10. Dec. 2005	Deputy director of division in SFA, previous chief of CNFEDRC	Genral application practice of SIA in forest investment projects in China
Li, Xiushan	Dec. 2006	Professor in Forestry Research Center in Gansu	Ecological and socio-economic impacts of the NFPP
Li, Wangjiang	30. Apri. 2007	Director of NFPP Center of Gansu	General information of NFPP implementatiom
Kou, Mingyi	2. May. 2007	Deputy director of division of Gansu forestry department	Information of Gansu forestry, its history and development
Wang, sunyan	4. May. 2007	Deputy director of division of Gansu forestry department	State-owned forest management in Gansu
Ye, Jiatian	10. May. 2007	Research fellow in Gansu forestry research institute	The implementation condition of NFPP in state-owned forests in Gansu; history and patterns of forest utilization by locals
Tian, Baohua	15. Jun. 2007	Forestry engineer in Gansu forestry research insititute	Institutional change as result of NFPP in local forest community of Gansu
Chen, Daojun	16. Jun. 2007	Forestry engineer in Gansu forestry department	Historical development of forests in local regions
Tan, Keping	Aug. 2007	Deputy director of survey & planning insitute	Condition of forests, consequences and impacts of NFPP implementation in whole region
Sun, jiangzhong	21. Jun. 2007	Deputy director of Xionglongshan forestry bureau	Local forest development condition, relationship between state-owned forests and local livelihood
He, Jianping	23. Jun. 2007	Deputy director of Xionglongshan forestry bureau	Implementation condition of NFPP and its general influences
Pan, Deqian	5.Jul. 2007	Director of division of forest protection in Xiaolongshan	History of local institutional change and economic condition
Yuan, Shiyun	Jul. 2007	Deputy director of division of forest planning&protection in Xiaolongshan bureau; research fellow in CAF (Ph.D)	Local land use patterns, historical development of local forests and local livelihood
Zhao, Wenjie	Jun.-Jul. 2007	Vice deputy director of division of forest planning&protection in Xiaolongshan	Objectives and activities of forest protection, connection with local livelihood
Zhang, Jianguo	8. Jul. 2007	Head of Maiji forest farm	General information of local forests, forest regulations, customary laws, forest fire protection, etc…
Song, Fenqi	10. Jul. 2007	Forestry technician of Maiji forest farm	Information of local forest resources from 1998 to 2007; Rewards and penalty regarding local forest activities, forest fire, conflict resolution.

Li, Weidong	13. Jun. 2007	Leadership of Maiji Village	Local demographic information; history of village and economic development; community institution&organization; infrascture and communication; and local utilization of forests land use patterns.
Wang, Wenshu	16. Jun. 2007	Leadership of Taohua Village	Local demographic information; history of village and economic development; community institution&organization; infrascture and communication; and local utilization of forests land use patterns.
Bai Yanghua	17. Jun. 2007	Teacher of primary school in Taohua Village	History and condition of local school and enrolment rate
Li, Changxiao	25. Apri. 2008	Professor in Southwest Normal University in Chongqing	Socio-econoic condition of Chongqing, implementation of NFPP, endogenous utilization of forests
Chen, Mingli	28 Apri. 2008	Director of NFPP Center in Chongqing	Admistrative work, general implementation condition of NFPP in local region
Wang, Faxiu	28 Apri. 2008	Engineer of NFPP Center in Chongqing	Objectives, activities and main results of NFPP in local region
Shi, Shengzhang	30 Apri. 2008	Direct of survey&planning institute	History of forest management and land use planning
Yuan, Yi	Apri.-May. 2008	Office director of division in survey&planning institute	Geographical and socio-economic condition of local region and forest planning&utilization
Zhu, Duizhang	6. May. 2008	Head of division for forest fire guard Forest Bureau of Dazu County	Historical development of forest regulation, especially forest fire and protection, reward and penalty regarding forest use
Zhang, Anjian	12. May. 2008	Engineer of NFPP Center of Dazu	Activitites and results of NFPP, conflicts with local trational forest use and resolution mechanism
Cai, Yongyuan	13. May. 2008	Head of division forest inventory of Dazu forest bureau	Collective forest condition and utilization
Liang, Zhuren	28. May. 2008	Head of Dazu forest station	Forest resources and utilization of local communities
Gu, Mingjian	23. May. 2008	Responsible farmer for mangement of a specific area of local forest	Histroy, activities, experiences of responsible forest mangement
Li, Yingjun	17. May. 2008	Leadership of Nanmu Village	Local demographic information; history of village and economic development; community institution&organization; infrascture and communication; and local utilization of forests land use patterns.
Zuo, Xiaofu	2. Jun. 2008	Leadership of Xinshi Village	Local demographic information; history of village and economic development; community institution&organization; infrascture and communication; and local utilization of forests land use patterns.
He, Jianhua	19. May. 2008	Head assistant of forest association in Nanmu Village	History, objectives, activities and experiences of local forest association
Deng, Guangde	7. Jun. 2008	Forest stewardship in Xinshi Village	Historical development of forest resources, local use of forests

Appendix 4-2: Data collected at the household level

1. Variables and indicators at household and individual level

Name of variable/indicator	Label	Coded values	Measurement level
Place	Name of place	1: Gansu; 2: Chongqing	Nominal
Village	Name of village	1: Taohua; 2: Maiji; 3: Nanmu; 4: Xinshi	Nominal
HH_ID	ID of household		Nominal
Name	Name of household respondent		Nominal
Gender	Gender of respondent	1: Male; 2: Female	Nominal
Ethnic	Ethnicity of respondent	1: Majority (han); 2: Minority	Nominal
Age	Age of respondent		Scale
Edu_head	Education level of house head	1: Illiterate; 2: Primary school; 3: Middle school; 4: Higher education	Ordinal
HH size	Household size (number of persons in household)		Scale
HH area	Floor space of household (m^2)		Scale
HH area_p	Floor space of household for production purpose (m^2)		Scale
H_material	Materials of house building	1: Wood; 2: Blick concrete&wood; 3: Reinforced concrete; 4: Complex of wood/clav/ blicks	Nominal
House time	Time for building the house		Scale
house cost	Cost for building the house (Yuan)		Scale
Dis_road	Distance to the nearest road	1: Very close, just near the road; 2: Distance between 100-500 m; 3: Distance more than 500 m	Ordinal
Dis_f	Distance to the forests	1: Distance less than 2 km; 2: Distance between 2-5 km; 3: Distance more than 5 km	Ordinal
Dis_Clin.	Distance to the nearest clinic	1: Distance less than 1 km; 2: Distance between 1-1.5 km; 3: Distance more than 1.5 km	Ordinal
Dis_Mark.	Distance to the nearest market	1: Distance less than 1 km; 2: Distance between 1-1.5 km; 3: Distance more than 1.5 km	Ordinal
Acc. WET	Access to water, electricity and telephone	1: Yes; 2: No (water from well or carried from river)	Nominal
Trafic tool	Main tool for daily traffic	1: Walk; 2: Bicycle; 3: Tractor; 4: Bus; 5: Car; 6: Motorcycle; 7: Tricycle; 8: Walk&bicycle;	Nominal
Land_agri.	Area of agricultural land (mu)		Scale
Land_f	Area of forest land (mu)		Scale
Type_f	Type of forest land	1: Wood forest; 2: Economic forest; 3: Bamboo; 4: Fuel wood; 5: Wood forest&fuel wood;	Nominal
C_NFPP	Forest covered by the NFPP	1: Covered by the NFPP; 2: Not covered by the NFPP	Nominal
TV	Family fixed property: Television		Scale
Tele.	Telephone		Scale
Refriger.	Refrigerator		Scale
Motor.	Motorcycle		Scale
Bicycle	Bicycle		Scale
Vcd	Vcd		Scale

Wash.mac.	Washing machine		Scale
Total in. 98	Total household income in 1998 (Yuan)		Scale
In_agricul. 98	Income from agricultural activities in 1998 (Yuan)		Scale
In_harves. trans. 98	Income from forest harvesting&wood transportation in 1998 (Yuan)		Scale
In_NTFP culti. 98	Income from NTFPs cultivation in 1998 (Yuan)		Scale
In_medic.p. 98	Income from medical plants in 1998 (Yuan)		Scale
In_fuelwood 98	Income from fuel wood collection in 1998 (Yuan)		Scale
In_livestock 98	Income from livestock raising in 1998 (Yuan)		Scale
In_migrat. work 98	Income from migration work in 1998 (Yuan)		Scale
In_handicra. 98	Income from handcraft making&selling in 1998 (Yuan)		Scale
Total in. 07	Total household income in 2007 (Yuan)		Scale
In_agricul. 07	Income from agricultural activities in 2007 (Yuan)		Scale
In_harves. trans. 07	Income from forest harvesting&wood transportation in 2007 (Yuan)		Scale
In_NTFP culti. 07	Income from NTFPs cultivation in 2007 (Yuan)		Scale
In_medic.p. 07	Income from medical plants in 2007 (Yuan)		Scale
In_fuelwood 07	Income from fuel wood collection in 2007 (Yuan)		Scale
In_livestock 07	Income from livestock raising in 2007 (Yuan)		Scale
In_migrat. work 07	Income from migration work in 2007 (Yuan)		Scale
In_handicra. 07	Income from handcraft making&selling in 2007 (Yuan)		Scale
In_remittan. 07	Remittance from family members working outside of village (Yuan)		Scale
Total ex. 98	Total household expenditure in 1998 (Yuan)		Scale
Ex_agricul. 98	Expenditure for agricultural activities in 1998 (Yuan)		Scale
Ex_culti. 98	Expenditure for cultivation activities in 1998 (Yuan)		Scale
Ex_touris. 98	Expenditure for tourism and visiting relatives in 1998 (Yuan)		Scale
Ex_educat. 98	Expenditure for education in 1998 (Yuan)		Scale
Ex_medic. 98	Expenditure for medical treatment in 1998 (Yuan)		Scale
Ex_others 98	Expenditure for other purposes in 1998 (Yuan)		Scale
Ex_alterne.fueluse 98	Expenditure for alternative fuel use and energy costs in 1998 (Yuan)		Scale
Total ex. 07	Total household expenditure in 2007 (Yuan)		Scale
Ex_agricul. 07	Expenditure for agricultural activities in 2007 (Yuan)		Scale
Ex_culti. 07	Expenditure for cultivation activities in 2007 (Yuan)		Scale
Ex_touris. 07	Expenditure for tourism and visiting relatives in 2007 (Yuan)		Scale

Ex_educat. 07	Expenditure for education in 2007 (Yuan)		Scale
Ex_medic. 07	Expenditure for medical treatment in 2007 (Yuan)		Scale
Ex_others 07	Expenditure for other purposes in 2007 (Yuan)		Scale
Ex_alterne.fueluse 07	Expenditure for alternative fuel use and energy costs in 2007		Scale
Total lab. 98	Total household labour time spended on household activities in 1998 (day)		Scale
Lab_crops 98	Household labour time spended on crops farming in 1998 (day)		Scale
Lab_harves. trans. 98	Household labour time spended on forest harvesting&transportation in 1998 (day)		Scale
Lab_NTFP culti. 98	Household labour time spended on NTFP cultivation in 1998 (day)		Scale
Lab_medic.p. 98	Household labour time spended on medical plants in 1998 (day)		Scale
Lab_livestok. 98	Household labour time spended on livestock raising in 1998 (day)		Scale
Lab_migrat work 98	Household labour time spended on migration work in 1998 (day)		Scale
Lab_handicra. 98	Household labour time spended on handicraft making and selling in 1998 (day)		Scale
Lab_ fuelwood 98	Household labour time spended on fuel wood collection in 1998 (day)		Scale
Total lab. 07	Total household labour time spended on household activities in 2007 (day)		Scale
Lab_crops 07	Household labour time spended on crops farming in 2007 (day)		Scale
Lab_harves. trans. 07	Household labour time spended on forest harvesting&transportation in 2007 (day)		Scale
Lab_NTFP culti. 07	Household labour time spended on NTFP cultivation in 2007 (day)		Scale
Lab_medic.p. 07	Household labour time spended on medical plants in 2007 (day)		Scale
Lab_livestok. 07	Household labour time spended on livestock raising in 2007 (day)		Scale
Lab_migrat work 07	Household labour time spended on migration work in 2007 (day)		Scale
Lab_handicra. 07	Household labour time spended on handicraft making and selling in 2007 (day)		Scale
Lab_ fuelwood 07	Household labour time spended on fuel wood collection in 2007 (day)		Scale
Q 5.1	Opinions that natural environmental condition has improved from 1998 to 2007	1: Highly agree; 2: Very agree; 3: Agree; 4:So so, on the line; 5: Disagree; 6: Very disagree; 7: Highly disagree	Ordinal
Q 5.2	Opinion that health condition of family members has improved from 1998 to 2007	1: Highly agree; 2: Very agree; 3: Agree; 4: So so, on the line; 5: Disagree; 6: Very disagree; 7: Highly disagree	Ordinal
Q 5.3	Opinion regarding intensity of feelings concerning a secure future from 1998 to 2007	1: Highly agree; 2: Very agree; 3: Agree; 4: So so, on the line; 5: Disagree; 6: Very disagree; 7: Highly disagree	Ordinal
Q 5.4	Opinon to move out of the village	1: Highly agree; 2: Very agree; 3: Agree; 4: So so, on the line; 5: Disagree; 6: Very disagree; 7: Highly disagree	Ordinal
Q 6.1	Importance of economic value of forests	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree;	Ordinal

Q 6.2	Importance of ecological value of forests	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree	Ordinal
Q 6.3	"Illegal logging and overharvesting will seriously destroy the forests"	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree	Ordinal
Q 6.4	Opinon regarding relationship between illegal logging and poverty	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree; 0: Don't know	Ordinal
Q 6.5	Opinion regarding harmonization between the NFPP and local cultural beliefs and tradtions	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree; 0: Don't know	Ordinal
Q 6.6	Pisitive expectation to the NFPP in terms livelihood generation and welfare in future	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree	Ordinal
Q 6.7	Opinion that everyone has responsibility to take care of the local forests in order to ensure the sustainable livelihood in future	7: Highly agree; 6: Very agree; 5: Agree; 4: So so, on the line; 3: Disagree; 2: Very disagree; 1: Highly disagree	Ordinal
Q 7.1	Willingness to join the NFPP	1: Freewill; 2: Not freewill	Nominal
Q 7.2	Channel of knowing the NFPP	1: TV newspaper/media; 2: Disemination from higher-up; 3: Both 1 and 2; 4: Never heart about the NFPP	Nominal
Q 7.3	Livelihood alternatives supported by government and forest sector since the NFPP	1: Seedlings from government with subsidy 1 Yuan/mu; 2: Subsidy for bamboo, 310 Yuan/year; 3: No support from government; 4: Technical training/extension; 5: Joint planting; 6: Ecological migration	Nominal
Q 7.4	Special utilization of forests; local traditional culture and costumes, religious beliefs related to forest use	1: No answer; 2: Don't believe the God (non religious); 3: No special use of forests; 4: There are some special use of forests and local costumsw	Nominal
Q 7.5	Feeling to the NFPP, whether positive or negative to household in general	1: Positive; 2: Adequate; 3: Negative; 4: Positive to environment while negative to livelihood; 5: Positive in the long run while should be integrated into local condition	Nominal
Q 7.6	Satisfaction to life and livelihood situation since the NFPP	1: Yes; 2: Adequate; 3: No	Nominal
Q 7.7.	Main reasons causing the poverty	1: Illness; 2: Low education and skill; 3: Low capital; 4: Less of labour 5: Inconvenient traffic condition; 6: Less of land resource; 7: Less of occupation position; 8: Unstable labour price; 9: Lack of support, less project led by government for wealthy	Nominal
Q 7.8	Sauces of obtaining information	1: Radio/TV; 2: Newspaper; 3: Local staffs of forest sector and staffs of local village/government; 4: Neighbours/friends; 5: Others	Nominal

2. Socio-economic data of selected households

HH_ID	Place	Village	Name	Gender	Ethnic	Age	Edu_head	HH size	HHarea	HH area_p	H_material	House time	house cost	Dis_road	Dis_f	Dis_Clin.	Dis_Mark.	Acc. WET	Trafic tool	Land_agri.	Land_f	Type_f	C_NFPP	TV	Tel.	Refriger.	Motor.	Bicycle	Vcd	Wash.mac.
1	1	1	Yan Feng	1	1	32	3	5	80	30	4	1975	900	1	2	1	2	1	1	1.2	1.2	2	2	1	1	0	0	0	1	1
2	1	1	Sun Xiaohong	2	1	31	3	4	80	0	2	2004	40000	1	1	1	2	1	1	1.7	2	2	1	1	1	1	0	0	0	0
3	1	1	Li Xianglan	2	1	34	2	5	120	0	2	2004	50000	1	1	1	2	1	1	1	0	2	1	1	1	0	0	0	0	0
4	1	1	Ren Wenge	1	1	40	3	5	100	0	4	1990	20000	1	1	1	3	1	6	11	7	2	1	1	1	1	1	1	1	1
5	1	1	Li Huiyuan	1	1	54	2	7	150	0	4	2006	13000	1	1	2	3	1	4	3	100	2	2	1	1	0	0	0	0	0
6	1	1	Li Fukui	2	2	78	2	2	110	0	2	2005	40000	1	1	2	3	1	4	7	0	2	1	2	1	0	0	0	0	1
7	1	1	Yan Jiahai	1	1	54	3	10	200	100	4	2004	50000	2	1	3	3	1	8	8.5	0	2	2	1	1	1	1	1	0	0
8	1	1	Li Decun	1	1	47	3	5	160	0	1	1989	3500	3	2	3	3	1	1	6	25	5	1	1	1	1	0	0	0	0
9	1	1	Zhang Rangnv	2	1	38	1	6	100	0	2	2000	20000	1	1	3	3	1	1	7.5	0	5	2	1	1	0	1	1	0	0
10	1	1	Li Dexi	1	1	31	2	4	80	80	2	1989	8000	1	2	3	3	1	1	6	14	2	2	1	1	1	0	0	1	0
11	1	1	Wang Yuzhong	1	2	40	3	4	80	40	2	1994	25000	1	1	1	3	1	9	6	3	2	2	1	1	0	1	1	0	0
12	1	1	Yang Chang'an	1	1	55	2	7	100	0	4	2001	17000	2	1	2	3	1	7	0	13.4	2	1	1	1	0	0	1	0	0
13	1	1	Chen Youzhi	1	1	36	3	4	60	0	1	1996	10000	1	1	1	3	1	1	0.5	4	6	1	1	1	0	0	0	0	0
14	1	1	Chang Weigang	1	1	27	3	6	100	0	3	2006	53000	2	1	2	3	1	3	3	11.5	2	1	1	1	0	0	0	0	0
15	1	1	Du Ximei	2	1	48	3	4	40	30	4	1985	1000	1	2	2	3	1	1	1.2	9	2	1	1	1	1	0	1	1	0
16	1	1	Wei Jincang	1	1	35	3	4	100	0	1	1968	600	2	1	3	3	2	1	2	4	2	2	1	1	0	1	0	0	0
17	1	1	Wei Chengcang	1	1	55	3	4	280	0	2	2007	80000	1	1	2	3	1	2	6	3	2	2	1	1	1	0	1	0	0
18	1	1	Zhang Gui	1	1	52	2	4	70	190	2	2007	30000	3	3	3	3	1	10	5	8	3	1	1	1	0	0	0	1	0
19	1	1	Zhu Yuehua	2	2	46	1	5	40	0	1	1975	600	1	2	3	3	1	1	1.3	2	2	2	1	1	0	0	1	0	0
20	1	1	Zhou Ducheng	1	1	45	3	4	72	260	3	2007	40000	2	3	1	3	2	6	6	4	2	2	1	1	0	1	1	0	0
21	1	2	Yan Laicun	1	1	40	2	4	80	0	3	2006	34000	1	1	1	3	1	1	13	10	2	2	1	1	0	0	0	0	0
22	1	2	Yan Jicheng	1	1	41	3	5	110	0	3	2002	30000	1	1	2	3	2	1	5	6	1	2	1	1	0	1	0	1	0
23	1	2	Yan Yuancun	2	2	36	4	6	110	0	3	2002	45000	2	1	2	3	1	6	3	15	2	2	2	2	0	1	1	0	0
24	1	2	Wang Xiaolong	2	1	40	3	5	180	0	2	1999	30000	1	1	2	2	1	6	5	18	2	2	1	1	0	1	0	0	0
25	1	2	Lv Haiyu	1	2	53	2	4	90	0	3	2001	25000	2	2	2	3	2	6	8	8	2	2	1	3	0	1	1	0	0
26	1	2	Zhang Minhua	1	1	29	2	3	120	0	2	2004	8000	2	2	2	3	1	4	0	9.3	2	1	1	1	0	0	1	0	0
27	1	2	Chen Shiyou	1	1	56	1	5	150	0	2	1997	20000	2	3	2	3	2	6	3	5	4	2	1	1	1	1	0	1	0
28	1	2	Wu Sanjiang	1	1	65	1	3	100	0	2	1990	5000	2	2	2	3	2	1	8	9	4	2	1	1	0	0	0	0	0

29	1	2	Li Rong	1	1	49	3	3	80	0	2	1991	3000	1	1	1	3	1	1	3	2	3	2	1	1	0	0	1	1	0
30	1	2	Liu Yongdai	1	1	51	2	4	90	0	3	2003	30000	1	1	2	3	2	7	3	4	2	2	2	1	0	1	0	0	0
31	1	2	Jiang Hong	2	1	34	2	5	110	0	3	2004	42000	1	2	3	3	1	8	3	4	2	2	1	1	1	0	0	1	1
32	1	2	Ma Hongbin	1	1	41	3	4	95	0	1	1989	2000	1	2	1	3	1	1	2	8	2	2	1	1	1	0	0	0	0
33	1	2	Mei Yin	2	2	53	2	4	90	0	2	1997	4000	1	1	1	3	1	11	3	5	3	2	1	1	1	0	1	0	1
34	1	2	Liu Yusheng	1	1	62	1	5	120	0	2	1999	20000	2	2	2	3	2	6	2	6	3	2	1	1	1	1	0	0	0
35	1	2	Jin Xiangyin	2	2	56	1	4	80	0	2	1990	5000	1	1	1	3	1	1	3	5.5	2	2	1	2	1	0	1	0	0
36	1	2	Xia Yulin	1	1	56	2	3	75	0	2	1993	4000	1	2	2	3	2	9	2.5	5	2	2	1	2	0	0	1	0	0
37	1	2	Liu Yijun	2	1	40	3	3	80	0	2	1989	2000	2	1	2	3	1	7	2	1	2	2	1	1	0	0	0	1	0
38	1	2	Liu De Chang	1	1	43	2	4	80	0	2	1991	3000	2	2	3	3	2	7	2.5	0	4	2	1	2	0	1	1	0	0
39	1	2	Wu Yuhong	2	2	38	2	3	60	0	1	1980	1000	3	1	2	3	1	1	4	4	2	2	1	2	0	0	1	0	0
40	1	2	Zheng Xiaomin	1	1	62	1	6	120	0	3	2005	50000	1	1	2	3	2	1	4	9	2	2	2	2	0	1	0	0	0
41	2	3	Shi Weizhen	1	1	49	3	4	300	0	3	2007	120000	1	2	2	3	1	5	2	0.2	3	1	1	1	1	0	1	1	1
42	2	3	Deng Shihong	2	1	52	2	3	120	0	2	1989	20000	1	2	1	1	1	1	1	8	2	1	1	1	0	0	0	0	0
43	2	3	Gu Mingjian	1	1	46	2	4	160	0	2	1995		1	2	1	1	1	1	1	400	5	1	2	1	1	0	0	0	0
44	2	3	Deng Zhongxi	1	1	55	2	3	150	0	2	2003	30000	2	1	1	1	1	1	3.2	3	3	1	1	1	1	0	0	0	0
45	2	3	Deng Guangde	1	1	53	3	3	110	0	2	1990	20000	1	1	2	1	1	1	0.4	3	3	1	1	1	1	0	0	0	0
46	2	3	Deng Guangnan	1	1	58	2	2	130	0	2	1993		1	1	1	1	1	1	1	3	1	1	1	1	0	0	0	0	0
47	2	3	Yu Jiaxiu	2	2	44	2	4	120	0	2	1992	30000	1	2	2	2	1	1	1	4	3	1	1	1	1	0	1	1	1
48	2	3	Qin Biyou	1	1	58	2	2	127	0	3	2004	85000	3	2	2	2	1	1	2.6	0.8	5	1	1	1	1	0	1	0	0
49	2	3	Li Chaoshi	1	1	66	2	2	130	0	2	2007	100000	3	1	1	1	1	1	2.5	1	3	1	1	1	1	0	1	0	0
50	2	3	Xu Longcheng	1	1	54	3	2	180	0	2	1989	50000	1	1	2	3	1	1	2	1	3	1	1	1	1	0	0	0	0
51	2	3	Li Guangyou	1	1	58	3	5	200	0	2	1979	10000	1	1	1	1	1	1	3	4	2	1	1	1	1	0	0	0	0
52	2	3	Yang Nairen	1	1	69	4	3	190	0	2	1979		2	1	2	2	1	1	2	1	3	1	1	1	0	0	0	0	0
53	2	3	Jiang Daoneng	1	2	40	2	2	160	0	3	1992		1	2	1	2	1	1	1	1	3	1	2	1	1	0	0	1	0
54	2	3	Luo Chuan	1	1	35	2	3	110	0	2	1988		2	1	3	3	1	6	2.5	1	3	1	1	1	1	1	0	0	0
55	2	3	Lin Changxiu	2	2	44	1	3	120	30	3	1998		1	2	1	3	1	6	3	3	3	1	1	1	1	1	0	1	0
56	2	3	Luo Jiming	1	1	44	1	3	140	0	2	1993	35000	1	1	2	3	1	1	2.3	2.3	1	2	1	1	1	0	0	0	0
57	2	3	Xie Ping	2	1	32	2	11	230	110	2	1993	100000	1	2	1	3	1	6	5	3	2	1	4	2	3	3	0	1	1
58	2	3	Zheng Chaogui	2	2	45	1	3	108	0	2	1996		1	1	1	3	1	1	2.1	2	3	1	1	1	1	0	0	0	0
59	2	3	Muo Daiqun	2	1	42	3	3	120	0	3	2001		1	2	1	3	1	1	3	1	3	1	1	1	1	0	0	0	0
60	2	3	Peng Zelong	1	1	46	2	4	230	0	2	1979		1	1	2	3	2	1	5	2	2	1	1	1	0	0	0	0	0
61	2	4	Cheng	1	1	59	4	4	120	0	2	1990		2	3	1	1	1	1	4	1	1	1	1	1	1	0	0	1	1
62	2	4	Liu Kaihua	1	1	65	3	2	90	0	2	1988		1	1	2	3	1	1	0.25	1	3	1	1	1	0	0	0	0	0

63	2	4	Wang Changji	2	1	53	3	4	50	0	2	1979		2	1	2	3	1	1	0.2	1.5	3	1	1	1	0	0	0	0	0
64	2	4	Wang	1	1	39	2	4	120	0	1	1996		1	3	1	2	1	1	2	2	2	1	2	1	1	0	0	0	0
65	2	4	Yang Yunfu	1	1	57	3	3	120	0	2	1984		2	2	1	2	2	1	1.2	2.5	1	1	1	1	1	0	0	0	0
66	2	4	Jiang Youdong	1	1	53	2	6	110	0	2	1989	10000	1	2	1	1	1	1	1	0	0	1	1	1	1	0	0	1	1
67	2	4	Li Deyong	2	2	58	4	3	150	0	2	1987	20000	3	1	1	3	1	7	2.5	0.3	3	1	1	1	0	0	0	0	0
68	2	4	Wu Yunfu	1	1	60	4	4	210	0	3	2003	189000	2	1	1	3	1	11	2.5	0.2	3	1	1	1	1	0	0	0	0
69	2	4	Yi Shiwan	1	1	51	2	5	220	0	2	1987	15000	1	2	1	3	1	1	2.5	1	3	1	1	2	0	0	0	1	1
70	2	4	Deng Youji	1	1	55	2	4	150	0	3	1993		1	1	2	3	1	7	1.2	5	2	1	1	1	0	0	0	0	0
71	2	4	Cai Changyong	1	1	41	2	3	130	0	2	2000		1	2	2	3	1	1	1.5	0.2	3	1	1	1	1	0	0	0	0
72	2	4	Deng Shijie	1	1	43	2	3	150	0	1	1974		1	1	1	3	1	1	2	0.1	3	1	1	1	1	0	0	0	0
73	2	4	Yang Linfu	1	1	66	2	5	240	0	2	2004	65000	1	3	2	2	1	11	3.8	1	3	1	1	1	1	0	0	0	0
74	2	4	He Yangguang	1	1	64	3	6	400	0	2	1991	60000	2	1	3	3	2	6	3	0.8	3	1	3	1	1	1	0	1	1
75	2	4	Wu Renming	1	1	62	3	5	120	0	1	1997		2	2	2	2	1	6	2.2	4.8	2	1	1	2	0	1	0	0	0
76	2	4	Xia Yianxiang	2	1	57	3	5	80	0	2	1990		1	1	2	3	1	11	2	3.5	2	1	1	1	0	0	0	0	0
77	2	4	Ding Wukun	2	1	41	3	3	110	0	2	1991		1	1	3	3	1	10	1.8	0.9	3	1	1	0	0	0	0	0	0
78	2	4	Luo Anhong	2	2	56	3	5	160	0	3	2002		2	2	2	2	1	10	3.5	3.5	2	1	1	2	1	0	0	0	0
79	2	4	Yang Jun	2	1	33	2	4	76	0	3	1986		2	1	3	3	1	1	2	2.3	2	1	1	1	1	0	0	0	0
80	2	4	Mo Zheping	1	2	50	3	4	130	0	2	1990		1	2	1	3	1	6	2	1.5	3	1	1	1	0	1	0	0	0

3. Data of economic income derived from various income generation activities for households from 1998 to 2007

	1998									2007									
HH_ID	Total in. 98	In_agricul. 98	In_harves. tranS. 98	In_NTFP culti. 98	In_medic.p. 98	In_fuelwood 98	In_livestock 98	In_migrat. work 98	In_handicra. 98	Total in. 07	In_agricul. 07	In_harves. tranS. 07	In_NTFP culti. 07	In_medic.p. 07	In_fuelwood 07	In_livestock 07	In_migrat. work 07	In_handicra. 07	In_remittan. 07
1	2880	510	850	300	320	0	100	0	800	19100	600	0	0	0	0	500	18000	0	0
2	2850	880	600	350	320	0	700	0	0	7400	700	0	700		0	0	6000	0	0
3	2390	200	1200	450	140	0	200	200	0	5050	550	0	0	0	0	0	4500	0	0
4	3200	950	1000	400	0	0	300	250	300	8600	1300	0	1800	0	0	500	5000	0	0
5	2770	500	550	500	320	0	200	350	350	8800	1300	0	2200	800	0	500	3000	1000	0
6	2480	300	1150	450	80	0	350	150	0	8300	1500	0	0	0	0	600	5000	1200	0
7	1780	610	350	100	220	0	500	0	0	5900	900	0	0	0	0	0	3000	2000	0
8	3700	1150	1200	500	50	0	450	350	0	15000	1800	0	1800	0	0	1600	8000	1800	0
9	3650	650	1000	350	650	0	400	600	0	10550	1650	0	0	0	0	1500	6000	400	1000
10	3350	900	1400	400	0	0	250	400	0	7000	1800	0	2000	0	0	500	1800	900	0
11	2730	600	850	200	780	0	200	0	100	6950	1750	0	1000	0	0	0	2200	2000	0
12	4102	1050	1050	300	630	0	422	650	0	6450	800	0	1500	1000	0	650	2500	0	0
13	2170	500	350	50	420	0	100	750	0	5800	300	0	1000	500	0	0	3000	1000	0
14	2510	950	500	300	300	0	360	100	0	7600	1300	0	2500	500	0	800	2500	0	0
15	4720	1250	2000	500	520	0	150	300	0	22200	400	0	1000	0	0	0	800	20000	0
16	2900	500	1100	600	0	0	700	0	0	7400	1000	0	1400	0	0	0	5000	0	0
17	4150	900	1500	50	0	0	700	1000	0	5300	1500	0	2500	0	0	0	1300	0	0
18	4150	850	1000	150	0	2000	150	0	0	7400	1300	0	1600	400	0	600	2500	1000	0
19	2300	400	1400	200	0	0	300	0	0	20200	500	0	1500	0	0	900	2300	0	1500
20	3330	1150	700	300	180	0	450	550	0	10400	1600	0	2000		0	800	6000	0	0
21	3550	1100	450	700	650	0	500	150	0	8900	1400	0	3000	2000	0	500	2000	0	0
22	3310	980	1300	400	80	0	350	200	0	11000	1500	0	5000		0	1500	2000	0	1000
23	3700	1000	1200	0	420	0	780	300	0	8700	1000	0	2000	600	0	1100	4000	0	0
24	2550	1050	900	50	50	0	500	0	0	9500	1100	0	5500	0	0	600	2300	0	0
25	2670	1100	1100	150	120	0	200	0	0	10000	800	0	3800	500	0	400	3000	1500	0
26	2480	800	1500	80	0	0	100	0	0	6850	1050	0	2000	0	0	800	3000	0	0
27	3000	900	950	50	900	0	200	0	0	14450	1150	0	3000	700	0	600	9000	0	0
28	4150	1350	1500	300	0	0	150	850	0	13500	2100	0	1400	0	0	0	10000	0	0
29	2730	840	800	240	320	0	230	300	0	7200	700	0	600	300	0	600	5000	0	0
30	3120	850	1250	390	380	0	250	0	0	9550	1850	0	900	1000	0	800	5000	0	0

31	3120	950	850	650	200	0	150	320	0	11800	900	0	1000	500	0	400	9000	0	0
32	2720	950	700	400	320	0	350	0	0	8200	1900	0	1300	1200	0	800	3000	0	0
33	2520	650	850	290	350	0	380	0	0	8100	1500	0	1600	1400	0	800	2800	0	0
34	3820	820	1300	130	620	0	450	500	0	7550	1150	0	2000	800	0	600	3000	0	0
35	2640	850	850	230	500	0	210	0	0	7500	1700	0	2000	600	0	700	2500	0	0
36	2750	600	1250	500	350	0	50	0	0	7850	1150	0	1350	500	0	350	3500	0	1000
37	2370	220	850	400	400	0	300	200	0	6070	1050	0	550	750	0	420	3300	0	0
38	2720	1050	650	200	400	0	420	0	0	7890	560	0	0	480	0	350	6500	0	0
39	2420	600	1000	350	250	0	220	0	0	7350	1150	0	1050	1050	0	600	3500	0	0
40	3640	1050	1100	350	220	0	420	500	0	3080	550	0	580	0	0	850	1100	0	0
41	5500	1000	1100	2100	100	0	200	1000	0	26300	2000	0	2500	0	0	1800	20000	0	0
42	3400	600	0	800	0	0	1500	0	500	12500	2500	0	0	0	0	0	10000	0	0
43	7550	1550	1200	1500	1200	0	800	1300	0	22500	2000	1000	5500	2000	0	1000	11000	0	0
44	2600	800	0	800	0	0	250	750	0	14800	600	0	0	0	0	1200	13000	0	0
45	2300	900	0	700	0	0	300	400	0	13000	3000	0	0	0	0	0	10000	0	0
46	1200	500	0	300	200	0	200	0	0	15000	2000	0	2000	1000	0	0	10000	0	0
47	7100	1200	1200	2800	800	0	500	600	0	25500	2500	0	0	0	0	2000	20000	1000	0
48	1500	500	0	800	0	0	200	0	0	12000	2000	0	0	5000	0	0	2000	3000	0
49	1850	750	0	300	100	0	200	500	0	9500	2500	0	2000	0	0	0	5000	0	0
50	1300	500	0	400	0	0	300	0	100	5500	4000	0	1500	0	0	0	0	0	0
51	5650	1800	800	1150	0	0	500	900	500	9300	6000	0	0	0	0	1000	2000	300	0
52	2600	850	200	300	0	0	250	1000	0	8500	3500	0	1500	0	0	1000	2500	0	0
53	1410	860	0	400	0	0	150	0	0	29800	4000	0	0	0	0	800	25000	0	0
54	4600	1300	300	1600	400	0	300	500	200	8500	3000	0	0	0	0	2500	3000	0	0
55	3850	1100	400	1100	200	0	250	800	0	24000	10000	0	3000	0	0	0	8000	3000	0
56	3350	1000	600	900	150	0	200	500	0	15000	3000	0	0	2000	0	3000	7000	0	0
57	19300	2500	3000	4800	0	0	5000	3000	1000	40000	500	0	4000	0	0	0	35000	500	0
58	5250	800	800	1850	500	0	1000	0	300	13000	3500	0	2000	0	0	0	7500	0	0
59	2900	800	0	500	100	0	500	1000	0	11000	6000	0	0	0	0	0	3000	2000	0
60	4750	850	300	1800	100	0	200	1500	0	13200	5000	0	0	3000	0	1200	4000	0	0
61	4050	1100	0	1750	0	0	400	800	0	30000	5000	0	0	0	0	2000	20000	3000	0
62	2050	850	0	900	0	0	300	0	0	12500	1000	0	1500	0	0	0	10000	0	0
63	5550	1100	300	2600	0	0	750	800	0	15600	500	0	2500	0	0	0	12000	0	600
64	7050	700	600	3550	600	0	500	1100	0	31200	3000	0	0	0	0	1200	27000	0	0
65	4450	1050	300	2000	800	0	300	0	0	8000	2000	0	0	0	0	0	6000	0	0
66	7890	2000	2000	1450	140	0	800	1500	0	18300	1500	0	0	0	0	1800	12000	0	3000
67	2600	1400	0	300	0	0	300	600	0	9000	1000	0	3000	0	0	3000	0	0	2000

68	5000	1250	500	2250	0	0	300	700	0	9700	4000	0	2500	0	0	1200	0	0	2000
69	6150	1650	700	1400	600	0	800	1000	0	28500	3500	0	2500	0	0	2500	20000	0	0
70	4100	900	600	1150	200	0	500	750	0	18100	1800	0	1300	1000	0	1000	13000	0	0
71	2350	950	500	200	0	0	100	600	0	9800	2000	0	0	0	0	1800	0	6000	0
72	2950	750	200	1100	0	0	200	700	0	5800	4000	0	0	0	0	1200	0	600	0
73	5950	1400	800	1300	600	0	1000	850	0	28500	4500	0	2000	1000	0	3000	18000	0	0
74	10900	1500	4500	2000	500	0	900	1500	0	31300	4000	0	2500	0	0	2800	22000	0	0
75	6700	1300	400	2900	500	0	500	1100	0	17000	2000	0	1000	0	0	2000	12000	0	0
76	6750	1750	1000	1400	1100	0	800	700	0	16500	2500	0	1200	0	0	1800	10000	0	1000
77	1600	500	0	0	0	0	200	900	0	9200	1000	0	800	0	0	800	6000	0	600
78	6750	1750	1000	2000	120	0	1000	880	0	25500	3000	0	3000	0	0	1500	16000	2000	0
79	5100	1100	700	1800	500	0	500	500	0	18200	1300	0	1500	0	0	900	14500	0	0
80	3900	1050	0	1500	150	0	250	950	0	17100	1800	0	1000	0	0	1300	13000	0	0

4. Data of household expenditure structure from 1998 to 2007

	1998								2007							
HH_ID	Total ex. 98	Ex_agricul. 98	Ex_culti. 98	Ex_touris. 98	Ex_educat. 98	Ex_medic. 98	Ex_others 98	Ex_alterne. fuel use 98	Total ex. 07	Ex_agricul. 07	Ex_culti. 07	Ex_touris. 07	Ex_educat. 07	Ex_medic. 07	Ex_others 07	Ex_alterne. fuel use 07
1	1650	300	250	0	400	600	100	0	5250	400	800	1200	0	1000	1200	650
2	1700	400	0	0	400	700	200	0	3300	0	0	0	700	1500	500	600
3	2300	500	0	0	1100	600	100	0	8000	700	200	300	5000	1000	350	450
4	2050	400	0	0	1000	450	200	0	3800	700	500	0	1500	500	300	300
5	2150	500	100	0	1000	350	200	0	2950	300	300	300	600	550	300	600
6	2350	500	200	0	800	650	200	0	9150	700	0	0	0	7500	450	500
7	1850	350	0	0	600	700	200	0	11380	200	0	0	380	10000	300	500
8	1700	200	100	200	300	300	600	0	2450	600	200	0	500	300	400	450
9	1350	250	0	0	600	350	150	0	5550	600	250	0	1600	2500	500	100
10	2000	400	0	0	700	700	200	0	2800	0	0	0	0	2000	350	450
11	1800	350	0	0	650	550	250	0	13100	0	1000	0	1500	10000	200	400
12	3300	500	600	150	800	850	400	0	4450	0	0	0	3600	0	400	450
13	1750	300	0	0	1000	350	100	0	2250	0	0	0	500	1100	300	350
14	2950	550	0	0	1200	700	500	0	4200	800	300	200	1200	800	800	100
15	10820	200	300	70	10000	250	0	0	3500	0	0	0	0	2000	500	1000
16	2290	600	100	0	240	850	500	0	4050	300	250	600	250	2000	600	50
17	2750	500	600	400	600	650	0	0	4150	500	600	1500	0	1000	400	150
18	1700	350	0	0	1100	100	150	0	4050	400	1300	300	600	500	400	550
19	2000	100	0	0	700	1200	0	0	3950	750	200	200	900	800	500	600
20	3450	500	400	100	2000	350	100	0	2350	400	200	300	400	600	300	150
21	2000	800	0	0	1000	200	0	0	5700	800	250	100	3500	300	400	350
22	2000	300	500	500	500	150	50	0	2600	500	300	400	0	1000	300	100
23	2450	300	50	100	1200	800	0	0	4380	200	200	0	1000	1800	1000	180
24	2250	350	0	0	1000	750	150	0	9450	300	500	1000	7000	0	200	450
25	2150	500	0	0	1000	350	300	0	3150	500	600	400	0	1000	300	350
26	2400	450	150	150	1100	400	150	0	4820	0	0	0	0	3000	1500	320
27	1850	300	0	0	800	650	100	0	3100	100	800	0	0	300	1000	900
28	2150	200	0	0	1500	200	250	0	3200	500	600	600	500	350	300	350
29	2700	400	100	200	950	850	200	0	3580	700	400	800	800	400	400	80
30	1450	200	0	0	500	650	100	0	2450	400	0	0	850	800	300	100

31	1500	250	0	0	750	300	200	0	2450	400	0	0	0	1500	550	0
32	2110	380	80	0	1300	200	150	0	3050	750	300	200	1050	300	350	100
33	1400	250	0	0	600	350	200	0	1950	500	0	0	600	400	300	150
34	1700	300	50	0	700	450	200	0	2400	600	0	0	100	800	300	600
35	1850	250	0	0	1200	200	200	0	3100	500	400	100	600	1000	400	100
36	1750	400	50	0	300	800	200	0	2800	700	300	300	100	1000	300	100
37	1200	200	0	0	600	200	200	0	2050	300	0	0	1200	150	250	150
38	2050	450	150	0	1200	100	150	0	3500	500	400	0	800	1200	400	200
39	1900	400	0	0	600	600	300	0	2650	800	300	300	400	500	300	50
40	1730	500	200	0	600	180	250	0	2600	600	0	0	500	1100	400	0
41	2700	450	600	0	500	1000	150	0	9900	1000	500	2000	1800	1000	3000	600
42	2250	400	250	0	100	1200	300	0	3500	500	300	0	500	1200	600	400
43	3000	450	350	0	1100	950	150	0	11900	700	200	1000	8000	1000	500	500
44	2600	400	0	0	400	1600	200	0	5550	1200	1100	0	0	2500	550	200
45	3700	800	1000	0	500	1100	300	0	3450	500	0	500	1000	500	650	300
46	3250	700	650	0	300	1200	400	0	2250	200	0	200	0	1100	450	300
47	2900	600	500	200	700	500	400	0	13700	350	500	1300	8000	1200	1000	1350
48	2000	400	100	0	0	900	600	0	3550	800	800	300	0	700	600	350
49	2300	250	0	0	300	1600	150	0	11650	800	0	0	0	10000	500	350
50	2200	400	100	0	0	1500	200	0	3870	600	300	200	570	1000	600	600
51	3150	600	500	200	650	850	350	0	4170	700	0	800	570	1000	650	450
52	3200	600	500	0	500	1200	400	0	3050	400	200	500	200	800	550	400
53	3400	300	1000	800	400	700	200	0	4750	500	300	1500	200	600	650	1000
54	3800	800	400	300	1200	600	500	0	2750	500	100	400	450	200	400	700
55	5100	800	400	300	2500	800	300	0	7950	2000	2000	500	2000	500	450	500
56	3400	700	300	100	1200	600	500	0	4400	700	1000	700	0	300	400	1300
57	9900	2000	2200	1000	2300	1800	600	0	20700	1200	2500	2000	5000	4000	2000	4000
58	2050	500	0	0	1100	200	250	0	7900	600	400	0	2000	2000	500	2400
59	2850	100	300	0	1500	700	250	0	6000	500	500	800	2000	1000	400	800
60	4350	500	200	0	2000	1300	350	0	3900	300	600	500	600	1000	550	350
61	2250	800	150	0	200	800	300	0	4250	400	500	400	800	500	750	900
62	1650	300	250	0	100	850	150	0	3550	200	400	500	0	1000	450	1000
63	4000	300	900	200	1200	1000	400	0	5750	200	900	1000	1300	1600	500	250
64	3150	500	500	0	800	1000	350	0	7250	700	150	800	4000	800	400	400
65	2800	450	900	200	200	750	300	0	4800	400	0	1500	0	500	400	2000
66	4100	700	600	300	1100	900	500	0	13300	450	600	1000	1000	8000	600	1650
67	2450	300	250	0	800	900	200	0	2450	500	0	500	100	500	450	400

68	2700	200	400	0	1500	350	250	0	4200	500	500	800	200	1000	900	300
69	3300	400	250	200	950	1100	400	0	3900	400	400	500	1000	700	700	200
70	2600	250	800	0	500	800	250	0	6260	500	200	1500	0	600	400	3060
71	2350	300	700	0	750	400	200	0	5000	400	0	1000	1400	300	300	1600
72	3180	380	800	150	1300	300	250	0	7950	300	300	1100	4000	400	350	1500
73	2150	250	400	0	600	700	200	0	13950	700	500	800	10000	1000	450	500
74	5500	800	600	0	2500	1200	400	0	7600	500	300	1500	1200	3000	500	600
75	3000	300	200	0	700	1500	300	0	4150	400	150	500	1300	800	800	200
76	2850	400	0	0	1200	900	350	0	3450	500	200	0	1000	600	800	350
77	2300	300	250	100	600	800	250	0	4260	400	0	800	1800	300	700	260
78	2200	200	0	0	700	900	400	0	3900	500	0	0	1000	800	600	1000
79	3100	450	300	150	1200	850	150	0	4550	700	250	800	1400	400	800	200
80	2100	400	0	0	600	800	300	0	2690	500	150	500	200	500	500	340

5. Data of household labour time distribution on various household activities, from 1998 to 2007

	1998									2007								
HH_ID	Lab_crops 98	Lab_harves. trans. 98	Lab_NTFP culti. 98	Lab_medic.p .98	Lab_livestok .98	Lab_migrat work 98	Lab_handicr a. 98	Lab_ fuelwood 98	Total lab. 98	Lab_crops 07	Lab_harves. trans. 07	Lab_NTFP culti. 07	Lab_medic.p . 07	Lab_livestok . 07	Lab_migrat work 07	Lab_handicr a. 07	Lab_ fuelwood 07	Total lab. 07
1	75	75	45	24	0	0	51	30	300	60	0	0	0	30	210	0	0	300
2	75	60	15	30	75	0	0	45	300	60	0	60	0	15	156	0	9	300
3	30	135	30	15	30	30	0	30	300	60	0	0	30	15	180	0	15	300
4	60	129	15	0	15	15	30	36	300	30	0	90	30	12	138	0	0	300
5	60	75	45	0	9	30	30	51	300	45	0	60	15	15	120	30	15	300
6	45	90	60	15	0	21	30	39	300	75	0	0	0	30	150	30	15	300
7	90	45	15	30	45	0	0	75	300	60	0	0	0	0	120	120	0	300
8	90	120	30	9	21	0	0	30	300	66	0	36	0	54	144	0	0	300
9	54	84	24	66	24	30	0	18	300	90	0	0	0	60	135	0	15	300
10	75	120	30	0	0	30	0	45	300	90	0	39	0	21	75	75	0	300
11	60	90	0	78	18	0	0	54	300	90	0	24	24	0	72	90	0	300
12	75	75	9	36	30	36	0	39	300	60	0	75	54	24	87	0	0	300
13	90	60	30	0	0	60	0	60	300	15	0	30	30	0	150	75	0	300
14	90	60	18	30	21	18	0	63	300	60	0	90	0	21	120	0	9	300
15	90	66	30	24	0	0	30	60	300	30	0	45	0	18	45	159	3	300
16	60	150	30	0	30	0	0	30	300	60	0	30	0	30	150	0	30	300
17	54	165	0	0	36	30	0	15	300	60	0	60	0	21	150	0	9	300
18	90	150	0	0	0	30	0	30	300	30	0	60	0	24	120	45	21	300
19	90	120	0	0	30	30	0	30	300	30	0	51	0	54	129	0	36	300
20	90	120	0	0	30	30	0	30	300	45	0	96	0	30	96	0	33	300
21	90	33	60	36	30	21	0	30	300	60	0	75	30	27	90	0	18	300
22	90	165	0	0	0	0	0	45	300	66	0	75	24	45	60	0	30	300
23	90	135	0	0	0	0	0	75	300	60	0	90	30	0	120	0	0	300
24	90	180	0	0	0	0	0	30	300	54	0	102	15	15	114	0	0	300
25	90	165	0	15	0	0	0	30	300	45	0	99	0	9	141	0	6	300
26	120	120	0	0	0	0	0	60	300	45	0	0	0	30	210	0	15	300
27	90	150	0	30	0	0	0	30	300	60	0	75	0	30	135	0	0	300
28	75	177	18	0	0	30	0	0	300	66	0	39	0	0	0	195	0	300
29	75	84	15	45	30	30	0	21	300	66	0	36	21	36	126	0	15	300
30	75	105	30	30	30	0	0	30	300	84	0	54	45	24	87	0	6	300

31	90	75	45	15	15	45	0	15	300	39	0	36	21	36	159	0	9	300
32	90	84	15	30	45	0	0	36	300	96	0	21	60	39	63	0	21	300
33	84	87	24	30	45	0	0	30	300	108	0	3	57	48	57	0	27	300
34	81	90	6	30	39	30	0	24	300	75	0	24	36	24	117	0	24	300
35	84	93	24	42	42	0	0	15	300	105	0	24	33	39	69	15	15	300
36	78	93	30	36	45	0	0	18	300	84	0	30	24	30	54	30	48	300
37	51	102	18	30	45	21	0	33	300	75	0	3	36	36	63	27	60	300
38	90	87	24	24	33	0	0	42	300	39	0	36	21	39	135	15	15	300
39	63	90	36	24	30	0	0	57	300	84	0	36	33	30	75	0	42	300
40	87	75	9	18	48	57	0	6	300	30	0	18	33	12	195	0	12	300
41	75	96	60	12	12	30	0	15	300	69	0	66	0	30	120	0	15	300
42	60	0	24	0	75	0	75	66	300	105	0	15	0	0	165	0	15	300
43	66	57	45	45	24	39	0	24	300	60	21	60	30	30	90	0	9	300
44	90	0	90	0	15	30	0	75	300	66	0	0	0	51	183	0	0	300
45	90	0	90	0	30	45	0	45	300	120	0	0	0	0	180	0	0	300
46	105	0	45	45	45	0	0	60	300	90	0	90	30	0	90	0	0	300
47	60	60	96	24	15	30	0	15	300	90	0	0	0	39	141	30	0	300
48	60	0	120	0	30	0	0	120	330	90	0	15	75	0	54	51	15	300
49	120	0	48	24	36	0	0	72	300	66	0	105	0	0	105	0	24	300
50	90	0	90	0	60	0	15	45	300	135	0	120	0	9	0	0	36	300
51	60	54	90	0	30	45	15	6	300	120	0	0	0	45	75	60	0	300
52	78	24	54	0	24	60	0	60	300	90	0	75	0	30	75	0	30	300
53	99	0	102	0	24	0	0	75	300	105	0	0	0	15	180	0	0	300
54	90	21	105	24	9	30	12	9	300	90	0	15	0	45	150	0	0	300
55	90	24	90	12	15	54	0	15	300	120	0	60	0	0	90	30	0	300
56	87	30	54	6	18	45	0	60	300	60	0	0	60	60	120	0	0	300
57	60	60	60	0	60	30	30	0	300	30	0	90	0	0	165	15	0	300
58	60	60	90	30	45	0	9	6	300	120	0	30	0	0	150	0	0	300
59	105	0	60	9	0	36	60	30	300	120	0	0	0	0	90	90	0	300
60	75	24	90	6	0	15	78	12	300	126	0	0	60	18	96	0	0	300
61	90	0	90	0	30	45	45	0	300	90	0	0	0	24	156	30	0	300
62	105	0	105	0	30	0	0	60	300	57	0	57	0	0	186	0	0	300
63	90	0	84	0	60	60	0	6	300	30	0	72	0	0	186	0	12	300
64	45	30	120	30	27	45	0	3	300	63	0	0	0	24	192	0	21	300
65	90	15	105	30	18	0	0	42	300	120	0	30	0	0	150	0	0	300
66	78	60	45	6	57	54	0	0	300	66	0	0	0	30	204	0	0	300
67	150	0	30	0	24	36	0	60	300	45	0	105	0	60	60	0	30	300

68	75	24	90	0	15	60	0	36	300	111	0	114	0	45	0	0	30	300
69	84	42	75	24	15	60	0	0	300	60	0	60	0	30	150	0	0	300
70	84	24	87	9	30	42	0	24	300	60	0	60	30	15	135	0	0	300
71	90	39	33	0	9	54	24	51	300	90	0	30	0	36	144	0	0	300
72	90	21	105	0	18	60	0	6	300	150	0	24	0	54	0	72	0	300
73	102	27	87	30	27	27	0	0	300	75	0	36	30	33	117	0	9	300
74	60	105	60	18	27	30	0	0	300	75	0	45	0	30	150	0	0	300
75	84	24	108	24	15	45	0	0	300	75	0	45	0	30	150	0	0	300
76	96	54	78	30	18	24	0	0	300	75	0	30	0	30	165	0	0	300
77	96	0	15	0	30	84	0	75	300	60	0	30	0	30	180	0	0	300
78	90	60	84	6	30	30	0	0	300	60	0	45	0	15	120	60	0	300
79	75	30	87	30	24	39	0	15	300	45	0	30	0	15	210	0	0	300
80	81	0	90	9	24	60	0	36	300	54	0	45	0	24	150	27	0	300

6. Data of perceptions and values towards forests perceived by local households, from 1998 to 2007

	Local perceptions on health/safety				Values of forests							Understanding and feeling to the NFPP						Reasons causing poverty									Sauses of information				
HH_ID	Q 5.1	Q5.2	Q5.3	Q5.4	Q6.1	Q6.2	Q6.3	Q6.4	Q6.5	Q6.6	Q6.7	Q7.1	Q7.2	Q7.3	Q7.4	Q7.5	Q7.6	Q7.7 1	Q7.7 2	Q7.7 3	Q7.7 4	Q7.7 5	Q7.7 6	Q7.7 7	Q7.7 8	Q7.7 9	Q7.8 1	Q7.8 2	Q7.8 3	Q7.8 4	Q7.8 5
1	3	6	4	6	5	6	6	5	5	6	6	1	2	3	0	1	3	0	1	1	0	0	0	0	0	0	1	0	0	0	0
2	3	6	3	4	3	4	5	5	4	3	5	1	2	3	0	4	2	0	1	0	0	1	0	0	0	0	1	0	1	1	0
3	6	6	4	5	6	5	6	6	5	4	5	1	3	1	0	4	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0
4	6	5	5	5	5	7	6	6	6	6	6	1	3	1	0	4	2	0	1	0	0	0	0	1	1	0	0	1	0	0	0
5	5	5	3	5	5	6	5	5	4	5	5	1	1	1	0	4	3	0	0	1	1	0	0	0	0	0	1	0	0	0	0
6	6	4	3	5	6	7	5	6	4	6	6	1	3	1	1	1	3	1	1	0	0	0	0	0	0	0	0	1	0	0	0
7	4	3	3	6	3	6	6	5	4	5	5	2	2	3	1	1	3	0	1	0	0	0	0	0	0	0	0	0	1	0	0
8	7	6	6	7	7	7	7	7	3	7	7	1	3	4	1	4	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0
9	7	3	5	5	5	7	5	5	3	7	6	1	3	3	1	4	2	0	1	0	0	1	0	0	0	0	0	0	1	0	0
10	5	5	5	3	7	5	7	7	4	6	7	1	2	3	1	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0
11	6	5	5	5	7	7	7	6	3	5	5	1	3	4	1	1	3	0	1	1	0	0	0	0	0	0	0	0	1	0	0
12	3	5	3	3	3	4	4	5	3	3	4	1	1	3	1	1	3	0	1	0	0	1	0	0	0	0	0	0	1	0	0
13	7	6	3	3	3	4	5	5	3	4	5	1	3	3	0	4	1	0	1	1	1	0	1	0	0	0	0	0	1	0	0
14	5	3	3	4	3	4	5	5	3	6	5	1	1	3	0	1	3	0	0	0	0	1	0	0	0	1	0	0	1	0	0
15	5	4	4	4	4	5	5	5	3	4	5	1	2	2	0	1	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0
16	4	4	5	5	5	7	6	5	4	4	5	1	1	3	0	1	3	0	1	1	0	0	0	0	0	0	1	0	1	1	0
17	7	5	6	6	6	7	6	7	5	6	7	1	2	5	0	1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0
18	7	6	6	6	6	7	6	6	5	7	7	1	2	3	0	1	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0
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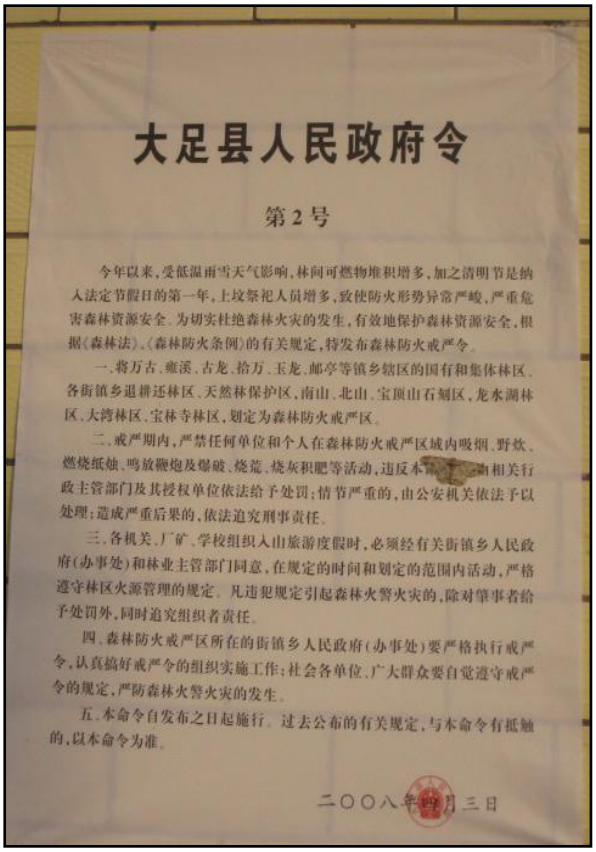
Appendix 4-3: List of NTFPs used by locals in study areas

No.	Local name /English name	Latin name	Economic value and local utilization
1	*Mu'er* or *Wooden ear* or *Jelly ear*	*Auricularia auricula-judae*	An edible fungus, traditionally used often in Asia for cooking; *Jelly ear* is known as a medicinal mushroom as it also has medicinal values. It is most often found on dead elder trees but also can be cultivated using wood materials.
2	*Huajiao* /Sichuan pepper	*Zanthoxylum bungeanum*	The outer pod of the tiny fruits are widely grown and consumed in local area as a spice, and widely used in the cuisine of Sichuan, from which it takes its name, and it also used widely for cooking in Chongqing, Gansu, and most of the regions in Western China.
3	*Daliao,* or *Bajiao*	*Fructus Anisi Stellati*	The fruits from the Illicium verum Hook plants, are a traditional cuisine material for cooking, also used for producing oil and medicinal purpose
4	*Hetao* /Walnut	*Juglandis*	The nuts and kernels from the fruits are edible; and also used for oil production; they are also used as a traditional Chinese medicine, which are used to strengthen the back and knees. It is also used by the elderly to relieve constipation.
5	*Xinzi* /Apricot	*Prunus armeniaca*	The fruits from the tree are edible. The kernels and seeds can be also used for traditional medical purpose.
6	*Taozi* /Peach	*Prunus persica*	The fruits from the tree are edible.
7	*Banli* /Chestnut	*Castanea mollissima Blume*	The nuts and kernels from the fruits are edible.

Note: Local name: name of tke tree or fruit in Chinese

Latin name: Scientific name

Appendix 5: Photos in the fields



大足县人民政府令

第2号

今年以来，受低温雨雪天气影响，林间可燃物堆积增多，加之清明节是纳入法定节假日的第一年，上坟祭祀人员增多，致使防火形势异常严峻，严重危害森林资源安全。为切实杜绝森林火灾的发生，有效地保护森林资源安全，根据《森林法》、《森林防火条例》的有关规定，特发布森林防火戒严令。

一、将万古、雍溪、古龙、拾万、玉龙、邮亭等镇乡辖区的国有和集体林区、各街镇乡退耕还林区、天然林保护区，南山、北山、宝顶山石刻区，龙水湖林区、大湾林区、宝林寺林区，划定为森林防火戒严区。

二、戒严期内，严禁任何单位和个人在森林防火戒严区域内吸烟、野炊、燃烧纸烛、鸣放鞭炮及爆破、烧荒、烧灰积肥等活动，违反本[illegible]由相关行政主管部门及其授权单位依法给予处罚；情节严重的，由公安机关依法予以处理；造成严重后果的，依法追究刑事责任。

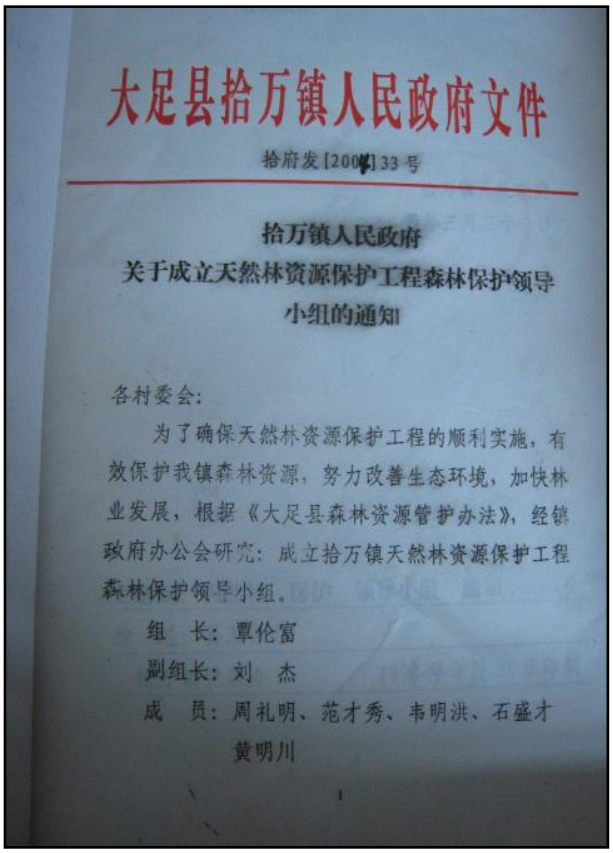
三、各机关、厂矿、学校组织入山旅游度假时，必须经有关街镇乡人民政府（办事处）和林业主管部门同意，在规定的时间和划定的范围内活动，严格遵守林区火源管理的规定。凡违犯规定引起森林火警火灾的，除对肇事者给予处罚外，同时追究组织者责任。

四、森林防火戒严区所在的街镇乡人民政府（办事处）要严格执行戒严令，认真搞好戒严令的组织实施工作；社会各单位、广大群众要自觉遵守戒严令的规定，严防森林火警火灾的发生。

五、本命令自发布之日起施行。过去公布的有关规定，与本命令有抵触的，以本命令为准。

二〇〇八年四月三日

Photo 1: Regulations on forest fire prevention issued by local government of Dazu County, Chongqing



大足县拾万镇人民政府文件

拾府发[200[illegible]]33号

拾万镇人民政府
关于成立天然林资源保护工程森林保护领导小组的通知

各村委会：

为了确保天然林资源保护工程的顺利实施，有效保护我镇森林资源，努力改善生态环境，加快林业发展，根据《大足县森林资源管护办法》，经镇政府办公会研究：成立拾万镇天然林资源保护工程森林保护领导小组。

组　长：覃伦富

副组长：刘　杰

成　员：周礼明、范才秀、韦明洪、石盛才
黄明川

Photo 2: Establishment of local NFPP committee in Dazu, Chongqing

Photo 3: An key informant interview: the director of Maiji forest farm explaining the regulations of NFPP and local forest management, of which are hanging on office wall, Gansu

Photo 4: Map indicating the local government structure and organization networks from Taohua Village, Gansu

Photo 5: Field reconnaissance survey in Maiji Village, Gansu

Photo 6: Key informant interview in Taohua Village, Gansu

Photo 7: Target group discussion (with leadership) in Taohua Village, Gansu

Photo 8: Household interview in Maiji Village, Gansu

Photo 9: Group discussion in Maiji Village, Gansu

Photo 10: Woman group discussion in Maiji Village, Gansu

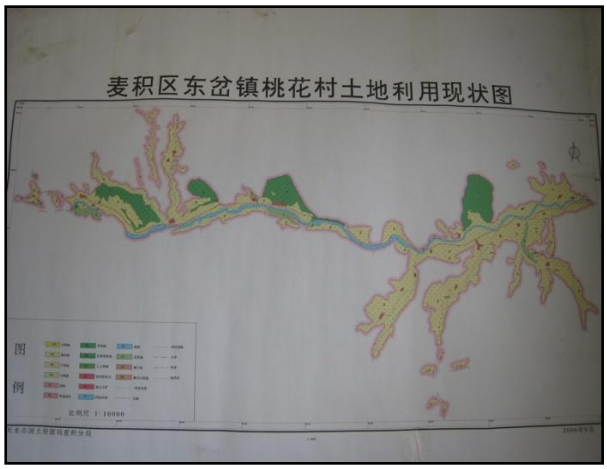


Photo 11: Land use map of Taohua Village, Gansu

Photo 12: Land use patterns in Taohua Village, Gansu

Photo 13: A reconnaissance survey in field

Photo 14: The truck, formerly used for wood transportation for farmers in state-owned forests, nowadays abandoned since the NFPP

Photo 15: The roof of a local farmer house made by woods

Photo 16: A view to Taohua Village, Gansu

Photo 17: Walnut (*Juglandis*) trees in state-owned forests in Maiji, Gansu

Photo 18: Local farmer collecting the Walnuts (*Juglandis*)- the fruits from forests in Maiji, Gansu

Photo 19: Apricot (*Prunus armeniaca*) trees near the farmer house

Photo 20: Peach (*Prunus persica*) trees cultivated by local farmers

Photo 21: Dried fruits of traditional medicine plants collected by locals in Gansu

Photo 22: Dried fruits of traditional medicine plants collected by locals in Gansu

Photo 23: *Huajiao*, Sichuang peper (*Zanthoxylum bungeanum*) cultivation in Chongqing and Gansu

Photo 24: Chestnut (*Castanea mollissima Blume*) trees in Maiji state-owned forest area, Gansu

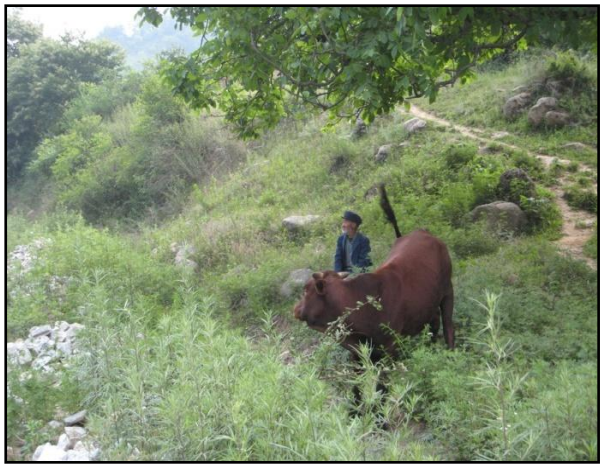


Photo 25: Grazing in Maiji forests

Photo 26: Livestock raising by local household

Photo 27: Alternative fuel use (coal for cocking instead of fuel wood)

Photo 28: Alternative fuel use (gas for cocking instead of fuel wood)

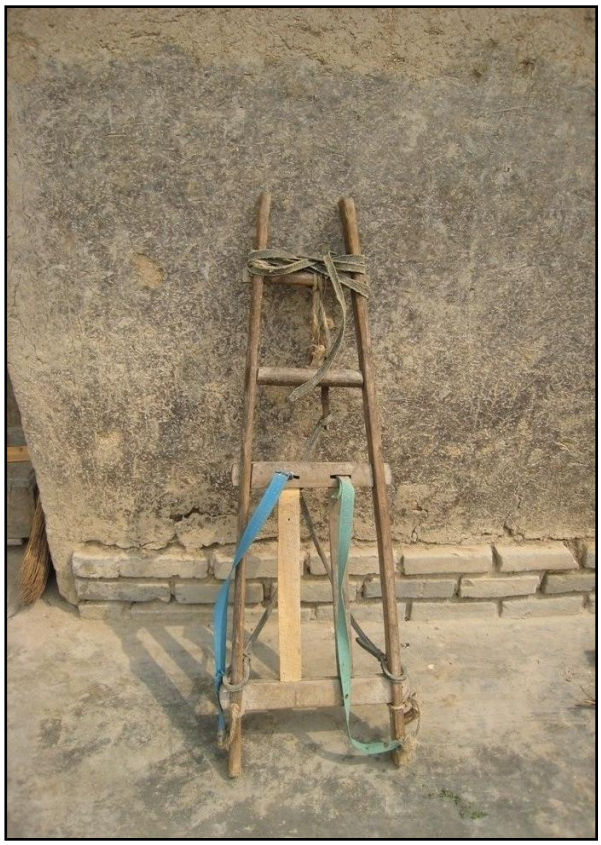


Photo 29: Tool for collecting fuel woods and crops

Photo 30: Tool for cutting and carrying the woods

Photo 31: Sacred forests, local access forbidden

Photo 32: Forests nearby the temple protected by locals due to religious purpose

Photo 33: Landscape including crops land, forest and farmer houses in Maiji Village, Gansu

Photo 34: Bee-honey cultivation by forests in Gansu

Photo 35: Forests in collective forest area in Dazu, Chongqing

Photo 36: Farmer houses in Nanmu Village nearby collective forest area of Dazu, Chongqing

Photo 37: Minority people in Taohua Village, Gansu

Photo 38: Household forests with crops in Xinshi Village, Chongqing

Photo 39: Landscape including crops land, forest and farmer houses in Xinshi Village, Chongqing

Photo 40: Crops farming in Nanmu Village, Chongqing

Photo 41: Traditional tool for fuel wood collection in Maiji Village, Gansu

Photo 42: Village school in Taohua, Gansu

Photo 43: Sleeve emblem for forest fire prevention in Chongqing

Photo 44: Caution from forest station in forest fire prevention in Dazu, Chongqing

Photo 45: Bamboo forests near the farmer house in Xinshi Village, Chongqing

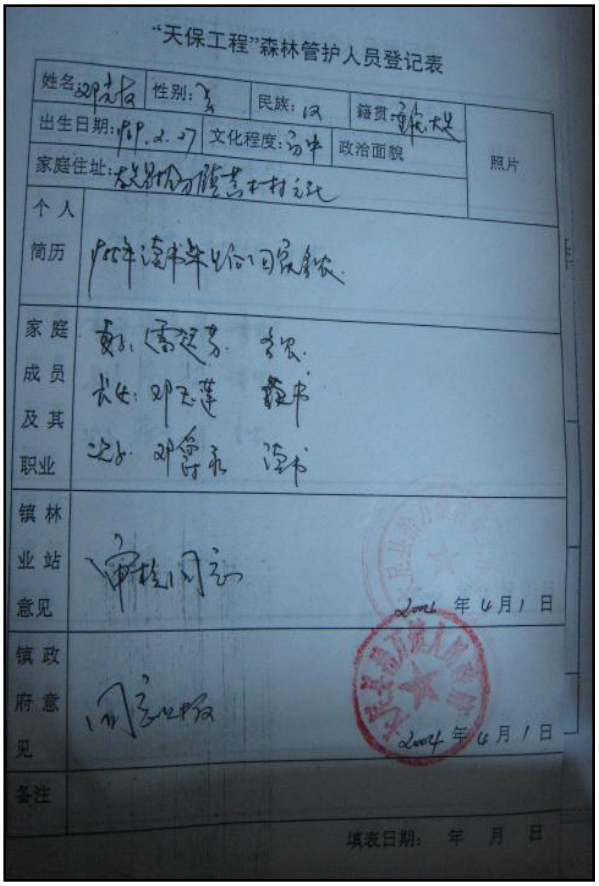
Photo 46: Target group interview in Xinshi Village

Photo 47: Crops land in Xinshi, Chongqing

Photo 48: Crops land in Taohua, Gansu

Photo 49: Formerly crops nowadays replaced by forests in sloping land in Taohua, Gansu

Photo 50: Forest God representing the religious value of forests in Taohua Village, Gansu


"天保工程"森林管护人员登记表

姓名		性别	民族	籍贯
出生日期		文化程度	政治面貌	照片
家庭住址				
个人简历				
家庭成员及其职业				
镇林业站意见				
镇政府意见				
备注				

填表日期：　年　月　日

Photo 51: Registration form of forest stewardship for local farmers in Nanmu, Chongqing

Photo 52: Honey bees, sources of producing honey and beeswax, domesticated by farmers near forests in Gansu

Photo 53: Collected edible mushrooms from local forests, Chongqing

Photo 54: "Wishes tree" representing the cultural value, ties hopes and wishes from local farmers in Xinshi Village, Chongqing

Erklärung

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Die Arbeit wurde bisher weder im Inland noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde zum Zwecke der Promotion vorgelegt.

Ich bestätige, dass ich die Promotionsordnung der Fakultät Forst-, Geo- und Hydrowisshenschaften der TU Dresden anerkenne.

Wang, Yi
Dresden, 02.06.2010