

ENVIRONMENTAL AND SOCIAL IMPACT ANALYSIS

STORA ENSO PLANTATION PROJECT IN GUANGXI, CHINA



Final Version

5 February 2006

Disclaimer: The Report is an independent result of an expert team commissioned by the United Nations Development Programme (UNDP), based on the team's analysis and research on facts, figures, scientific reviews, site visits, testimonies and surveys. The analysis and recommendations of this report do not necessarily reflect the views of UNDP.

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FOREWORD

The United Nations Development Programme (UNDP) is pleased to have been associated with the conduct of an Environmental and Social Impact Assessment (ESIA) on Stora Enso's forest plantation project in Guangxi Zhuang Autonomous Region in the People's Republic of China. This report presents key findings and recommendations of a half year long preparatory effort.

UNDP's decision to positively reply to Stora Enso's proposal and to undertake this ESIA was based on its previous experience in ESIA analyses and on its poverty alleviation and environmental experience in China during the past 25 years. It also has access to a worldwide knowledge network and expertise of the methodologies and procedures required for such an exercise. UNDP intends to use this opportunity to demonstrate the potential of these ESIA's to promote sustainable development and the importance of public and private partnerships to China's development.

China's accelerated growth has raised new challenges such as increasing disparities among people and environmental degradation. The links between human well-being and threats to the ecosystem are complex. Environmental sustainability is a major concern in China and is itself exacerbated by poverty. The current fragility of China's ecosystems may well pose serious challenges to sustaining high levels of growth into the first decades of the 21st century.

In response to such challenges, China's new development policy in 2002 calls for building a well-off society (Xiaokang) in an "all around way" by 2020. This vision for China's future is very much in line with the historic compact of the Millennium Declaration and its Millennium Development Goals (MDGs) adopted by world leaders at the United Nations in 2000. In March 2004, the National People's Congress of China adopted a scientific concept of development around five balances: balancing urban and rural development, balancing development across regions, balancing economic and social development, balancing development of man and nature, and balancing domestic development and opening up to the outside world. China is actively engaged in identifying best practices to achieve the balance between man and the environment in the overall efforts of achieving the MDGs and the goal of "all around" Xiao Kang .

The private sector is considered by all as a powerful engine of economic growth and a key driver to meeting the MDGs and achieving Xiaokang. Environmental and social responsibility have globally become part of the management philosophy of many businesses, which is also an essential factor for their long-term success. Capacities of the private sector have to be harnessed to foster development and poverty reduction. As part of a broader commitment to support Western provinces in China, community-oriented investments are crucially important to create local employment and wealth, while sustaining the environment. Stora Enso's decision to include this ESIA as part of its investment strategy is therefore a positive contribution to this approach.

UNDP hopes this ESIA can help Stora Enso make a positive contribution to the expanding estate of commercial plantations in China and offer a benchmark for operational best practices for large scale investment projects. It may also be of service to the Chinese Government in its goals of establishing criteria for "Green GDP", strengthening effective biodiversity management, and mainstreaming biodiversity in the planning and investment process. It is hoped that the findings and results of this ESIA can be widely shared and this ESIA can be used as a Public Private Partnership example for large scale investors.

Finally, UNDP wants to thank Stora Enso for offering this opportunity to demonstrate the validity of the ESIA as a good practice of Corporate Social Responsibility, and for possible future partnership initiatives.

A handwritten signature in blue ink, appearing to read 'Khalid Malik', followed by a long horizontal line.

Khalid Malik
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Beijing, 5 February 2006

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Abbreviations

BEKP	Bleached Eucalypt Kraft Pulp
CBA	Cost-Benefit Analysis
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CICETE	China International Center for Economic and Technology Exchange
CIFOR	Centre for International Forestry Research
CSR	Corporate Social Responsibilities
CTMP	Chemi-Thermo Mechanical Pulp
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
GXSE	Guangxi Stora Enso Forestry Co., Ltd
IRR	Internal Rate of Return
NBS	National Bureau of Statistics
NGOs	Non-Government Organisations
NPV	Net Present Value
OHSAS	Occupational Health and Safety Management System
PPP	Public-Private Partnership
R&D	Research and Development
RMB	Ren Min Bi (Chinese Currency)
SE	Stora Enso
STBA	Southern Tree Breeding Association in Australia
UNDP	United Nations Development Programme
WWF	World Wildlife Fund

Measurement Units:

1 hectare = 15 mu

1 US Dollar = RMB 8.17 yuan

Executive Summary

This report presents the findings, analysis, and recommendations of the Environmental and Social Impact Assessment (ESIA) on Stora Enso's forest plantation project in Guangxi Zhuang Autonomous Region, People's Republic of China, recently undertaken by the United Nations Development Programme (UNDP) during the period of 9 May to 15 September 2005.

1. Background on the Partnership and ESIA

Stora Enso, a Finnish-Swedish joint venture that is a leading global integrated manufacturer of integrated paper, packaging, and forest products, has a commitment to sustainability as the cornerstone of its operations and business strategy. As of August 2005, Stora Enso owns a plantation of 20,000 hectares of eucalypt hybrid trees in Guangxi. By 2010, Stora Enso plans to establish a sustainable fibre base of 120,000 hectares of plantation in southern China to support the development of its pulp and paper industry.

Stora Enso began discussions with UNDP's Liaison Office in Copenhagen for Nordic Countries in 2003 to explore the possibility of forging partnerships between UNDP and Stora Enso. As a result of these discussions and with regard to its forestry project in Guangxi, Stora Enso expressed its interest in exploring possibilities for cooperation with UNDP in China.

UNDP decided to lead and undertake this ESIA, because of its past experience with poverty alleviation and environmental projects in rural China, particularly in western provinces. More recently, UNDP has promoted Public-Private Partnerships by introducing the UN Global Compact to national and multi-national enterprises in China. The compact includes advocacy for Corporate Social Responsibility (CSR), a vision shared by Stora Enso. UNDP hopes this ESIA can help Stora Enso make a positive contribution to the expanding estate of commercial plantations in China and offer a benchmark for operational practices of international standard. It is expected that the findings and methods of this ESIA used could be widely shared, discussed, and critiqued. Environment and social impact assessments are still relatively new in China. UNDP hopes that this ESIA will also prompt interest and serve as a model for similar ESIAs in the context of other large-scale commercial and public projects to be developed in the future in China.

The specific objectives of the ESIA are to:

- Identify the groups affected by the project;
- Assess the environmental, economic, and social impacts of the project on local communities and, if appropriate, the region and society in general;
- Analyze and recommend how the positive effects might be increased and the negative impacts reduced;
- Suggest a monitoring framework, and
- Analyze development prospects and recommend options, including a set of development activities focused on ecosystem sustainability and poverty alleviation that may include establishment of a development fund.

The core prism in this ESIA is to promote the "people centered" concept that harmony between humans and the natural environment can be achieved by adopting the right measures in the business process of large-scale investment projects.

The ESIA analysis is largely based on a sectoral approach, with three main segments: (1) environmental, (2) social, and (3) integrated environmental-social. The guiding principles of the environmental impact assessment in the ESIA are facts and science from the scientific literature, empirical research, and experiments. Expert testimonies using the Leopold Matrix and questionnaires, designed as supplementary instruments to obtain the opinions of experts in various fields, were used to help identify and analyze the impact of eucalypt plantations on the environment and biodiversity. The social assessment used two main methods: (1) an extensive questionnaire-based survey of stakeholders and (2) in-depth interviews of stakeholders conducted by an expert team at provincial, county, and community levels. The integrated social-environmental analysis consisted of three main components: (1) analysis of affected communities' concerns about environmental impacts of eucalypt plantation (based on the social survey), (2) cost-benefit analysis, and (3) scenario analysis. For the cost-benefit analysis, a simplified matrix of potential beneficial and adverse impacts was developed. The scenario analysis presents two scenarios: (a) with Stora Enso and (b) without Stora Enso. It then evaluates each of these scenarios at the national, provincial, and local levels.

The ESIA has followed independent, ethical procedures. First, in no activity had the ESIA served specific commercial purposes and promote the company itself, its products or services. Second, ethical procedures were adhered to all interview processes for both the environmental expert testimonies and social surveys. The participants in such interviews were assured of anonymity, confidentiality and the right to withdraw from the consultation process without forfeit.

2. An Outlook on the Industry in China and Guangxi

China is today the world's second largest producer of paper and paperboard with an aggregate and expanding consumption of an estimated 48 million tonnes in 2003, compared with North America's 105 million and Western Europe's 86 million tonnes. Although national consumption is high, per capita consumption is only 37 kg/capita/yr, compared with 320 kg/capita/yr in the USA, but is expected to reach 65 kg/capita/yr by 2010. China's paper and paperboard sector will grow to 68.5 million tonnes by 2010, which will foster an increase in demand for fibre (non-wood pulp, recovered paper, and wood-based pulp) for all grades of paper.

Given current limited capacity of China to service the raw material needs of its pulp, paper, and wood products industries and pressure to import from world market, China's central government has adopted a series of key targets and measures for the development of the nation's wood fibre resources. These policies include incentives to develop the domestic wood fibre base to reduce China's dependence on imported wood fibre, paper, and processed wood products, and encourage foreign investment in the wood fibre, pulp, paper, and wood processing sectors through a variety of financial and tax incentives.

National-level targets call for the development of 13.33 million hectares of fast-growth, high-yield plantations between 2001 and 2015 requiring a total estimated investment of US\$8.65 billion. The central government is encouraging companies to integrate paper processing facilities with plantations by granting loan interest subsidies to virtually all forms of enterprises that invest in fast-growth, high-yield plantations. Within the national policy context, the government of Guangxi Zhuang Autonomous Region recently designed its forestry sector strategy calling for fast growing plantations for pulp making to be established around existing and new plants: 660,000 ha of fast growing plantations are to be established mainly in the areas of Qinzhou, Beihai, Liuzhou, and Hezhou.

Stora Enso began in 2002 to establish its China plantation of 120,000 ha in 15 counties or cities including Beihai, Fangcheng, Bobai, and Yulin, among others near Guangxi's coast, to provide raw materials to a proposed pulp mill. Stora Enso has started the application process for an integrated forest industry project

in Guangxi, including annual production capacity of about 1 000 000 tonnes of chemical and chemi-thermomechanical pulp, and about 1 000 000 tonnes of paper and board. Guangxi is one of the few places in China where Stora Enso could build a pulp, paper and board mill complex close to the plantations that the ESIA is conducted for. An investment of the size proposed by Stora Enso has the capacity to make possible impacts at the national, provincial and local levels.

3. Key Findings and Conclusions

Based on fieldwork results and the highly charged public debates on eucalypt¹ plantations, the ESIA recognizes public concerns in key areas, such as sustained plantation management; equity (large industry vs. small landholders and contracted labour); soils (long term damage, sustainability); water (disrupted hydrological cycle, competition with crops); biodiversity (monocultures vs. native forests and related community benefits, such as medicinal herbs, food etc); and landscape change (extensive plantations landscapes may offend aesthetic values).

When fully operational, the plantation project will bring about a variety of impacts, some potentially positive and others potentially negative. As the following chapters will show, some impacts can already be seen or are more easily predicted. Others are more difficult to anticipate given the lack of available data, especially concerning soil and water samples from areas within the plantation region. Ecological benefits are also anticipated, as the following sections will show.

At its anticipated peak of operation, the project will affect over 100,000 households in land leasing alone. This presents income-generating potential for those choosing to lease out their land, which could bring significant improvements in livelihood. The degree to which households benefit depend, in large part, on the contractual terms of that leasing arrangement and alternative land lease options available to them. In terms of employment, as many as 30,000 individuals will gain income-generating work opportunities. Some of these will be local residents, others will be migrant laborers coming to Guangxi to look for work.

The team did not discover any major “show-stoppers” or social or environmental disasters in-the-making having the potential to jeopardize Stora Enso operations in Guangxi. The ESIA, however, did find major challenges in the social dimensions, while environmental impacts are much more related to plantation operations and therefore can be mitigated through rigorous and disciplined management. The findings and conclusions are presented below by topical area.

3.1 Scenarios: With and without Stora Enso

National level. The With Stora Enso Scenario of plantation investments in Guangxi is consistent with Chinese government policies to meet projected needs, will form the foundation for a proposed national target of 2.7 million hectares of plantations committed to pulpwood production. The South Coastal Region is one of the identified priority regions and is suitable for the broad scale cultivation of eucalypts; The Without Stora Enso Scenario would not contribute to policy at the national level and would not change established Government policies regarding establishment in fast-growth, high-yield plantations and encouragement of foreign investment in the wood fiber, pulp, paper and wood processing sectors.

Provincial Level. The With Stora Enso Scenario will generate roughly a contribution of Rmb 1.1 billion GDP annually. It will offer tax revenues of an estimated tax Rmb 109 million annually. Behai city revenues will increase by Rmb 1.3 billion (from the current Rmb 1.6 bill) at the full Stora Enso pulp mill and plantation. Industry standards indicate that a pulp mill and plantation base of the proposed size can generate about 30,000- 35,000 jobs in the region through the pulp mill, plantation management,

¹ Throughout this ESIA analysis report, *Eucalyptus* is used for the formal generic name and *Eucalypt* refers to common usage.

harvesting, transport and service and supply industries. Stora Enso's presence will provide an international standard to the plantation and pulping sector in Guangxi, offering transparency and world class commitments to sustainability, the environment and to corporate social responsibility. The Without Stora Enso Scenario would not influence the magnitude and ambitious establishment of a large industrial resource of eucalypt plantations in Guangxi. If Stora Enso withdraws from the project it is highly likely that other companies and investors will fill the void. Should Stora Enso withdraw however, Guangxi faces the prospect of having a large eucalypt plantation resource without a substantial accompanying modern processing facility. This would represent a considerable loss of opportunity to the Region.

Local Level. The With Stora Enso Scenario offers landholders and stakeholders the stability associated with 120 000 ha of sustainably managed plantations linked to a modern mill. It brings with Stora Enso's technologies and commitment to Corporate Social Responsibility. This will inject land lease and rental monies in excess of Rmb 72 million annually to local forest farms and farmers in some of Guangxi's poorer counties. In addition to direct employment opportunities through staffing, the project offers labor opportunities of 4.6 million days of labor annually worth approximately Rmb 115 million to the local and migrant labor market. Part of the annual tax revenue generated by the project will flow back to communities in the form of government services and infrastructure. Improvements in the social and environmental impacts have been identified by the ESIA and are manageable and there are no technical impediments to sustainable production from the plantations. With the Without Stora Enso Scenario establishment of plantation eucalypts will remain an attractive land-use option. Field interviews have demonstrated that a strong interest exists with local leaders and entrepreneurs to make investments in eucalypt plantations. Such expansion of the eucalypt resource without the stability offered by a pulp mill, will introduce an element of commodity risk to local farmers. There was strong evidence from the field interviews and inspections that local investors and growers did not share the same commitment as Stora Enso to sustained productivity or social and environmental values.

Eucalypts are a preferred source for high quality fibre for China's expanding modern pulp and paper industries. Given the positive and supportive policies at national and provincial level and the pressing market needs, the EISA team considers it inevitable that the commercial eucalypt plantation estate in southern China and specifically Guangxi will expand substantially. Provided the principles of sustainable plantation management are respected and followed, eucalypt plantations offer an economically, socially and environmentally attractive option for supply of high quality raw material to meet national needs.

3.2 Environmental Impacts

Plantations of eucalypts in Guangxi are largely established on degraded or deforested land or replace low yielding pine plantations or unecomonic fruit orchards. The plantations thus create a new forest resource and will offer a valuable alternative to logging and conversion of old-growth forests in other parts of South East Asia, where governance issues are sometimes a major concern. The results of a review of available literature and experiences on the environmental impacts of eucalypts are consistent with the expert testimonies conducted and indicate that eucalypt plantations will in general not affect water resource and water quality in the region and will be helpful for soil and water conservation.

Water

The issue of eucalypts and water consumption will not be a constraint in the high rainfall, high humidity conditions of the areas of Beihai, Yulin, Nanning, and Fangchenggang. There was little information publicly available on water balance at sites with <1200 mm rainfall, such as Dongmen, where the investor should consider introducing wider spacing of plantations to reduce water use per unit area. The team identified a knowledge gap on the impacts of intensive silviculture (such as high fertiliser application) on the water quality of runoff. There is therefore a need to monitor water quality under commercial plantation management.

Soil

Enhancing the chemical and physical properties of soils will be the foundation for sustained productivity of Stora Enso's plantations. Ongoing experiments in nutrition should be a feature of Stora Enso's R&D program. Stora Enso will operate tractor ripping for site preparation on flat lands and hole site preparation for hilly or mountainous lands. As total soil tillage is not used in Stora Enso's plantations and all roots of harvested trees are kept at site, soil erosion will be substantially reduced.

Tree Breeding, Pests, and Diseases

Eucalypt plantations in Guangxi increasingly rely on planting material from a very narrow genetic base, presenting a serious risk to productivity through predation by pests or diseases. A disease resistant genetic selection program and a broader selection of high yielding clones² selected for wood quality, as well as a disease and pest monitoring program, should be part of Stora Enso's R&D program. The eucalypt rust *Puccinia psidii* poses a potential threat to the eucalypt forest industry in southern China and has recently been recorded in Hawaii. Any proposals to transfer germplasm from South America should be discouraged or given the greatest phytosanitary caution.

Biodiversity

The biodiversity of a natural forest in Guangxi and that of a eucalypt plantation are not comparable. Local natural ecosystems are very diverse, whilst the biodiversity of mono-specific plantations is limited. Stora Enso has committed itself not to convert native forest to eucalypts. The appropriate comparison is not between eucalypt plantation and biodiverse native forest, but between eucalypt plantation and the human-modified habitats that currently exist on the land that will be converted to eucalypt plantation. These are largely plantations of pine, sugar cane, highly degraded forests, grasslands, bare lands and non-economic fruit orchards. None of these habitats are believed to support significant indigenous biodiversity, either in terms of species richness, genetic diversity or key endemic or threatened species.

There is no evidence that eucalypts as introduced species has any direct impact on biodiversity at the genetic and species levels. No cases of eucalypt spreading outside of their planted forest ecosystems into the natural flora have been recorded in China.

Guangxi is highly diverse and contributes significantly to China's overall biodiversity, but this biodiversity has been threatened by loss, degradation and fragmentation of habitats, and by hunting and over-collection of valuable species. Many species are threatened with extinction in Guangxi, and the needs of these species and their habitats should be considered by any development project, particularly if project sites are near or adjacent to key natural habitats, such as existing or proposed nature reserves. Issues such as hunting and collection of forest products by migrant workers and fragmentation of natural forests need to be considered when siting and managing plantations.

Stora Enso project areas accounts for only 5 percent of the total land area of the counties involved. The assessment indicates that no obvious landscape and biodiversity changes will be caused by this project alone. However, the project must be considered in the context of larger changes in Guangxi's landscape. Besides Stora Enso, several other companies and private investors also have active plantations and, in total, eucalypt plantations will account for around 40 percent of the total commercial plantations in Guangxi. About one tenth of Guangxi is considered suitable for fast-growing plantation forestry, and by 2010, the area of intensively managed forest plantations established with all species will reach 1.0 million ha. Most of this is expected to be concentrated in the south and south east of the province.

² Throughout this ESIA analysis report, the technical term "clones" of eucalypts refers to simply vegetative propagules through a conventional tree breeding methodology in plantation forestry.

Although most of the original vegetation in Guangxi was lost long ago, an intricate mosaic of agricultural ecosystems and native and planted-forest ecosystems co-exist and shape the landscape today. This landscape variation is very diverse and to some, aesthetically attractive. Landscape diversity may provide significant benefits to the industry in the long-term by reducing risks from pests and disease. Management at a landscape level should be one of Stora Enso's major considerations for the long-term sustainability of its eucalypt plantations. Genetic diversity is critical for the success of plantation forestry as it affects adaptability and resistance to the physical environment and to biotic disturbances. Because of the ease of hybridization and vegetative propagation of eucalypts, rather than using biodiversity at the species level in plantation operations, more clones of eucalypts should be developed and used, especially, at landscape level.

3.3 Social Engagement

Effective and positive engagement, especially between the company and those renting land, is critical to the success of the project. A number of specific recommendations to facilitate constructive communication follow below. Stora Enso's plantation program directly involves more than 10 different types of local affected groups (e.g. farmers renting land, migrant labour, state farm staff, etc.). When functioning fully it will affect a population on the order of 650,000 people in 130,000 households through land rental alone. While offering potential income opportunities, especially on formerly unproductive wasteland or slopeland, this project also offers substantial challenges in engaging and communicating effectively. Poor initial engagement with affected communities could present considerable risks to Stora Enso's plantation business. Should communities refuse to rent land, or offer labour or, in the worst case, prevent Stora Enso from conducting its legitimate operations through civil disobedience, the business attraction of the Guangxi project will be diminished.

Information Flow and Gap

A critical need exists to improve the flow of information from the company to its "village rental" and other stakeholders and to ensure greater transparency in the process. A striking finding of the survey is that stakeholders have a strong desire for information on the company and its plantation project. Survey results also show that while stakeholders do have some information on the project, they rarely get it directly from Stora Enso. Information relating to land rental must reach those who use the land, not simply village and community leaders. Although the scientific review and expert testimonies conducted do not suggest negative environmental impacts, the large scale survey and expert fieldwork found that people appear genuinely worried about the environmental impacts of eucalypt on human, animals, crops, soil, and water. Local communities and households should be given the information they need to alleviate their fears. In addition, some of the ecological concerns voiced may actually have been a means of indirectly expressing overall dissatisfaction with the rental, in which case the roots of this dissatisfaction (e.g rental terms, participation, etc., as discussed elsewhere) must be addressed.

Land Rental Decision Making Process

In terms of village land use rights, land rental in village areas includes both private and collective land³. The ESIA found participation in the decision to rent collective land to be weak. The majority of project village households surveyed indicate a small group of people had represented their community in making the collective rental decision, while only about 30 percent indicated that the collective had followed the legal procedure of at least two-thirds vote for the decision of collective land rental. Some village households renting private land also expressed a feeling of not having been given a choice in the matter.

³ "Private land" is here defined as land for which the household has been granted individual use rights by the collective. "Collective land" as used here may refer either to land for which a lower level of collective unit (e.g. villager's small group) has been granted use rights by a higher level collective unit (e.g. administrative village) that owns the land or to land that is owned directly by the same level of collective as that using the land.

These results are likely linked much more closely to the traditional practices of public decision-making in the areas involved than to any special characteristics of Stora Enso's project.

While it would be difficult and inappropriate for Stora Enso to attempt to directly influence the collective decision-making process, both the company and the government should make greater efforts to ensure that private land rental is in all cases fully voluntary and transparent. Generally, findings suggest that farmers have made a rational choice to rent out their land, despite the possibly lower income per mu relative to other options, because of certain constraints such as the financial strength, know-how, and economies of scale needed to develop the alternatives. Farmers, however, lack an advocate in the rental process to help them make decisions and consider the longer-term implications. Also, while findings do not indicate that middle-persons (either those that "introduce" rental opportunities to the company or those that rent land from others and then re-rent to the company) benefit excessively from their role, there is a need to monitor their benefits. Ideally, given increasing divisions (in terms of income) in rural China, Stora Enso would cooperate directly, to the extent possible, with those renting out their land, so as not to promote such divisions.

The ESIA team also revealed that dissatisfaction with the rental process on collective land could originate not in actions made by the company, but in the decisions over whether or not to rent collective land and how collective rental income is spent. In contrast to findings on private land rental, in which households are indeed the final decision-makers, the analysis found participation in decisions over community land to be weak. These decisions are made completely separate from the company, and separate to the company's lease terms, but might influence overall impression of the company and the desire to lease land in the future. This conflict is best resolved at the local village level, but could be moved along with support and encouragement from the company given the stake that all entities have in making land leasing a win-win situation.

Stora Enso also rents land from state forest farms. Results indicate that state farm staff in project areas, as a group, do not strongly support land rental to Stora Enso, are not involved in the decision (though their involvement is not legally required) to rent, and are not very aware of rental terms. Interestingly, however, 83% of state farm households who participate in work on Stora Enso plantations and who responded to the surveys revealed that their annual cash income had increased by 2872.2 yuan. Findings suggest a need to explore further the issue of participation of state farm workers in rental decisions or at least ensure they are informed and benefit from the rental.

Concerns Regarding Fuelwood

Results suggest the poorest in the community still depend on fuelwood collected from collective and private use forest land. Fieldwork uncovered perceptions that these people will be denied access to fallen woody branches or woody harvesting residues in areas under Stora Enso's management. Discussions with Stora Enso managers suggest that, while the company wishes to keep leaf and bark residues on site for soil protection, nutrient recycling, and water conservation, it is willing to allow collection of fallen woody branches and woody harvesting residues for fuelwood. This important message has not yet reached the affected people.

Records of Village Stakeholders

Accessible records of village stakeholders will be an important tool for the company as it strengthens its contacts with village and community stakeholders. Computer-based systems will be very useful and the company should upgrade its information systems to accommodate a database including, to the extent possible, the name, location, and nature of rental of each and every household involved in the project. The database might also keep a record of company liaison with and information flow to each of these households.

Perceptions of Slowness

Some villagers are concerned about Stora Enso being "slow" to develop the land. They worry they will not receive rental payments. Particularly, when Stora Enso does not develop the land for some time after rental, their concerns tend to grow. Findings indicate that in some cases rental payments have been delayed because of slowness in determining exact land area and borders, while, these issues are not unique to Stora Enso, and are typical of land boundary issues in rural China.

3.4 Employment, Special Populations and Other Issues

Stora Enso plantation work presents an opportunity near to home for those locals that do not wish to out-migrate, though may not offer as many months per year of work as out-migration. Across survey groups, results indicate that respondents are not dissatisfied with their working conditions as compared to the alternatives, but nor do they believe their working conditions are particularly good compared to other options.

Employment Opportunities

Full-scale plantation employment generation once operations have reached steady state is estimated to be between 12,400 and 14,400 full-time jobs. A rough industry standard for all direct and indirect jobs, both related to plantations and the pulp mill itself and based on the scale of the planned mill, is 30,000 to 35,000 full-time jobs.

Work Contracts, Wage, Emergency Services, and other Employment Issues

The survey and expert fieldwork indicate that most employment on Stora Enso plantations (handled by contractors that develop the plantations for Stora Enso) is in compliance with local labor regulations and that serious employment problems have not emerged. Yet, there are a number of key areas with regard to employment that Stora Enso may wish to be aware of. First, contractors rarely have formal written contracts with the workers that they employ and have verbal agreements instead. According to officials at the Guangxi Labor Bureau, if work is both for over three months and for 30 or more hours per week, then, contractors should be providing work contracts. Based on wage rates quoted in fieldwork, the minimum wage level set by the Labor Bureau is in most cases being met by Stora Enso contractors. Labor disputes have not become an important issue for workers involved in Stora Enso plantation development, though Stora Enso should be aware that such disputes do occur in the plantation contracting business. Serious on-the-job health and safety problems are uncommon among those working on Stora Enso's Guangxi plantations, though one important issue identified in the field is workers' lack of access to emergency services for cases such as urgent illness, injury, or exposure to natural disasters. Lacking permanent local accommodation, most migrants live in simple work sheds or tents near the work site. Living conditions, while typical for this type of work, are poor.

Women

Overall, work opportunities on the company's plantations do not appear to be higher for women than for men. Women, however, may appreciate the benefits from the project for different reasons: Some women, particularly those with children, do not want to out-migrate for work and appreciate the flexibility of plantation opportunities. Also, through increased income, their role in decision making is strengthened. A negative impact of involvement on women would be higher work burdens, as most women will still have to perform their traditional household and agricultural activities in addition to their newly found work.

Ethnic Minorities

The proportion of minorities involved in village land rental to Stora Enso is small, but the counties and districts in which Stora Enso currently leases village land or may lease village land in the future have a minority population of about one million, or about nine percent of the total population of these areas. The main minorities in current and future Stora Enso village project areas are Zhuang, Yao, and Jing.

Minorities appear to be much more prevalent among migrant workers on Stora Enso plantations than among land renters. The ESIA team discovered well-integrated relations between Han and minorities.

Poor Households

The large role of migrant labour in the project and the significant proportion of migrants from Northwest Guangxi imply the project areas not to be the poorest within Guangxi. Guangxi has 4,060 "poverty villages." From 2005 to 2010, the province plans to conduct a poverty alleviation program for all these villages in three phases. The first phase will include 1,731 villages. Altogether, there are a total of 150 of these phase one "poverty villages" in the Stora Enso areas, making up about nine percent of phase one poverty alleviation targets.

Poorer households may be more willing to rent land to Stora Enso than others for reasons of: lacking financial resources to invest in their land, insufficient household labor to work on their land, urgent capital requirements for a particular reason, or desire to use the rental money as core investment for shifting themselves out of poverty. Thus, this group deserves special attention from Stora Enso.

Natural and cultural heritage

No major structures or sites of natural or cultural heritage significance were identified in the project area. Tombs and burial sites within plantations are believed a common issue to be addressed. While during the field visits and discussions with field managers and villagers, the team did not observe any evidence of conflicts on such an issue. It is believed, future graves can be an issue.

3.5 Development Needs

The most important development priorities of surveyed groups in project areas are: irrigation, roads, medical services, and drinking water. These priorities provide indications to how Stora Enso might integrate its plantations (e.g. through road development) or non-project development work (e.g. work in healthcare, irrigation, or drinking water) to address the most pressing community development needs.

Micro-Credit

Results indicate that interest in getting a loan is high among affected groups in project areas and higher than the proportion that believe they can get a loan through existing channels.

Health Services and Education

Health services and education are priorities for large proportions of project area respondents. The improvement of community medical services could be integrated into Stora Enso's corporate policy for its field workers' health and safety. Education is also a sector in which needs in the area are strong and which is conducive to development projects.

Rural Tele-centres

While village respondents put a low priority (among other options) on telecommunications and the internet, an idea that would combine the company's needs to communicate with stakeholders with a development project is village tele-centres. The concept would call for the installation of a computer with internet connection (when possible) in project area natural villages. Villagers could use the centre to access information on Stora Enso, communicate with the company, and view materials on eucalypt plantations. Meanwhile, these centers could also function as a social gathering venue for entertainment, market information for their household agricultural and other products, information on employment opportunities, etc.

Eucalypt Plantations

The survey and fieldwork indicate that some local people would like to develop their own eucalypt plantations, but lack the necessary funding, knowledge, and technology.

Development Initiatives in Migrant Communities of Origin

Stora Enso may also wish to consider a non-profit development initiative in migrant villages of origin, keeping in mind their top-reported priorities of roads, water supply, medical services, and housing.

4. Recommendations for Stora Enso

Given the complex land tenure issues in southern China, it is highly unlikely that any one company will be able to control the entire resource base necessary to supply a large modern pulp mill. It is inevitable that smaller growers and plantation managers will become an intimate part of the wood supply equation and industry partnerships with smallholders will expand. The ESIA has found that while the issues surrounding sustainable productivity and the environment (specifically water and biodiversity) can be adequately addressed, the greatest challenges facing Stora Enso in its Guangxi operations are those relating to effective and positive engagement with landholders, including private households and collectives, and the surrounding local communities.. To mitigate these existing and potential negative impacts and maintain the “good will” of the plantation project, the following recommendations, organized under four thematic areas, are made by the ESIA team.

4.1 Technical Knowledge and Sustained Productivity

Stora Enso should maintain its commitment to a robust program of applied R&D and maintain its engagement with research providers in China and other countries. Important elements of the R&D program should include:

- Monitoring of water quality of runoff from intensively managed plantations and water use at sites where rainfall is less than 1200 mm.
- Experiments in nutrition to maintain and improve the chemical and physical properties of soils.
- Optimisation of the amount of fertiliser applied in the plantations to minimise leaching while maximising growth.
- A monitoring program for pests and diseases
- A breeding program which seeks to develop (or gain access to) a broader suite of clones as early as possible.
- Consideration of a cooperative breeding program with other commercial eucalypt growers in southern China.
- A program of practical biodiversity conservation which focuses efforts on selected sites and utilises the technical skills within the company.

4.2 Awareness Campaign, Participation and Engagement with Society

As top priority for communications work:

- The company should strengthen its communication practices with local communities and seek expert advice on means through which more effective and transparent flow of information to all levels of affected communities can be achieved.
- The company should address, as a matter of urgency, issues surrounding clarity and transparency of rental agreements, fuelwood collection, and community perceptions of slowness. As a specific module in its communication program, the company (and its Government supporters) should not leave the eucalypt rumors within the communities unaddressed. Brochures, field demonstrations, and face to face meetings with concerned communities should all be a part of a program that seeks to reinforce the environmental credentials of the eucalypt program.

Many problems in communication and lack of participation stem from the actual rental process itself, one that operates within already established local power frameworks that exist largely independent of Stora

Enso, While recognizing this, relationships created between the company representatives, middlemen, decision makers in collectives, local government, and laborers also influence the degree to which households can benefit from new opportunities, on the one hand, or avoid negative impacts of the project on the other. In this light, the company may also wish to employ a number of additional means to support better awareness and participation, such as:

- Maintaining a greater presence of national and foreign staff in the field to help explain the project directly to people.
- Development of peer support groups within villages.
- Establishment and support for forest plantation associations, which include land users and managers, contractors, and other stakeholders.
- Expansion of the functions of the company's Hotline.
- A strengthened schools' program and additions to the curricula.
- Development of tele-centres (web-based information systems) as a part of the school computer program or general village out-reach.
- Regular excursions organized for local communities to plantation sites. In the longer term, an annual opportunity to visit the pulp mill.
- Introduction of communications approaches with sensitivity for gender, ethnicity, and poverty.

4.3 Commitment to Stora Enso Corporate Policies

There is a difference between what is legally acceptable for establishment of plantations in rural Guangxi and the highly regarded Corporate Social Responsibility (CSR) principles of Stora Enso. To maintain a position as an employer of choice for plantation workers in southern Guangxi, Stora Enso should offer a safe and healthy work environment. The following recommendations are offered:

- Stora Enso provides clear guidelines for minimum working conditions and wages to its contractors, and makes these publicly available to the local communities and migrant workers.
- A comprehensive monitoring system is introduced for contractors to ensure that the legal requirements for minimum wages are met and that they follow corporate guidelines.
- The company works with contractors to improve the living conditions of migrant workers, taking into consideration supply of minimum standard temporary accommodation and drinking water.
- Whilst migrant relationships with local communities are wider problems best dealt with by local governments, Stora Enso sets an example through encouragement of its staff to treat migrants well through a corporate culture that encourages respect.
- The company, in consultation with local authorities, develops processes to resolve labor disputes should these arise (especially important given the general absence of written labor contracts between workers and the contractors).

4.4 Development Initiatives

Stora Enso has expressed an interest in continuing to pursue development projects in affected communities. Stora Enso is not a specialized development agency itself. At the same time, in the spirit of Public Private Partnership, Stora Enso may consider cooperating with and engaging international and national development agencies, government institutions, and NGOs to meet priority needs of social and environmental development in its project areas.

The ESIA results indicate that top development priorities of stakeholders in village areas are irrigation, roads, medical services, and drinking water, while for forest farm communities these are medical services, roads, provision for the aged, and improvement of living environment. Education is also an important area for a large proportion of respondents in both groups.

A *social development fund* could be conceived as an umbrella mechanism to meet these above priorities of development needs of the project communities. Such a fund can strategically target the following areas:

- Focusing on drinking water or medical services or expanding work in the education area.
- Introducing a micro-credit mechanism in affected communities, for instance, targeting eucalypt planting, with the corollary benefit of increasing the supply of market pulpwood.
- Establishment of village tele-centers. These could provide computer and internet access in project villages and might also be used by Stora Enso to communicate with villagers about the project and provide them with educational information on relevant topics, such as the impacts of eucalypt plantation, and any information necessary for them to improve their livelihoods.
- Contract consulting firms for micro-entrepreneurship and vocational training to state farm workers and villagers who have rented out their land and want to develop small business or work in non-farming sectors.

Significant opportunities now exist in Guangxi to improve the status of native biodiversity by reducing habitat fragmentation and increasing connectivity through forest restoration. Stora Enso should avoid foreclosing on these opportunities by converting areas that have potential value for this effort, such as lands in or adjacent to existing or proposed protected areas, or land straddling between blocks of healthy natural forest. It is recommended that the company contributes some of its substantial technical expertise to help efforts to restore natural forests by supporting nurseries of key native species, particularly rare lowland species now mainly found in *fengshui* forests, for use in restoration programs.

5. Issues and Recommendations for Government Stakeholders

Whilst the Environmental and Social Impact Assessment of Stora Enso's eucalypt plantation project in Guangxi has an obvious focus upon the company's operations, other needs were identified during the fieldwork and surveys. Three such needs which deserve attention from Government administrations are:

5.1 Revenues and Tax

The study has demonstrated that the Stora Enso project will deliver substantial revenues through taxes, fees, levies and other administrative imposts from local governments. The current ESIA analysis could not identify actual future allocation and expenditure of such tax and revenues. In particular, it is unclear how large a proportion of government revenues from the project will be returned to the plantation communities for environmental and social needs. It is critical that the investment will directly generate sound social and environmental results, while pro-poor redistribution of the tax revenue is fundamentally important for equity and quality service delivery to vulnerable groups and communities.

In the past, a significant part of the mill door delivered cost of wood in Guangxi was taxes and fees. While these have been reduced substantially, there is still some lack of clarity with regard to taxes and fees. Earlier studies in Guangxi in 2003 identified some 30 different taxes, fees, government charges, and other levies, which were due between harvesting and delivery to the mill gate. In Jiangxi, similar studies have identified some 14 "unofficial forestry fees" imposed by county, prefecture, township and village administrations. Whilst these taxes could potentially benefit the broader community, they have in the past also acted as a serious disincentive to growers of commercially grown wood and successful and competitive wood processors. The issues surrounding tax on commercially grown eucalypt wood in Guangxi are far from clear and there is a pressing responsibility for Governments and administrations at all levels to provide clear and unambiguous rulings.

5.2 Advocacy for Viable Land Use Options

As do most plantation companies, Stora Enso disseminates information about the benefits of plantation forestry as a viable land use alternative. Following government priorities to promote the plantation industry, the provincial government and administrations at city, county and collective levels also disseminate information that is pro-plantation. The ESIA study could not identify any source of impartial advice for farmers and communities wishing to assess and discuss land-use options for their private and community lands. The benefits of impartial, third-party information include better-informed land-users with a greater commitment to the land-use choice they have made. Such an impartial information source would avoid land-users placed at a disadvantage due to lack of information, especially when discussing and negotiating land lease contract terms with companies or forestry bureaux. The ESIA team suggests that such a mechanism be put in place.

5.3 Support for Stora Enso's CSR and sustainable plantation policies.

Whilst Stora Enso has a corporate commitment to CSR and to transparency, these worthy principles can only be delivered within the context of China and Guangxi. If Guangxi is to benefit from Stora Enso's high technical, environmental and social standards, then the Government should be encouraged to work with the company to facilitate achievement of these standards. Examples where such dialogue and cooperation might be required are via accurate mapping of natural habitats not suitable for conversion, equitable and transparent systems for land acquisition, treatment of migrant workers and exchange and transfer of hybrid clones. This issue should remain a regular item of discussion between the company and the Guangxi authorities and is critical in the possible absence of media coverage or supportive NGOs.

5.4 Maintenance of Landscape Diversity

In promoting and expanding the substantial eucalypt plantation base in Guangxi, maintenance of landscape diversity will remain an important consideration in sustainability for all plantation growers. There is a role for the Provincial authorities to offer coordination in southern Guangxi to balance the legitimate commercial needs of Stora Enso, Asia Pulp and Paper, Guangxi Oji Plantation Forest Co and other growers with the needs to maintain healthy landscape diversity.

5.5 Monitoring and Adaptive management

Finally, both the Government and Stora Enso will need to monitor and respond to issues which might affect productivity, the environment or the community. Monitoring systems will provide the data against which Stora Enso's own commitments to Corporate Social Responsibility and sustainable plantation management will be judged. An environmental and social monitoring plan is important and would be integrated with the regular monitoring of plantation productivity and should logically incorporate the elements of maintenance and improvement of site productivity, clone performance, issues relating to soils, quality and quantity of water and biodiversity at species, ecosystem and landscape levels, social issues relating to skills development, poverty, access to infrastructure and services, quality of life, gender and levels of community consultation and participation. Mechanisms should be put in place to provide guidance to plantation managers based on the results of monitoring, so that management practices can be adapted as needed.

6. Content of Full Report

The full report presents the findings, analysis, and recommendations of the environmental and social impact assessment (ESIA) team. It is divided into six parts. The opening part, Part I, provides background on Stora Enso and the geographical, policy, and industry setting in which its Guangxi plantation project is being carried out. Parts II through IV present the ESIA analysis and findings. Part II discusses issues related to the productivity and sustainable management of eucalypt plantations and especially Stora Enso's approach to eucalypt plantation management in China. Part III, "Environmental Impact Analysis," covers project impacts related to water, soil, carbon sequestration, and biodiversity. Part IV, "Social Impact Analysis," presents findings and analysis of social impacts of the project, including results of an extensive survey of households and other stakeholders. Part V presents special analyses integrating social and environmental impacts, including environmental concerns of local stakeholders, a cost-benefit analysis, review of impacts on natural and cultural heritage, a scenario analysis as well as a monitoring framework in issues and risks identified by the ESIA. The ESIA team fully recognizes the importance of the interplay between social and environmental impacts; and, thus, other sections, in addition to the integrated analyses of Part V, address the interplay as appropriate. For example, the environmental discussion of soils covers impacts and suggestions regarding use of tree litter by local communities. The report closes with, in Part VI, a consolidation and presentation of key conclusions and recommendations from the analysis.

Part I

Background

Before results are presented in subsequent parts of this report, Part I reviews pertinent background information (Chapter 1). Background information begins with an introduction, provided by Stora Enso, on the company, its purpose in coming to Guangxi, and reasons for commissioning this environmental and social impact assessment. Next, the report presents background on Guangxi Zhuang Autonomous Region and its plans for its forest and forest products sectors. Guangxi, the province in which Stora Enso's China plantation project is located, has ambitious targets for expanding plantation area and industrial capacities in forest products, particularly pulp and paper. Background on provincial plans is followed by an introduction to the national policy context, which also shows ambitious plans and strong support for plantation forestry. The Chapter then presents background on sustainability as relates to the project, first reviewing Stora Enso's successful record to date in sustainability in its worldwide operations and then introducing principles of sustainable plantation forestry.

Chapter 1. Background

1.1 Stora Enso: Background, Purpose to Guangxi, and Motivation for ESIA

Company Background and Reasons for Investing in Guangxi

Company Profile

Stora Enso is an integrated paper, packaging, and forest products company producing publication and fine papers, packaging boards and, wood products, areas in which the Group is a global market leader. Stora Enso sales totalled EUR 12.4 billion in 2004. The Group has some 45,000 employees in more than 40 countries in five continents. Its annual production capacity is 16.4 million tonnes of paper and board and 7.7 million cubic metres of sawn wood products, including 3.2 million cubic metres of value-added products. Stora Enso's shares are listed in Helsinki, Stockholm, and New York.

Stora Enso serves its mainly business-to-business customers through its own global sales and marketing network. A global presence provides local customer service. Customers are large and small publishers, printing houses, and merchants, as well as the packaging, joinery and construction industries worldwide. The main markets are Europe, North America and Asia. The Group has production facilities in Europe, North America, and Asia. Its modern production capacity and the good integration between raw material, energy, and efficient processes ensure production continuity.

Stora Enso is committed to developing its business towards ecological, social, and economic sustainability. This commitment is demonstrated through its values and its environmental and social responsibility policy. Stora Enso is the only forest products company that has been included in the Dow Jones Sustainability Index (DJSI World) since it was launched in 1999. Stora Enso is also included in the FTSE4Good index.

Stora Enso in China

Stora Enso's Suzhou Mill in Jiangsu Province, with an annual production capacity of 240,000 tonnes, is one of the largest manufacturers of coated fine paper in China. In Hangzhou, Stora Enso has a core factory with an annual production capacity of 30,000 tonnes. In 2004 Stora Enso started a joint venture with Shangdong Huatai Paper of China to assess the feasibility of publication paper production in China. In August 2005 Stora Enso signed a letter of intent with the Chinese board producer Foshan Huaxin Packaging to start liquid packaging board production in China. In Guangxi Zhuang Autonomous Region, in southern China, Stora Enso is establishing industrial plantations and owns at the moment about 20,000 hectares of plantations.

Stora Enso Guangxi: An Integrated Forest-Pulp-Paper Project

China is one of the biggest and fastest growing paper markets in the world, but the country faces a critical shortage of locally produced and sustainably managed timber and wood fibre. Stora Enso established Guangxi Stora Enso Forestry Co., Ltd in 2002, with headquarters in the provincial capital, Nanning, and operational headquarters for plantation management in Hepu. Stora Enso Guangxi's overall development plan is guided by the Guangxi government's stated priority to develop fast-growing, high-yield plantations as a key priority industry for the region. The company's final goal is to develop an integrated forest-pulp-paper industry in southern Guangxi supporting a 600 000 ADT/a chemical pulp mill using a local raw material forest base.



Picture 1. Stora Enso plantation project location in China

Stora Enso's China plantations are located in southwestern Guangxi, primarily in five counties on or near Guangxi's coast. As of August 2005, Stora Enso Guangxi is managing 20,000 hectares of plantations mainly consisting of eucalypts. The unit plans to manage 120,000 hectares of plantations by the year 2010. Stora Enso Guangxi works together with local government authorities who identify appropriate land and facilitate the acquisition process. This process will be explained in more detail in later sections of this report.

Motivation for ESIA

Stora Enso Commitment to Sustainability

Stora Enso has publicly stated a commitment to sustainability. Its operations worldwide must adhere to the Group's Environmental and Social Responsibility Policy (see Annex I), as well as its Principles for Corporate Social Responsibility. Stora Enso Guangxi aims to achieve the targets included in these policies in the long-term, and is therefore striving to minimize any possible gaps between the high level set by the Group's worldwide targets and its operations in Guangxi.

Stora Enso Guangxi's plantation development project involves complex land leasing arrangements and a wide variety of stakeholders, including individual local land owners, collectives, state-owned farms, government bureaus, and contractors, among others. Stora Enso recognizes that only by thoroughly understanding the role of stakeholders in its business, potential impacts on stakeholders and the environment, and how those impacts occur, will they be able to design plans and policies for their Guangxi plantations that meet standards for sustainability and corporate social responsibility. The company further recognizes that the complex dynamics involved require in-depth examination by a well-qualified and competent third-party institution that uses internationally recognized social science and natural science research tools and methods for impact analysis.

Objectives of Commissioning ESIA

By engaging UNDP to conduct an integrated ESIA of its Guangxi forest plantation project, Stora Enso aims to achieve following objectives:

- 1) Gain a full understanding of the environmental and social impacts of the plantations as part of a normal risk assessment.
- 2) Satisfy high corporate social responsibility standards and expectations to meet sustainable development principles of the Chinese and international community, including civil society, Stora Enso shareholders and customers, and the Chinese government.
- 3) Avoid potentially negative impacts on social and natural environments in and around its plantation sites in Guangxi.
- 4) Protect communities in its project areas and avoid unnecessary long-term costs to solve problems that could have been avoided.
- 5) Through suggestions and recommendations, including identification of social investment opportunities (e.g. in education and healthcare support), maximize improvements to local livelihoods, welfare, and poverty alleviation efforts, thereby promoting improvement of local economic conditions
- 6) Adhere to all Chinese laws and regulations regarding environmental impact.
- 7) Solidify presence as a long-term, trusted partner in the China market.
- 8) Improve operations and decision-making through better relationships with stakeholders, including local residents, land owners, contractors, government officials, and other sectors of civil society, such as NGOs and media representatives.
- 9) Meet social and environmental requirements of multilateral lending institutions, such as the IFC, for project support.

UNDP-Stora Enso Partnership

Stora Enso began discussions with UNDP's Liaison Office in Copenhagen for Nordic Countries in 2003 to explore the possibility of forging partnerships between UNDP and Stora Enso. As a result of these discussions and with regard to its forestry project in Guangxi, Stora Enso expressed its interest in exploring possibilities for cooperation with UNDP in China.

UNDP's decision to undertake this ESIA was based on its past experience in poverty alleviation and environmental programmes in China, also its experience in ESIA analyses, obtained from successful implementation of similar projects in China and other countries, including the Social Impact Assessment Survey of the China West-East Gas Pipeline Project in partnership with Shell. Stora Enso also acknowledged UNDP's access to a worldwide knowledge network and state-of-the-art expertise of the required methodologies and procedures, which UNDP intended to best use this opportunity to demonstrate.

1.2 Guangxi: Background and Strategic Plans for Forestry and the Forest Products Sector

Background on Guangxi

Guangxi Zhuang Autonomous Region is located in coastal southern China, borders Vietnam, and adjoins the provinces of Yunnan, Guizhou, Hunan and Guangdong. It has an area of 23,760 km², almost the size of the United Kingdom.

Guangxi has a total population (2004) of 49 million people, ranking 10th among China's provinces and provincial-level municipalities. Of the population, 39 million live in rural areas, where agriculture is the main economic activity. Administratively, Guangxi is one of China's five Autonomous Regions. It was established in 1958 in recognition of its rich ethnic structure, which includes 37 ethnic groups with Zhuang as the dominant minority.

Guangxi has a dominant tropical/ subtropical monsoon climate, which varies with latitude and altitude. Summers are hot and humid and winters relatively cooler and dry. Annual average temperature is 17-22 °C, with a maximum 23-29 °C in July and 6-14 °C in January. Annual sunshine time varies from 1400-1800 hours. Average annual rainfall in Guangxi is 1500 mm and varies from 1100-1200 mm in

the western basin areas to 2060-2780 mm in the southeast areas. Average rainfall in southern Guangxi's Beihai, one of the main project areas, exceeds 2000 mm (Table 1-1).

Table 1-1
Average Monthly Rainfall and Mean Monthly Temperatures for Beihai

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total/Average
Mm	34	42	69	99	174	264	463	458	246	91	48	40	2,034
°C	15	16	19	24	27	28	29	28	28	25	21	17	23

Source: www.worldclimate.com

Guangxi is generally a mountainous region, dominated by karst topography. The southern areas are flat and undulating. Some 57 percent of land (13.6 million ha) in Guangxi is classified as forest land. Land with forest cover is 9.8 million ha, or 41 percent of total forest land area. The area classified as commercial forest land totals 7.8 million ha (57 percent of the land classified as forestland). The original native forests of the province were mainly tropical rainforests in the valleys and seasonally dry rainforest on slopes below 500 m. Forest cover decreased dramatically before 1950 to 16 percent of land area (3.8 million ha) primarily through slash and burn agriculture and other conversion to agriculture, with farmers growing extensive areas of corn, cassava, sugar cane, and other crops.

Guangxi's economy is predominantly agricultural; and the province is one of China's poorer provinces. Average net income per capita in rural areas is 2,300 yuan compared an average for all Chinese rural households of 2,936 (2004 figures). Compared with neighbouring southeast provinces, Guangxi is poor; and poverty alleviation in the countryside is one of the local government's priorities. Rural people have a high dependence on forests for employment, fuelwood and other products.

Background on Forestry in Guangxi

Of the 7.8 million ha of land classified as commercial forestland in Guangxi, 6.8 million ha is forest, 44,000 ha poor quality open forests, 450,000 ha bush or shrub lands, 400,000 grass or bare land, 100,000 ha regeneration sites, and 933 ha nurseries. Of the 6.8 million ha of commercial forest, there are 5.5 million ha of what are classified as forests or timber plantations, 1.2 million ha of economic tree plantations (including rubber, tea, and fruit orchards), and 130,000 ha bamboo forests. More than 5 million ha of commercial forest lands are suitable for establishing timber production plantations, such as Chinese Fir, pine, eucalyptus, acacia, valuable broad-leaf timber species, and bamboo. The total land area identified as suitable for fast growing tree plantations is 2.3 million ha. In 2002, there was 750,000 ha of fast growing tree plantations in Guangxi, which included 350,000 ha of eucalypt plantation, 20,000 ha of acacia plantation, and 430,000 ha of pine and bamboo plantation.

Guangxi's climate is suitable for short rotation, fast growing tree plantations such as eucalypts, acacias and pines. The region is one of the main wood producers in China and is expected to produce more wood in the future to meet the nation's increasing demand. However, within the province, traditional forest management can not generate sufficient forest resources to balance supply and demand for wood and wood products, or contribute to meeting national needs. Currently, the annual timber consumption in southern China is approximately 7.8 million m³, whilst annual local production is only 5 million m³. The high and increasing demand for timber is increasing the pressure on Guangxi's natural forests and threatening its fragile biodiversity. This has also led to a significant increase in the import of wood and wood products from neighbouring countries and caused negative impacts on the sustainable management of forests in Southeast Asia.

There is a growing need in Guangxi to increase domestic forest resources through establishing fast growing commercial plantations to meet the increasing timber demand, while reducing pressure on natural forests in the region. Increased establishment of fast-growing plantations in Guangxi will also meet the goals outlined in the nation's plan for sustainable management of China's forest resources and its strategic plan for the development of the wood pulp and paper industry over the next ten years.

Provincial Plans for Forestry and the Forest Products Industry

Guangxi's provincial forest plan of 2001 presents targets to be reached by 2005. The plan estimates that there will be 10.5 million ha forests in Guangxi by the end of 2005 and forest coverage will reach 44 percent. The plan calls for there to be 5.5 million ha ecological forest (not to be touched for commercial purposes), representing 40 percent of total forest land and including 1.8 million ha of protected areas. The provincial plans also call for expanding the area of fast-growing plantations to 1.3 million ha (including 100,000 ha of bamboo forest), by converting 520,000 ha of young tree plantations into fast-growing plantations through intensive management. Short-rotation, fast-growing plantations for industry are to reach 628,000 ha, and annual wood production, to reach 5.5 million m³ annually. About 150,000 ha of agricultural cropland in the province has been converted to forest over the past 5 years.

According to the provincial government's most recently designed forestry strategies, by the end of 2010, there will be 11.2 million ha of forests in the province; and forest coverage will reach 53 percent. There will be 1.9 million ha of protected areas by that time. About 110,000 ha of land will be converted from agricultural crops to forests between 2006 and 2010. Annual wood production is to reach to 10 million m³ 2010, most of which will come from fast growing plantations. The plan calls for there to be 3.6 million ha of commercial forest, with industrial fast-growing plantations reaching 2 million ha, of which plantations to support the pulp industry will be 1 million ha (including 130,000 ha of bamboo forest). These pulp plantations are to produce annually 5 million m³ of wood and 3.2 million tons of fresh bamboo. Provincial plans call for plantation area to continue to increase until 2015, when commercial forest area is to reach 3.8 million ha (including 330,000 ha for bamboo). Fast growing plantation area is to reach 2.5 million ha in 2015, of which 1.3 million ha (including 230,000 ha of bamboo) will be used to supply pulp and paper production. Annual production in Guangxi for 2015 is targeted to reach to 12 million m³ of wood and 5.5 million tons of fresh bamboo in 2015.

Along with the development of fast-growing tree plantations to support the pulp and paper industry, the annual pulp making capacity of Guangxi is targeted by provincial plans to increase from 400,000 tonnes to 2 million tonnes between 2005 and 2010. Of this capacity, 1.2 million tonnes is to be based upon wood pulp and 800,000 tonnes on bamboo pulp. From 2011 to 2015, it is planned that capacity will continue to expand to 4.2 million tonnes (2.8 million tonnes of wood pulp and 1.4 million tonnes of bamboo pulp) annually. Along with increasing pulp capacity, paper production in the province is targeted to increase from 1.2 million tonnes (33 percent from wood pulp) in 2005 to 2.5 million tonnes (45 percent from wood pulp) in 2010 and to 5 million tonnes (55 percent from wood pulp) in 2015. Two large pulp mills have been approved for Qinzhou and Baihai (together having a total capacity of 300,000-600,000 tonnes annually). At Liuzhou, the Liujiang Pulp and Paper mill is planning to expand to produce a total of 800,000 tonnes of bamboo-based pulp annually. The Phoenix Pulp and Paper Plant in Nanning plans expansion as well, so that it will produce a total of 150,000 tonnes of pine-based pulp annually; and the Heda Pulp and Paper Plant in Hezhou is targeted to expand to produce 300,000 tonnes of pulp annually. Another new pulp and paper plant is being considered for western Guangxi. In addition to expanded pulp capacity in Guangxi, the large BEKP mill on Hainan operated by Asia Pulp and Paper (APP) will seek to gain access to wood fibre from Guangxi. It was announced recently the Shandong Chenming Paper Holdings is to take over a pulp project in Zhanjiang, which Finland's UPM abandoned late last year. Under the original scheme, a 700,000 tonne/yr eucalyptus pulp mill was to be built in Zhanjiang, but Shandong Chenming may change the scope of the plan after conducting its own studies. This will also increase demand for eucalypt wood fibre from eastern Guangxi. It is highly likely that these substantial investments in other provinces will influence wood flows in southern and eastern Guangxi

To guarantee wood supply for the proposed or expanded pulp and paper plants, provincial plans call for fast growing plantations for pulp making to be established around those plants. In the Qinzhou region, 130,000 ha of fast growing plantations to produce pulpwood have been or are to be established over 1.2 million ha of suitable commercial forestlands. In the region around Beihai, 130,000 ha of fast growing plantations have been or are to be established over 840,000 ha of suitable commercial

forestlands. In region around Liuzhou, 130,000 ha of plantations (50,000 ha of which is bamboo) have been or are to be established over 330,000 ha of suitable commercial forest lands. In the Hezhou region, 70,000 ha of plantations (20,000 ha bamboo) have been or are to be established over 330,000 ha of suitable commercial forestlands. Another 200,000 ha of plantation for pulpwood is to be established over 860,000 ha of suitable commercial forest lands in other locales.

1.3 National Policy Context

Besides at the provincial level in Guangxi, China's central government has also set ambitious capacity expansion targets for its pulp, paper, and wood processing industries. To achieve these targets, a series of aggressive development policies have been set in motion, backed by central government policy directives and funding, to speed the development of China's pulp, paper and wood processing industries. These policies are premised on the following objectives:

- Reduce China's dependence on imported wood fibre, paper, and processed wood products by developing the domestic wood fibre base through: 1) Development of fast-growth, high-yield plantations; 2) Reduction of high taxes and fees on plantations, so as to stimulate investment; 3) Tariff reductions on imports of raw materials and processing machinery; 4) Protection of China's forestry base.
- Encourage foreign investment in the wood fibre, pulp, paper, and wood processing sectors through a variety of financial and tax incentives.

China's central government has adopted a series of key targets and measures to promote development of the nation's wood fibre resources. National-level targets call for the development of 13.33 million hectares of fast-growth, high-yield plantations between 2001 and 2015 requiring a total estimated investment of US\$8.65 billion. The central government is encouraging companies to integrate paper processing facilities with plantations by granting loan interest subsidies to virtually all forms of enterprises that invest in fast-growth, high-yield plantations. Indeed, the Government of China has given high priority to the development of large-scale, fast-growing, high-yielding plantations and farm plantings to secure the raw material base for national needs for pulp and paper. Development of such plantations and farm plantings constitute one of the six main programs of China's State Forest Administration. The central aim of this program of the State Forestry Administration's is to develop a commercial wood supply to support domestic forest product industries, especially through providing raw material for new wood pulp capacity. Of the overall target to plant 13.3 million ha between 2001 and 2015, 2.5 million ha is to cater to the needs for large-diameter timber, 5.0 million ha is to provide materials for solid wood products, and 5.8 million ha (45 percent of total area) is to provide pulpwood. These plantations are expected to produce 140 million m³ of timber and 15.8 million m³ of wide diameter wood. This wood fibre is expected to support the production of 13.9 million tons of wood pulp and 21.5 million m³ of wood-based panels (ITTO, 2005). In order to achieve these targets, the Government has initiated 99 priority projects, including 39 for pulpwood plantations.

Of the nation's priority regions for fast-growing, high-yielding plantations, the South Coastal and Middle/Lower Yangtze regions suit the broad scale cultivation of eucalypts. In these areas, eucalypts will form a significant part of a proposed 2.7 million hectares of plantations committed to pulpwood production (Cossalter, 2004). These plantings will comprise one of the world's larger estates of plantation eucalypts.

Stora Enso's project in Guangxi is consistent with stated targets and policies of the Chinese central government. The project is also consistent with the Guangxi Government plans, as referenced in the preceding section, for its forest and forest product sectors.

1.4 China and the International Pulp and Paper Sector

China has some longstanding intellectual property in the global paper sector - most papermakers recognise that Tsai Lun invented paper in China in 105 AD. Excellent recent reviews of China's pulp and paper industries and their influence on international markets have been published recently (He

and Barr, 2004, URS Forestry 2002, Jaakko Pöyry 2000). China is now the world's second-largest producer of paper and paperboard with an aggregate and expanding consumption of an estimated 48 million tonnes in 2003, compared with North America's 105 million and Western Europe's 86 million tonnes. Although national consumption is high, per capita consumption is only 37 kg/capita/yr (compared with 320 kg/capita/yr in the USA), but is expected to reach 65 kg/capita/yr by 2010 (Ilkka Kuusisto, 2005). He and Barr (2004) project that China's paper and paperboard sector will grow to 68.5 million tonnes by 2010. They further forecast this growth to foster an increase in demand for fibre (non-wood pulp, recovered paper, and wood-based pulp) for all grades of paper from 40 million tonnes in 2003 to 60 million tonnes in 2010.

Net imports of paper products in 2003 were 5 million tonnes and it is estimated that these will only rise to 6 million tonnes in 2010 because of substantial newly installed paper making capacity. However, pulp imports are expected to continue to rise with 2003 net imports of paper grade wood pulps of 5.7 million tonnes expanding to 8.2 million tonnes in 2010. Recovered paper provides about 50 percent of total pulp consumption in China; and imports of recovered paper, 12 million tonnes in 2004, are estimated to grow to 16.8 million tonnes in 2010 (Ilkka Kuusisto, 2005). It is expected that Bleached Eucalypt Kraft Pulp (BEKP) will be the fastest-growing segment of wood pulp demand, a response to the rapid growth of printing and writing paper production. He and Barr (2004) project that by 2010, pulp producers in China will supply a little over 50 percent of national demand for BEKP, with the remainder being imported.

Brady (2005) similarly predicts that China's capacity to service the raw material needs of its pulp, paper, and wood products industries will remain limited and domestic fibre deficits will continue. The continuing need to import pulp will be based upon the substantial increased demand from newly installed paper mills at a time when the domestic resource of wood from fast-growing commercial plantations is not yet fully mature and plantations are troubled by low yields and several limiting social factors. China is expected to become a net importer of wood chips for the first time in 2005. From a high of 1.6 million BDMT (bone dry metric tonnes) of hardwood chip exports in 1995 (mostly eucalypts), China is expected to substantially reduce exports and predictions are that net imports will reach 1.6 million BDMT in 2007 (Flynn, 2005). Cossalter (2004) has concluded that considering the various obstacles to plantation development that several pulp companies in southern China are facing, it is likely that the region will remain largely reliant on imported wood chips beyond 2009.

Recognising the opportunity presented by a presence in the Chinese market, at least seven of the world's ten largest producers of paper and paperboard have made substantial investments in China. Securing reliable and sustainable supplies of pulp to maintain these investments remains imperative to corporate success.

1.5 Principles of Sustainability

Stora Enso and Sustainability

As discussed in Section A of this chapter and as is evident from the Group's Environmental and Social Responsibility Policy (Annex I), Stora Enso attaches a high priority and commitment to Corporate Social Responsibility (CSR) and to the concept of *sustainability*. The company has gone a long way to institutionalize these in all of its operations. It uses the word "sustainability" as an umbrella term to describe responsible business operations that include economic, environmental and social responsibility. The challenge in sustainable management is to effectively balance these components.

In seeking recognition for its commitment to the principles of sustainability, Stora Enso has been included in a number of sustainability indices, which provide investors a useful objective framework for evaluating responsible investment. In addition to its aforementioned inclusion in the DJSI World and FTSE4Good, the Group is also included in the following sustainability indices: Ethibel Pioneer Sustainability Index, the Nordic Sustainability Index, Ethical Index Euro and Global, and Vigeo's ASPI Index.

The DJSI World assesses the performance of companies worldwide that are leaders in sustainability. In 2004, Stora Enso once again received DJSI's highest possible score (100 percent) in environmental and corporate social responsibility reporting. The FTSE4Good index measures the performance of socially responsible companies and assesses achievements in: upholding and supporting universal human rights, developing positive relationships with stakeholders, and working towards environmental sustainability selection criteria based on globally recognised codes of conduct, like the UN Global Compact and the Universal Declaration of Human Rights. Ethibel, a leading European research and advisory agency in the field of Socially Responsible Investing, has developed the Ethibel Investment Register, which lists all constituents in the Ethibel Sustainability Index. The Ethibel Investment Register is used as the basis for Socially Responsible Investment (SRI) products for European banks, fund managers, and institutional investors. The distinctive characteristics of Ethibel's methodology originate from the integration of two of the strongest aspects of Corporate Social Responsibility: sustainable development and stakeholder involvement. The Nordic Sustainability Index assesses Nordic companies dedicated to sustainable development and good corporate governance. The index is maintained by Oxford Research and GES Investment Services.

Stora Enso has a set of clearly stated corporate principles for sustainable wood and fibre procurement and land management which have been developed in line with leading multilateral environmental agreements, such as the Convention on Biological Diversity, and international processes to develop standards for sustainable forest management. The principles set out a framework for implementing, monitoring, and improving environmental and social responsibility in wood and fibre procurement and forest management.

The plantation operations of Stora Enso in Guangxi belong to the raw materials part of the company's value chain. Environmental and social performance goals set by the Stora Enso for this part of the value chain cover the areas of biodiversity, sustainable use of renewable raw materials, legality of wood, workers' rights, and impacts on local livelihoods. Stora Enso has a corporate commitment to creation of business opportunities for suppliers and promotion of fair business practices. At the operational level in Guangxi, Stora Enso's Management Plan (2005), follows operating principles aiming to produce internationally cost competitive fibre in an environmentally and socially sound way.

The approach adopted by Stora Enso in Guangxi is generally consistent with the key elements of sustainability for the plantation forest industry identified by the leading environmental NGO - World Wildlife Fund (WWF). These elements are: (1) maintenance of high conservation value forests, (2) multi-functional forest landscapes, (3) sound environmental management practices, (4) respect for rights of local communities and indigenous peoples, (5) positive social impacts, (6) proficient regulatory frameworks, and (7) transparency. Stora Enso's corporate policies are consistent with the concept of sustainable plantation management; and this is clearly enunciated in the corporate operating principles for the Guangxi plantations.

Principles of Sustainability in Plantation Forestry

Despite general agreement that tree plantations must be managed sustainably, the meaning of sustainable forest management as the basis for corporate policy and decision making remains generally vague and open to interpretation that varies between individuals, companies, and even countries. Within the plantation forestry industry, a paradigm shift from the classical approach of sustained yield to approaches committed to the principles of sustainable forest management has occurred. Sustainable plantation forestry is based upon a holistic approach to land management. Nambiar (1997) identifies the basic tenets of inter-generational fairness: the moral responsibility current generations have to their descendants, and the role of natural assets (such as forests) in meeting the needs and obligations of current generations. He suggests a core set of goals for helping define sustainability:

- to ensure that the trend in plantation production is non-declining over successive harvests;
- to protect and if possible enhance the quality of the soil and water values in the plantation environment;

- to promote incentive, innovation, and profit for the business of growing and utilizing wood;
- to improve the economic and social benefits to the community.

There can be other goals; and biodiversity values are accommodated. The single-minded pursuit of any one goal (such as commercial wood production), while disregarding other values, is unacceptable. It is also impractical to expect that structure, composition, and function of plantation forests should mimic those of native forests.

Sustainability of Productivity

Sustained forest productivity is the foundation on which the sustainable business of forestry rests. A central goal of modern forest management is to ensure that the trend of forest productivity is non-declining or is positive over successive rotations and harvests while maintaining and enhancing the quality of the soil resource base in perpetuity. The measures of productivity may range from net primary production to wood yield, depending upon the purpose of the particular plantation (Nambiar, 1996). The central goal is achievable; and, with scientifically-based management, ongoing overall improvements in wood yield from plantations are being achieved across a range of soil and environmental conditions in radiata pine plantations in Australia and eucalypt plantations in Brazil (Nambiar, 1997, Brinkley and Stape, 2004). The enhancement of the productive capacity of the soil wherever possible is a good fundamental basis for sustainability.

Nambiar (1998) has identified a number of factors that contribute to unsustainability of production at a management unit level:

- loss of soil quality: initiation or acceleration of soil degradation process, which decreases productivity and increases cost of amelioration and production;
- a weak or inappropriate genetic base unadapted to the environment;
- threats from pests and diseases, an issue requiring continuous monitoring and integrated management plans;
- adverse environmental effects, for example off-site negative impacts on the quantity and quality of water in the ecosystem; and
- poor management: often a common reason for failure and leading to unsustainable extractive practices.

Sustainability is neither static nor absolute. The concept when applied to commercial plantation forestry is continuously reshaped through changing variables, values and needs. The variables include the expanding role of plantations and expectations from them, ongoing change in productivity through biophysical interactions and management interference, environmental change, social aspirations, political policies and markets (Nambiar 1999).

Key points of the Background Chapter:

- Stora Enso is a global leader in the paper, packaging and wood products sector and has a strong presence in China via a large paper mill in Suzhou.
- The company proposes an integrated forest-pulp-paper project in Guangxi Zhuang Autonomous Region (Guangxi) in southern China.
- Guangxi has a tropical climate and a population of 49 million people.
- Stora Enso's proposals are consistent with national and provincial policies and plans and will help meet China's growing demand for wood fibre.
- The company has a highly publicized commitment to Corporate Social responsibility and has strong positive policies and commitment relating to the Environment and Sustainability.
- The principles of sustainability in plantation forestry are discussed.

Part II

Eucalypt Plantation Management

Part II consists of three chapters. Chapter 2 answers several key problems involving in eucalypts and plantations, beginning with a review of why eucalypts are a desirable plantation crop and why they have done well in places to which they have been introduced. The chapter then examines the history and status of eucalyptus in China and, in particular, Guangxi. Chapter 3 examines the productivity of eucalypts and sustainable issues of eucalypt plantation management. Chapter 4 discusses especially on Stora Enso's approach to eucalypt plantation management and operations in Guangxi. It focuses on the management and silviculture of eucalypts and how Stora Enso's management plan addresses various aspects of management, such as site selection, nursery, breeding, etc.

Chapter 2. Eucalypts and plantations

2.1 Why Eucalypts?

Commercial eucalypt plantations are important global assets which provide wood and wood fibre products to modern societies and offer a wide range of social, environmental and economic benefits to many millions of people.

The genus *Eucalyptus* comprises some 700 species, all but two of which occur naturally in Australia. Of the two non-Australian species, one, *Eucalyptus urophylla*, has a limited range at the south-eastern end of the Sunda Archipelago, Indonesia and the other, *E. deglupta*, has a wide range, from New Britain in the east, through the island of New Guinea to Ceram and Sulawesi in the west, and north to Mindanao. Nine of the northern Australian species (*E. alba*, *E. brassiana*, *E. confertiflora*, *E. leptophleba*, *E. papuana*, *E. pellita*, *E. polycarpa*, *E. tereticornis* and *E. tessellaris*) extend also into southern New Guinea and one of those, *E. alba*, is found in Indonesia (Davidson, 1995).

Despite the large number of species, the global commercial use of eucalypts is based on a relatively few species. According to Eldridge *et al.* (1993), the ranking of the ten most important eucalypts, in terms of current annual increment of wood, would include: *E. grandis*, *E. camaldulensis*, *E. tereticornis*, *E. globulus*, *E. urophylla*, *E. viminalis*, *E. saligna*, *E. deglupta*, *E. exserta*, and then either *E. citriodora* (*syn Corymbia citriodora*), *E. paniculata* or *E. robusta*.

Eucalypts have grown vigorously as exotics in other countries, demonstrating a tolerance of a wide range of environmental conditions. They have been planted as exotics for over 150 years and can now be found in over 100 countries in the tropical, sub-tropical and warm temperate regions of the world. From an estimated global plantation base of 700 000 hectares in 1955 and 6 million ha in 1985, the area of planted eucalypts has increased to 16 million hectares in 2005 (Table 2-1). They are currently used in approximately 50% of planted forests in the tropics (Evans and Turnbull, 2004).

Several million ha of additional equivalent area is estimated to have been planted to eucalypts on farms and in other rural areas (such as China's 4-round plantings along roadsides, canal banks, railway embankments and on common lands) as single trees and in lines and small groups.

Table 2-1
Countries with Major Eucalypt Plantations. (ha)

Africa:

Angola	135,000
Burundi	40,000
Congo	42,000
Ethiopia	95,000
Libya	26,000
Madagascar	130,000
Malawi	30,000
Morocco	200,000
Rwanda	60,000
Senegal	40,000
South Africa	538,000
Sudan	23,000
Tanzania	25,000
Tunisia	42,000
Zambia	26,000
Zimbabwe	30,000
Sub-total Africa	1,636,000

Mediterranean:	
Italy	40,000
Portugal	500,000
Spain	350,000
Sub-total (Mediterranean)	920,000
North America:	
USA	110,000
Sub-total (North America)	110,000
South America:	
Argentina	250,000
Brazil	3,617,000
Chile	360,000
Ecuador	44,000
Uruguay	400,000
Peru	211,000
Venezuela	70,000
Sub-total (South America)	4,991,000
Asia:	
India	4,800,000
Indonesia	80,000
Pakistan	245,000
PR China	1,500,000
Thailand	480,000
Vietnam	350,000
Sub-total (Asia)	7,518,000
Pacific:	
New Zealand	50,000
Australia	600,000
Sub-total (Pacific)	660,000
WORLD TOTAL	16 million

Notes: This Table was adapted from Davidson (1995) which was compiled by CSIRO Australian Tree Seed Centre in 1993, using data from FAO's global inventory programme. It has been updated with supplementary estimates extracted from references (eg. Qi, 2003, Le Dinh Kha 2003, Luangviriyasaeng, 2003 and Subhani *et al* 2003) and personal communication. Countries with reported estates of less than 20 000 ha have been omitted from the table but areas maintained in the totals. The majority of figures are approximate and reliability varies.

2.2 Why have eucalypts been successful exotics?

Rates of growth of eucalypt trees are often much faster in exotic locations than are experienced in their native forests, and usually very much faster than local indigenous species. The conventional wisdom for this has been that insect pests which attacked the trees heavily and continuously in Australia were absent from the exotic location. Though this idea has merit, it is now considered that, given the evolution of *Eucalyptus* in response to declining soil fertility and a dry climate on the Australian continent, they are mostly planted in exotic conditions with more nutrients and moisture than they would experience at home. Though they grow fast, their evolutionary background still means they usually consume less nutrients and water than indigenous species for production of the same amount of biomass (Davidson, 1995).

In addition to this robust physiological adaption to a wide range of site conditions, eucalypts have several other attractive features which have made them popular exotics:

- Their ease of propagation. Eucalypts are easy to propagate. The seeds of the popular species are small (typically 600 000 per kilogram) and are orthodox in behaviour and able to stored easily for long periods. These features have made them easy to distribute between growers and countries.

Many of the widely planted species and hybrids can be readily and efficiently propagated vegetatively allowing quick capture of genetic gains. Despite their ease of propagation, eucalypts have demonstrated a very low potential to become weeds and threaten local biodiversity through invasion of natural ecosystems.

- Their capacity to grow fast. Typically, eucalypt plantations produce over 20 m³/h/yr and can be managed in short (<12 year) rotations). On highly productive sites in Brasil, growth rates of over 50 m³/h/yr have been recorded. This capacity to grow fast offers attractive economic rates of return to farm level and industrial growers. Many popular species have the capacity to coppice offering productive second rotation crops.
- Their capacity to grow straight. Eucalypts demonstrate an apical dominance which results in straight growth and straight stems that are easy to harvest and process and useful for a wide range of products and applications.
- Their capacity to offer a wide range of wood and non-wood products. Eucalypts can produce a wide range of useful wood and non-wood products. In addition to environmental and non-wood products such as site and habitat protection, carbon sequestration, tannins and leaf oils, industrial chemical additives, adhesives and fodder additives, eucalypts provide many wood products – construction timbers, furniture, farming tools, transmission poles, railroad sleepers, fuelwood, charcoal, honey, pulp and paper, rayon, fibreboard and plywood.

Eucalypts are a preferred fibre source for a number of different pulps. Bleached Eucalypt Kraft Pulp (BEKP), made through the chemical Kraft process, is of high quality and is in strong demand internationally for the production of high quality writing papers for which Stora Enso is a world leader. Another pulp, CTMP (Chemi-Thermo Mechanical Pulp) offers high yields from raw material and is used to manufacture soft and absorbent tissue, box board (high quality packaging such as perfume boxes, take-away food boxes, shoeboxes etc) and coated fine paper (such as glossy magazines and brochures). Eucalyptus CTMP is among the high grades of this type of pulp and is in short supply worldwide.

Over the past 50 years, the international forestry research community has undertaken a great many species assessment trials in the warm temperate and tropical regions of the world. Many hundreds of species from many genera have been assessed for their suitability for growing on farms and as plantations. In this broad and thorough search for species suitable for wood production, eucalypts have emerged consistently as a popular option. The choice of eucalypts as a preferred plantation species in southern China is no accident and has been based upon many years of scientific assessment which has demonstrated that they consistently outperform plantations of other species such as pines and acacias on most sites.

2.3 Eucalypts in China

Eucalypts have been planted in China since the 1880's; eucalypts being recorded as growing in the grounds of the French Legation in Kunming in 1894 (Morrison, 1895). As part of a sustained partnership between Chinese and Australian forest scientists for the past 25 years, more than 300 species of *Eucalyptus* have been introduced to 16 provinces of China and assessed in a scientific fashion. Of these introductions, only 10 are widely planted or have become part of China's extensive estate of hybrid eucalypts.

In total, China now has about 1.5 million hectares of eucalypt plantations and 1.8 billion trees in "four-sided" plantings equivalent to an additional 350 000 ha. Almost all of these plantations are south of the Yangtze River with the largest areas in Guangdong (570 000 ha), Hainan (350 000 ha), Guangxi (340 000 ha) and Yunnan (150 000 ha) (Qi, 2002). Since these figures were compiled in 2002, several new initiatives have established an additional estimated 150 000 ha of eucalypt plantations. This large resource places China among the world's largest commercial growers of

eucalypts, Brasil, Chile, Uruguay, Thailand, India, Spain, Portugal and South Africa. These plantations have been established almost entirely with Chinese resources and responding to Chinese needs, official policies and market opportunities.

Species commonly planted in China include:

E. grandis
E. urpohylla
E. tereticornis
E. camaldulensis
E. pellita
E. exserta
E. globulus ssp globulus
E. globulus ssp maidenii
E. nitens
E. smithii
E. dunnii
Corymbia citriodora

2.4 Eucalypts in Guangxi

It was not until the end of 19th century that eucalypts arrived in Guangxi. An individual tree of *E. tereticornis* Sm. was planted in southern Guangxi in 1890. About a half century later, Shankou Forest Farm was established to grow *E. exserta*. It is very interesting that the forest farm is now a partner of Stora Enso. Guinan Eucalypt Forest Farm which has specialized in growing eucalypts was set up in 1963 in Hepu County, which is now a main area for Stora Enso's eucalypt plantations. Windbreak systems were established in Hepu by 1966 using *E. exserta* to protect rubber plantations and agricultural crops from typhoon damage. Since 1982, a great deal of eucalypt genetic material was transferred from Australia to Guangxi via the China-Australia Dongmen Afforestation project. About 100 eucalypt species have so far been introduced to Guangxi for assessment. These materials comprise a large volume of eucalypt genetic biodiversity at the species level. Successful eucalypt plantation forestry in Guangxi would not have been so advanced without the efforts in this germplasm transfer.

From small plantings of *E. robusta* in the county of Longzhou in 1947, Guangxi has become one of China's largest growers of eucalypts. The 1980's saw a boom in eucalypt planting in southern Guangxi and this was influenced by the Dongmen afforestation project. Since 1990's clonal forestry has rapidly developed with intensively managed eucalypt plantations a common part of the rural landscape. There are in excess of 350 000 ha of eucalypt plantations in Guangxi plus an equivalent of 100 000 ha in "four-sided" plantings (Qi, 2002; Xiang Dongyun *pers comm.*). The 10th 5-Year Plan aims to increase this area to a total of 670 000 ha by 2010 and to have these linked to processing industries. In addition to Stora Enso, a number of other companies, APP, Oji Pulp & Paper, Jahan Forest Products (Sino Forest Group), Feng Lin, Gao Feng Group, and Guangxi Plantation Development Company are also developing new plantations in the southern and south-central parts of the province. Results from the Social Impact Assessment of this study confirm the expansion of eucalypts in Guangxi. Interviewees in both communes and townships indicated that the dominant form of land use on land designated as "forest lands" over the past 20 years has been forest plantations and that there has been a steady shift from pines as the dominant species, to eucalypts.

Since 1981, Guangxi has been among the Chinese leaders in research and innovation with the China-Australia program based at Dong Men Forest Farm and subsequently through the Guangxi Forest Research Institute as major players. The impacts of the Dong Men project are widely felt in commercial eucalypt plantations in southern China. Further expansion of Guangxi's plantation base (including R&D support) will be supported by a proposed World Bank Project which will finance the establishment of about 200 000 ha of timber plantations, much of which will be eucalypts.

2.5 Eucalypts and China's National Policies

In addressing the national priorities for wood production through fast-growing high-yielding plantations discussed in Part I, it is inevitable that eucalypts will be widely cultivated in the priority regions of the South Coastal and Middle/Lower Yangtze. Here, they will form a significant part of a proposed 2.7 million hectares of plantations committed to pulpwood production (Cossalter, 2004). These plantings will comprise one of the world's larger estates of plantation eucalypts.

Key points of the Chapter:

- Eucalypts, largely native to Australia, are among the world's most successful exotic trees, providing social and environmental benefits and resources for major wood fibre industries in many countries. Their emergence as a world resource and the reasons for their success as exotics are discussed;
- More than 16 million ha of plantations have been established globally;
- Eucalypts have been in China for over 120 years and in Guangxi for most of this time. The choice of eucalypts as a preferred plantation species in southern China is no accident and has been based upon many years of scientific assessment and community experience.

Chapter 3. Eucalypts and Sustainability

Provided the principles of sustainable plantation management are addressed, commercial eucalypt plantations can meet the sustainability goals enunciated by Nambiar (1997):

- to ensure that the trend in plantation production is non-declining over successive harvests;
- to protect and if possible enhance the quality of the soil and water values in the plantation environment;
- to promote incentive, innovation, and profit for the business of growing and utilizing wood;
- to improve the economic and social benefits to the community.

Experience in China and elsewhere has demonstrated that eucalypt plantations can achieve sustainability. However, like any commercial crop, the commitment to sustainability varies between growers.

3.1 Commercial Eucalypts and Productive Sustainability

The success of commercial eucalypt projects and associated wood processing ventures demands that the trend in plantation production is non-declining over successive harvests. The productivity of commercial eucalypt plantations has increased steadily over the past four decades as a result of improved species selection, selection of genotypes, clonal propagation techniques, and improved silvicultural techniques, especially in site preparation and fertilization. Binkley and Stape (2004) and Nambiar (1997) have reported dramatic trend in Brazilian eucalypt plantations, with yields increasing from about 10m³/ha/yr to 40m³/ha/yr over the past 40 years. This international trend is being mirrored in southern China where the mean annual increment of *Eucalypt* plantations grown by the Leizhou Forestry Bureau and repeated elsewhere, increased from about 6m³/ha/yr in the 1960s to more than 27m³/ha/yr today (Dr. Mo Xiaoyong, *pers comm.*).

The operational silvicultural practices of modern commercial eucalypt planting emphasize minimal site impacts (no burning, no bedding) and higher rates of fertilization. Binkley and Stape (2004) report that the old style of site preparation in Brazil provided 20 percent less wood in the first rotation than the current style incorporating minimal site disturbance. The impacts of poor site preparation at plantation establishment increased in the second rotation, with a further reduction in wood growth of 20 percent relative to the first rotation. The current style of site preparation has shown sustained growth in the second rotation. In reinforcing Nambiar's holistic view of sustainability outlined above with a commitment to issues of environmental quality, biodiversity, and society, Binkley and Stape (2004) concluded that, given appropriate silviculture, wood production should face no barriers in sustainability.

3.2 Commercial Eucalypts and Ecological Sustainability

The expansion of eucalypt plantations is often opposed because of perceptions that they harm the environment and especially that they are "sterile" and lack biodiversity. These concerns have an obvious justification where exotic plantations have replaced biodiverse natural forests. "The biodiversity of a natural forest and that of a *Eucalyptus* plantation are not comparable. The natural ecosystems are very diverse, whilst the biodiversity of *Eucalyptus* plantations is limited. (FAO, 1996)" However, plantations of eucalypts in Guangxi are largely established on degraded or deforested land or replace low yielding pine plantations, not biodiverse original forests. Thus, plantation advocates in the province believe that they are creating a new forest resource.

While plantations do not mimic native forests, Jactel *et al* (2005) offer empirical studies of the biodiversity values of different types of plantation forests in temperate and tropical countries and demonstrate that plantation management can be adapted to favour biodiversity outcomes.

Whilst the prime purpose of fast-growth, high-yielding plantations is to grow wood efficiently, eucalypt plantations, even large scale industrial ones, can support a diverse understorey fauna and flora. The understorey flora may yield benefits in improved sustainability and productivity of the plantation trees (Bernhard-Reversat, 2001). Plantations are almost never as valuable for biodiversity as natural forests, however some plantations do have biodiversity and catchment protection values. Sayer *et al* (2005) observe that these values are often under-rated by plantation managers. A valuable review of this topic is provided in IUFRO (2003) and this report's detailed discussion on biodiversity.

Plantation companies often control large areas of land, not all of which is put under plantations; and the spatial arrangement and land cover of the non-planted area can be important for biodiversity. Many countries, although not China, have laws requiring plantation schemes to include set-asides of natural forest or riparian strips of forest. In many situations, these can be very valuable for a variety of wild species. The plantations may provide a buffering function and enhance the protection of these natural forest patches from so-called edge effects, such as increased insolation of the understory and risk of blow-down.

Brazil's three million hectares of industrial eucalypt plantations offer a good example of the buffering function of plantations. It has been found there that, by providing adequate distribution of native forest remnants in the landscape, plantations may act as sinks for species accumulation, increasing their role in biodiversity conservation. Plantations can also be managed as an intermediate step for native forest restoration in degraded areas. To enhance their potential role in biodiversity conservation, management strategies can include the maintenance of understory, changes in harvesting techniques, and the design of buffer zones and corridors with native species. There are examples of many short rotation eucalyptus plantations having woody species richness comparable to native forest fragments (Engel and Onofre, 2005).

Sayer *et al* (2005) observe that plantations may relieve pressure on natural forests. Plantation advocates argue that their activities provide wood that would otherwise have to come from natural forests. This is partially true, although in many cases plantation wood is destined for different markets and end uses than the wood from natural forests. In the case of China, producing wood for pulp and paper industry on degraded lands locally is expected to reduce demand for supplies imported from other countries, and this may relieve economic and political pressures elsewhere in the region that have led to replacement of natural tropical forests with plantations.

Water

Eucalypt plantations in several countries have been the subject of criticism because of perceptions of high water use. All closed forests take up more water than scrub or grass; and the use of water is proportional to the amount of biomass (wood, branches and leaves) produced (FAO, 1988). Calder (1992) found that indiscriminate speculation concerning the water use of eucalypts may be misleading because of the variation that exists between particular environments. Examination of the evidence for these claims has usually concluded that well-managed plantations are beneficial rather than detrimental to the environment (Morris *et al*, 2004). However, studies in India and in South Africa indicate that, when water resources are limited, the area, location, and management of plantations must be carefully considered to avoid conflict with other water users (Calder, 1994). Detailed data on the water use and water balance of plantations are essential both to evaluate their environmental impacts and to design optimal land use strategies in catchments where wood production is an important economic component. Southern China is fortunate to have such data and from an extensive study in Leizhou and this is demonstrated later in this report where Lane *et al* (2004) conclude that it would seem the eucalypt plantations do not pose a threat to water resources in the region.

Use of Chemicals in Plantations

It is common responsible practice to use fertilisers to maintain growth in high-yielding plantations and to use herbicides as a tool in limiting site disturbance during establishment. It has been suggested that land resources in southern China could be used for crops that are more environmentally friendly and socially beneficial than eucalyptus, such as sugar cane or litchi plantations. In Australia, Jenkin (2004)

assessed the chemical inputs to 100 ha of eucalypt plantations over a 10 year period and compared these to inputs to similar areas of popular agricultural crops, including sugar cane. A total of 135 tonnes/ha of N were typically applied to sugar cane over 10 years compared with 20 tonnes/ha for eucalypts (Fig. 1). For herbicides, sugar cane required 3.6 tonnes of active ingredient for each 100 ha over the 10-year period, while eucalypt plantations required 0.2 tonnes; and, for insecticides, sugar cane required 0.1 tonnes per 100 ha and eucalypt plantations received no application. Cossalter and Pye-Smith (2003) concluded that *“there is little evidence that the use of fertilisers in fast-wood plantations has caused significant problems as far as the pollution of wetlands is concerned”*. This conclusion contrasts with many well-documented problems from the use of fertilisers on farmlands.

In southern Guangxi, litchi plantations are fertilised at the rate of 3,000 kg per hectare per year (200 kg/mu) from the time that the plant begins to flower and set commercial quantities of fruit at year three – more than six times the fertiliser rate for a 5-year rotation of eucalypts. In addition, during fruit set, litchi trees are sprayed for insect pests and fungi with two chemicals three times a month for three months. Whilst the high chemical needs of other plantation crops do not excuse eucalypt plantation managers from taking every possible environmental care, it does demonstrate that alternatives to eucalypt plantations require high levels of inputs that can be potentially dangerous to growers, consumers, and the environment.

Evidence for allelopathy and toxic effects

There have been many questions raised by members of local communities regarding eucalypt plantations: Why can ground vegetation not develop under the canopy of eucalypt plantations? Do eucalypts kill other plants and animals? Do eucalypts poison the soil or emit noxious gases? These concerns need to be addressed in a balanced way.

Like many plants, such as native pines and Chinese fir, extracts from eucalypt leaves contain substances that are biologically active. Allelopathy is the inhibition of growth in one species of plants by chemicals produced by another species, and this has often been blamed for the reduced growth of understory plants in plantations of eucalypts. Laboratory experiments indicate that leachates from eucalyptus leaves and stem flow can inhibit growth of a variety of species of plants, including pines, acacia and eucalypts themselves. Evaporation can concentrate these leachates, and it has been suggested that the effect may be significant in areas with annual rainfall below 400 mm. However, there are other explanations for reduced growth under eucalypt plantations. In a short review of work on allelopathy, Davidson (1995) found that results from laboratory experiments have not been substantiated or replicated in the field; and competition for water and nutrients is a far more plausible explanation of reduced growth by companion crops and undergrowth. He found little compelling evidence to support allegations of eucalypt-initiated allelopathy.

The main reasons for less species of understory in eucalypt plantations are that ground vegetation must be cleared out prior to planting trees by silviculture which include site clearance and preparation, weeding and tending for the first two years after planting. If these practices are not followed, eucalypt plantations are difficult to establish. If such silviculture measures are not carried out, competition for soil nutrients and water from shrubby undergrowth, grass and other non-purpose species leads to rapid reduction in wood production of eucalypts.

Despite much of Australia’s farmlands being on areas formerly dominated by natural eucalypt forests, there have been no reports of the eucalypts poisoning soils, suggesting that there may be alternative explanations to reports of soil damage. Decay reduces the allelopathic effects of eucalypt leaf and bark litter leachates. Although some inhibitory chemicals may remain after 5 months, there is no evidence for long-term accumulation (May and Ash, 1990).

Feedback from the expert testimonies indicates that no allelopathy was found in Guangxi’s eucalypt plantations. Moreover, the feedback from the expert testimonies offered several examples in which eucalypts are intercropped in agroforestry systems, eg. in Yunnan where *E. globulus* is planted in

lines in the fields of sweet potato and tobacco, and in Guangxi where *E. grandis* is planted as a buffer zone to protect litchi orchards from animals. Eucalypts are also used to establish shelterbelts in Hainan to protect rubber, pepper, coffee and other tropical crops from typhoon damage.

In the popular literature, eucalypts have also been blamed for toxic effects on soil macro-flora, including on beneficial earthworms. A study of earthworm densities in replicated stands of pure and mixed stands of *Eucalyptus saligna* and *Albizia falcataria* found that mean densities ranged from 92 m² in the pure eucalypts, to 281 m² in the mixture, and a maximum of 469 m² in the pure albizia stands. The study concluded that litter quality was probably the explanation for the differences. Contrary to popular belief, many native animals, both vertebrates and invertebrates, have adapted to life in groves of eucalypts. The Nature Conservancy, commenting on groves of introduced *Eucalyptus globulus* in the western US, found a rich assortment of amphibians such as salamanders, newts, and tree frogs living in the forest, primarily under fallen logs and duff. These amphibians feed on such invertebrates as millipedes, centipedes, sow bugs, Collembola, spiders and earthworms. Several species of rodents and snakes live in these groves, and over 100 species of birds have been recorded there, including several species of conservation concern.

Some species of eucalypt commonly grown in China have high levels of foliar oils (mainly cineole); and these are commercially exploited (*E. exserta*, *E. globulus* and *C. citriodora*). China provides a significant portion of the world's eucalypt oil; and this is used for a range of products including disinfectants, soaps, rubbing oils, and insect repellents. The species and hybrids being used by Stora Enso in their Guangxi plantations (*E. urophylla*, *E. grandis*, and their hybrids *E. camaldulensis* and *E. tereticornis*) have low levels of leaf oil and do not offer commercial opportunities for exploitation.

These aromatic oils may have given rise to rumours that eucalypts produce poisonous gases. A search of the literature has found no credible reference to toxic gases from the foliage of commercial eucalypt plantations.

There is a fear by some villagers that eucalypts would make it difficult for women to conceive and that the water coming out from eucalypt plantations will kill their agricultural crops. The team has been unable to locate any scientific evidences in the international literature, or experience in other countries to support these allegations. The harmonious association which Australia's Aborigines have enjoyed with eucalypt forests and eucalypts have lasted for some 40,000 years.

3.3 Commercial Eucalypts and Social Sustainability

As supply of wood from the world's native forests decreases, more wood for industrial use will come from tree plantations (Cossalter and Pye-Smith, 2003, Evans and Turnbull 2004). Eucalypt plantations can provide a range of materials useful at the local level and offer a viable option for commercial sales by smaller growers. Unfortunately there is a poor history of success in poor countries and globally only 70% of new plantations established annually are judged successful (FAO 2001) and in private plantings survival can be as low as 25% (Bahuguna 2001).

Pulp mills are capital intensive investments. A typical large modern BHKP mill will cost in the order of US one billion dollars. It is vital for their economic viability that they run at capacity and there are adequate and sustainable supplies of raw materials. Ideally, pulp and paper companies prefer to exercise control over the plantations that provide their raw material needs. In some countries such as Brazil and Uruguay this can be achieved through purchase of land and self-management of large areas of high-yielding plantations. Given the complex land ownership/ land tenure issues in southern China, it is highly unlikely that any one company will be able to control a resource base sufficient to supply a modern pulp mill. It is inevitable that smaller landowners and growers and plantation managers will become an intimate part of the wood supply equation; and industry partnerships with smallholders will expand. Such relationships are increasing elsewhere in the world and there are now many examples of successful out-grower schemes in Brazil, Indonesia, India, and South Africa. Reviews of such schemes are offered in Cellier (1999), Mayers (2000) and Evans and Turnbull (2004).

In southern China where sustained commercial supply from small growers is just beginning, in return for plantations establishment on their lands, landowners can be offered an annual rent, a share of the wood at harvest, or a share of the profit from the sale of wood. The long-term success of such arrangements depends upon trust and transparency. Transparency ensures that everyone knows what the arrangement is and that there is no ambiguity. Trust will ensure that the buyer offers a fair price reflecting current market reality and that the seller does not offer wood to alternative markets, that land rents will be paid on time, and that the contract harvester and buyer accurately measure the wood harvested.

A strong attraction of large industrial facilities is that they offer opportunities for skills enhancement and employment. Estimates of employment created by a pulp mill integrated with a 100,000 ha plantation estate are of the order of 30,000 (Eugene van As, 2005, *pers comm*), including all mill activities, silviculture, harvesting, transport, service industries, and social support. This will vary from country to country as social and management conditions change.

A significant part of the mill door delivered cost of wood in China is tax. Taxes on wood are usually higher than taxes on agricultural products such as fruit. In the case of a pulp mill, these taxes can be substantial and attractive to local governments. A study in Guangxi in 2003 identified some 30 different taxes which were due between harvesting and delivery to the mill gate (Pegg and Li, 2003, *pers. comm.*). Similarly, Lu et al (2002) identified some 14 “unofficial forestry fees” imposed by county, prefecture, township and village administrations in Jiangxi. Whilst these taxes can obviously benefit the broader community, they also act as a serious disincentive to growers of commercially grown wood and successful and competitive wood processors. The issues surrounding tax on commercially grown eucalypt wood in Guangxi are far from clear and there is a pressing responsibility for Governments and administrations at all levels to provide clear and unambiguous rulings. As well as taxes, restrictions of felling on private land and lack of investment capital can act as disincentives for woodlot owners in China (Liu, 2003).

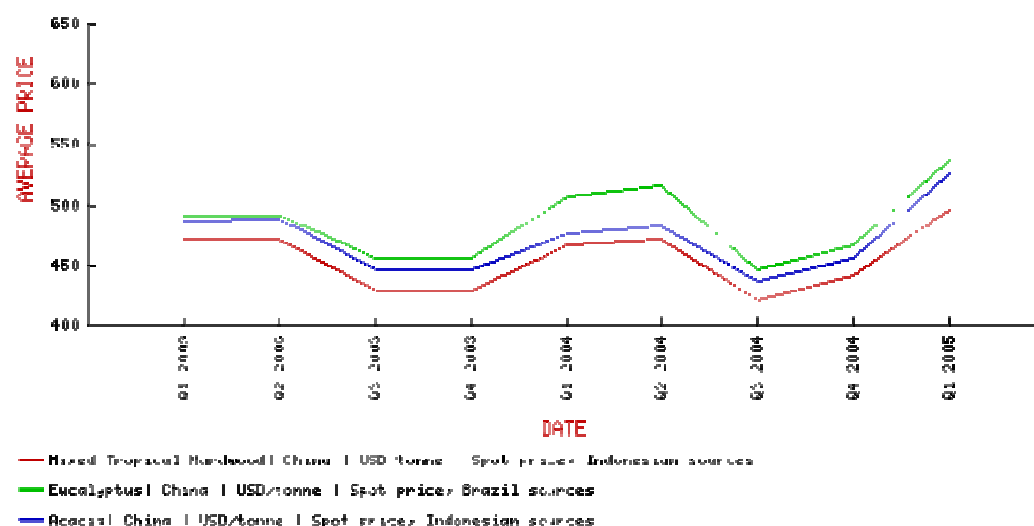


Figure 3-1 Fluctuations in Chinese spot prices for imported BHKP, 2003 – 2005.

Source: Paperloop, March 2005

The presence of a pulp mill in a community can offer certainty for prices for wood from small holders. The projected demand growth for pulp in China is positive and prices are stable and/or increasing (Figure 3-1). This trend will minimize the ebbs and flows of commodity prices. It is anticipated that

wood in close proximity to Chinese pulp mills will be in high demand. This together with the high cost of imported wood chips place the growers in a strong position to negotiate for fair prices.

Whilst expectations of production from eucalypt plantations are high, these must be balanced with environmental and social values to accommodate the broader concept of sustainable forest management. Such accommodation is an added cost on production and leads to an initial increase in the unit cost of wood. This may place Stora Enso at a short-term disadvantage in the context of its Chinese plantations, but reinforces its place as a responsible global producer committed to world class practice.

Key points of the Chapter:

- Eucalypts are examined in the context of the 3 pillars of sustainable plantation management: productivity, the environment and society.
- World experience has demonstrated that, given appropriate silviculture, wood production from eucalypt plantations should face no barriers in sustainability. Experience in China and elsewhere has shown that site productivity can increase across rotations.
- International criticism is leveled at commercial eucalypt plantations because of perceptions of unfavourable impacts on biodiversity, water, and soil. These perceptions are examined in the context of southern China.
- Commercial plantations reduce demands from native wood resources in the region.
- Complex land ownership/land tenure issues in China make it essential that Stora Enso has a commitment to social sustainability and community engagement.

Chapter 4. Stora Enso's Approach to Eucalypt Plantation Management in Guangxi, China

Chinese management and silvicultural practices for commercial eucalypt plantations broadly align with those successfully used in other countries. Stora Enso has prepared a detailed corporate management plan for its Guangxi plantation operations which was reviewed by the ESIA team. The plan includes clear standards and operational guidelines for all activities from land procurement to nursery practice through to site preparation and weeding. These standards are consistent with Stora Enso's stated corporate principles for sustainable wood and fibre procurement and land management. The standards have been based upon Stora Enso's extensive experience with sustainable commercial eucalypt plantations in Brasil and Portugal, best practice and experience in China, and in consultation with local and international experts. In maintaining a disciplined and science-based approach to plantation silviculture, Stora Enso recognises that an overall increase of productivity, wood quality and efficiency of the plantation base will offer significant benefit through reducing delivered costs of wood to the mill. Given the seasonal nature of plantation operations and the scattered nature of the plantations established directly by Stora Enso, the ESIA team was unable to inspect all GXSE-established plantations or inspect and observe standards for all field operations. In their field visits and discussions with field managers, the team did not observe any evidence of departure from the operational standards outlines in Stora Enso's management plan. Many of the plantations managed by Stora Enso have been purchased from other growers who have used different management practices to those encouraged by Stora Enso. The company has operating guidelines in place to convert these to plantations which meet their standards for sustainability.

Elements of Chinese practice and Stora Enso's guidelines include:

Site selection. Stora Enso aims to select lands that have clear legal title, close to the mill site (c. 75 km), accessible by existing roads, in blocks of about 100 ha with slopes below 15°. Site selection and lease rates are influenced by site class and soil quality and depth. The site selection process is done in close consultation with local village and town-level authorities who ensure that there are no hidden conflicts of land use rights (including grave sites and sites of cultural significance). The high competition for suitable land in Guangxi and significant promise of an expansion of commercial eucalypt planting, have made many landowners reluctant to commit to long-term leases as they suspect (with some justification) that land rents will continue to rise with demand. This has the consequence that companies accept sites which do not meet all specifications (other than legal title). Stora Enso has a clearly defined land acquisition process which staff are obliged to follow. Whilst the acquisition process is understood by community leaders, the ESIA team found that there was confusion and uncertainty among land users, adding to a reluctance to commit lands to company plantations. Areas of natural forest or in other environmentally-sensitive areas are not selected for plantation establishment and there is no evidence to suggest that the plantation program will cause loss of human habitation or create the need for involuntary resettlement.

Nursery. Vegetative propagation of selected clones governs commonly used nursery practice in southern China. Popular clones are straightforward to propagate using a mini-cuttings system. Private nurseries provide the needs of the most private and small growers and rudimentary, but robust, nurseries are a roadside feature in much of southern Guangxi and western Guangdong. These practices use large banks of small cuttings hedges and raise plants in polythene pots. Some of the large forest farms have larger and more sophisticated nurseries and tissue culture is used for rapid multiplication of shoots and maintenance and juvenility. The tissue culture plantlets are used to establish 'gardens' of small hedge plants which provide small stem cuttings which are propagated as rooted cuttings for commercial planting stock.

Stora Enso plans to adopt a central nursery as the basis for its supply of planting material. This will enable strict quality control and scheduling of planting stock plus protection of intellectual property

related to newly developed clones. The current nursery at Shankou produces about 4 million plants per year and is efficient and is being expanded and improved to meet Stora Enso's needs.

Eucalypt Domestication and Breeding. Over the past 40 years, testing of eucalypt species, provenances, families and clones has been the focus of much cooperation between scientific institutions in Australia and those in eucalypt growing countries such as Brasil, India, China and South Africa. More than 150 species and over 500 provenances and several thousand families have been introduced and assessed in China since 1980. Eucalypt domestication and breeding programs in China have followed an evolution similar to that in most other eucalypt-growing countries:

- Selection of adaptable and productive new species to replace inferior species currently planted;
- Identification of the best provenances of successful species;
- Progeny testing and selection to supply good reproductive material (seed or cuttings) for establishing seed orchards;
- Hybridisation and clonal reproduction and selection to increase productivity of eucalypt plantations;
- Establishing potential species breeding populations and developing of effective technology for seedling seed orchards (SSOs) and clonal seed orchards (CSOs) to produce improved high quality seed to meet the demand for large-scale plantations.

Associated with this process has been an increasing sophistication in vegetative propagation techniques which allow the operational capture of genetic gains made through the improvement programs. Whilst some planting programs still use seed, most plantations are now based upon clones selected for high performance under southern Chinese conditions. These clones are propagated using a combination of tissue culture and mini-cuttings techniques. Current breeding programs are placing an increasing emphasis upon wood quality (primarily density) and disease resistance. Chinese breeding programs now have available to them within China a suite of molecular technologies which complement the conventional breeding technologies.

The main species being used commercially in southern Guangxi and neighbouring Guangdong are *Eucalyptus urophylla*, *E. tereticornis* (12ABL Congo) and a number of eucalyptus hybrids including: *Eucalyptus grandis* x *E. urophylla*; *E. urophylla* x *E. grandis*; *E. urophylla* x *E. tereticornis*.

There is little cohesion in China's eucalypt breeding programs, with tree improvement being geographically and institutionally fragmented. Groups such as Dongmen Forest Farm, Leizhou Forest Bureau, China Eucalypt Research Centre and the Research Institute for Tropical Forestry have been leaders in tree improvement of tropical eucalypts. Numerous other institutions engaged in tree improvement programs in southern China have undertaken individual and generally uncoordinated programs – these institutes range from provincial forestry bureaus, provincial forestry academies/research institutes, universities, city and county forestry bureaus, county and city forest research institutes and individual forest farms. More recently, foreign companies with eucalypt investments in China (including Stora Enso) have also initiated tree improvement work. Unfortunately, with few exceptions, these diverse but related improvement programs have remained separate with little interchange.

In spite of this important research effort, the number of eucalyptus clones which are available for mass distribution is still extremely limited and a relatively small suite of high-yielding clones form a substantial part of Guangxi's eucalypt plantation resource. The new clonal eucalypt plantations in southern Guangxi lack the minimum threshold of diversity that would place the risks of pest and disease attacks at a reasonable or acceptable level. This issue has been recognised by Barr and Cossalter (2004) and Arnold (2005) and there are still serious research needs to breed and select a broad suite of clones of hybrids and pure species which incorporate high growth performance, high fibre yields, and known tolerances to drought, disease and wind damage.

Stora Enso has recognised the need for tree improvement and this is a substantial part of its R&D effort in its operations in both Portugal and Brasil where genetic testing and selection is strongly orientated towards wood quality and pulp yield per hectare. The company has a commitment to conventional breeding techniques and has decided to refrain from any commercial use of controversial genetic engineering techniques on trees or any other organisms. Nevertheless, Stora Enso will continue to take part in basic research in this area in order to keep up to date with developments. This research will not lead to any commercial applications.

In China, the company seeks to use a large number of clones of genetically broad base and has adopted a 3-stage approach to tree improvement with a similar commitment to wood quality:

- Short term through the use of the best performing clones currently available in China.
- Medium term through performance assessment of newly developed clones and contract production of control pollinated hybrid seeds, and
- Long term through their own corporate breeding program.

It is an unfortunate fact that, despite over 25 years of intensive genetic improvement of eucalypts in southern China, most programs have not progressed beyond the 1st generation. All of the key plantation eucalypt species for tropical/ subtropical southern China start to flower as young as age 2-3 years and the economic rotation lengths adopted for plantation management are usually within the range of 4 to 7 years (Arnold, 2005). Thus it would be possible to complete a complete generation of breeding (propagation, field testing, and selection, mating and seed production) within 7 to 8 years. There is a very strong case for the establishment of a cooperative eucalypt breeding program in China.

Site preparation. Site preparation practices in southern China vary considerably between growers. Commonly practiced techniques include full site cultivation, spot cultivation and ripping. Stora Enso's operational guidelines suggest ripped lines to 90 cm along the contour, 4 metres apart. On steep sites, unsuitable for mechanised operations, planting holes are prepared manually. As the planting program expands, the use of excavators for spot cultivation on steep slopes will be considered.

Planting. Typical Chinese planting densities are 2222 trees per hectare (at 3 x 1.5 metres) which are higher than densities used for commercial plantings in other countries. Stora Enso has elected for a density of 1250 stems per hectare (at 4 x 2 metres) which is consistent with practices in Brasil, Australia and South Africa. It allows for the option of mechanical harvesting at rotation's end at Year 7. Planting is linked to soil moisture and guidelines call for watering-in should condition become too dry. Plantations are established as clonal blocks to offer uniformity in management and genetic diversity in case of fungal attack.

Stand Management: Soil Management and Fertiliser Application. (An overview of soil management and fertiliser use by Stora Enso in Guangxi is offered in Chapter 6.1 of this report). Stora Enso uses several commonly available inorganic fertilisers in its plantation operations and application is adjusted to meet site needs. Inorganic fertilisers are extremely attractive commodities in poor rural areas of southern Guangxi and the ESIA team was offered several examples of widespread nocturnal theft of fertiliser after field application. It was also reported that workers put more fertiliser on trees close to the road than on steep sites or distant compartments. This is obviously a matter for effective supervision. Effective use of fertilisers is critical for the long-term growth of eucalypt plantations and must be a consideration in community engagement and plantation management and monitoring.

Stand Management: Weed Control. Weeds compete directly with the planted eucalypts for light, soil moisture and nutrients. In commercial eucalypt plantations in other parts of the world, it is common to both a pre-planting and post-planting control of weeds using both mechanical and chemical means up until crown closure. By far the most commonly used herbicide is Glyphosate (commonly marketed as Roundup) which offers reliability and effectiveness along with being accepted

environmentally (although recent research suggests the possibility of toxicity to amphibian larvae at field concentrations). Some commercial operations control weeds mechanically using a tractor and plough before planting and subsequently as needed. This is sometimes supplemented with hand weeding in spots around the trees. This approach is falling into disfavour on sites which experience high rainfall intensity due to erosion risks. Control of weeds is a vital part of successful eucalypt silviculture and this generally continues until crown closure is approached. Many of the sites available for plantation establishment in southern China are severely degraded and can support little weed growth. Stora Enso's Management Plan has clear guidelines for the use of herbicides which respect workers' safety and environmental needs. Site inspections by the ESIA team noted good site capture and weed control in plantations established by Stora Enso.

Stand Management: Coppicing and Coppice Management. Coppice is a forest crop raised from shoots produced from the cut stumps (called stools) of the previous crop. It also describes the operation of felling and regenerating. In coppicing, the originally planted eucalypts are felled and the next crop develops from vigorous shoots (coppice) which sprout from the stumps. It is common to retain only one or two strong, well-attached shoots to be grown on for another rotation. For some species of eucalypts and under certain conditions, several coppice rotations are followed, however in China, it is common practice for only one coppice rotation. Normally, the yield of the coppice crop is higher than the seedling crop provided that soils fertility is maintained. In Brazil a 50% reduction in productivity in the first coppice crop was recorded on some sites due to nutrient depletion, especially phosphorus (Evans and Turnbull, 2004). The practice followed by the Leizhou Forestry Bureau is common practice in commercial eucalypt plantations. When coppice shoots are 1 metre high, they are thinned to 2 stems per stump. The soil is tilled between rows (similar to Years 2 and 3) to a depth of 35cm then a further base application of fertiliser is made between the rows. The trees are re-fertilised in the 2nd year of coppice and the coppice rotation harvested at 4 years.

At some sites with strong seasonal variation, the timing of coppice regeneration can be critical to success. It is generally recommended that trees are coppiced at the end of the wet season when soil moisture levels and the tree's carbohydrate reserves are high. The method of felling can also be important. It has been found that saws, rather than axes, yield better coppice since the rougher surface stimulates more rapid callus development on the stool. Stool height is commonly about 30 – 50 cm. (Evans and Turnbull, 2004). There is some debate in southern China at the moment regarding the merits of harvesting with chainsaws or with axes (which is current practice). If coppice management is to be a feature of Stora Enso's plantation management, then it is suggested that this be resolved as part of its R&D program.

Stand Management: Protection from Fire. Forest fires in southern Guangxi are mostly man-made, started either accidentally or deliberately. In the project area, the ESIA team saw examples of eucalypt plantations which had been deliberately burnt because of landholder dissatisfaction with companies (not Stora Enso) that had rented their land at unfair rates and/or had not paid rents on time. Stora Enso establishes a series of fire breaks at establishment and these are maintained throughout the rotation. Roads, if designed by the company, also perform a fire break role. Effective weed control (as described in the management plan and practised in the field) helps minimise the risk of serious fire. Given that much of the SE plantations will have common borders with farmers' land (either forest or agriculture), a key feature of any fire control strategy must be a program of community engagement. Aligned to such a program will be a network of fire towers and firebreaks however these must be linked operationally with social monitoring systems within the adjacent communities.

Stand Management: Protection from fungal diseases. Under humid tropical conditions, high levels of leaf and shoot diseases can limit growth rates and affect product quality. The Manual of Diseases of Eucalypts in South-East Asia (Old et al, 2003) offers a good background to the threats posed by diseases in situations such as southern China. *Cylindrocladium* foliar blight is a major problem on eucalypts grown in the humid tropics. In Vietnam, *E. urophylla* and *E. camaldulensis* have both suffered crown dieback through repeated defoliation of susceptible provenances and *E. pellita* was found to be largely resistant. The *Phaeophleospora* leaf diseases are common in the lower crowns of

trees and can cause significant defoliation of seedlings in nurseries. *Phaeophleospora destructans* has caused severe damage to young *E. grandis* and hybrids with *E. urophylla* in Sumatra, to *E. camaldulensis* in Thailand and to *E. camaldulensis* and *E. urophylla* in Vietnam. An important consideration for fungal pathogens is the risk presented by eucalypt rust, a devastating foliar disease that poses a significant threat to eucalypt forest industry. The causal fungus, *Puccinia psidii* was first recorded on eucalypts in Brazil in 1944 and is now a serious problem in Central and South America and the Caribbean and has recently been recorded in Hawaii. It is a devastating foliar disease that poses a potential threat to the eucalypt forest industry in southern China. Any proposals to transfer germplasm for Stora Enso's South American interests to southern China must be very carefully considered. It would be logical for eucalypt growers in southern China to have a cooperative R&D and response program for eucalypt rust.

Stand Management: Protection from bacterial wilt. The causal organism, *Ralstonia solanacearum*, is a complex species causing diseases to a wide range of crops, including eucalypts. The pathogen is soil borne and disease symptoms develop soon after planting when trees display foliar discoloration, wilting, leaf drop, stem death and reduced growth. Variation in resistance to bacterial wilt has been identified for a range of eucalyptus species in Brasil. Some evidence of clonal variation in southern China with the clone U6 being reported as resistant. There is some circumstantial evidence for enhanced disease incidence following cassava (Old et al, 2003) and indicate that crop sequences might be an important consideration. The Leizhou Forestry Bureau reports that 8 clones have been selected which demonstrate resistance to bacterial wilt. At field sites inspected during the ESIA, the team saw no evidence of bacterial wilt in plantations established by Stora Enso, however it is recognised by most growers as a risk.

Stand Management: Protection from insects. Insect predation on eucalypt plantations in southern China is not unexpected. Historical evidence from Australia suggests that insect pest problems of commercial *E. globulus* plantations in south-western Australia have greatly increased in the last 10 years, which corresponds to a time of rapid expansion of the blue gum industry in the region. Current major pests of established trees in south-west Australia are the Eucalyptus weevil, *Gonipterus scutellatus*, and chrysomelid beetles, *Chrysophtharta* spp. and *Cadmus excrementarius*. (Loch and Floyd, 2001).

In California, where eucalypts have been grown for over 150 years, eucalypts were largely free of both insect pests and diseases. In the last 15 years, numerous herbivorous insect species have been introduced accidentally into the State and have caused significant damage to the trees. Several of these species, e.g. *Phoracantha semipunctata* (Fabricius), *Phoracantha recurva* Newman (Coleoptera: *Cerambycidae*) and *Gonipterus scutellatus* Gyllenhal (Coleoptera: *Curculionidae*), have also been introduced into other parts of the world where eucalypts are grown, whereas others, e.g. *Glycaspis brimblecombei* Moore (Hemiptera: *Spondyliaspidae*) and *Eucalyptolyma maideni* Froggatt (Hemiptera: *Spondyliaspidae*), are currently restricted to California and Australia. Research programmes have provided management solutions to individual pest problems, but as more pest species are introduced, these solutions must be integrated across broad geographic, horticultural, and economic scales, in a systems approach (Paine and Millar, 2002).

A gall-forming wasp, *Leptocybe invasa* (Hymenoptera: Eulophidae) has caused considerable damage to eucalypts in the Mediterranean region and in tropical Africa (Mendel et al, 2004) and has been recently recorded in Vietnam and Thailand (Old, pers comm; La Salle pers comm).

Application of chemical pesticides and poisons to reduce damage by insect and vertebrate pests in plantations is costly to plantation owners and also incurs hidden costs of health hazards and loss of biodiversity. Experience in Australia, California and elsewhere suggest that it is prudent to maintain a regular and disciplined program to monitor the incidence of insect pests in eucalypt plantations in Guangxi. A key focus of insect management will be to manage insect populations without the application of non-specific pesticides.

Stand Management: Monitoring for pests and diseases. Pests and disease present risks to commercial plantations, especially clonal plantations based on relatively few clones. Although no pests and disease problems were identified during field visits, it was unclear to the ESIA team if Stora Enso has a monitoring program and effective response strategy for insects and diseases in place. It is strongly recommended that the company develop and implement an integrated pest management plan and that this becomes an integral part of the R&D program. Such a program would link regular monitoring with appropriate silvicultural practices such as segregating different clones in blocks and using sufficient numbers of clones to provide diversity and be linked to the breeding programs activities on pest and disease resistance.

Stand Management: Response to typhoons. Typhoons are a risk to eucalypt plantations in coastal southern China and can cause wind breakage and wind throw. Young plantations with large crowns and developing root systems are particularly vulnerable. If damaged in Year 1, the normal operational response to typhoon damage has been to prop trees that have been bent or flattened. Trees damaged after Year 3 are salvaged as wood fibre. Local growers feel that the greatest risk is in Year 2 when trees have large crowns, developing root systems but are not of a size to be commercially useful if damaged. An average of 1 - 2 typhoons per year are recorded on the Guangxi coast. These are generally not as severe as those experienced in coastal Guangdong and Hainan. Typhoons play an important role in maintaining annual rainfall, particularly on sites away from the coast. Years without typhoons are often years when drought is experienced. Many of the clones used in southern China have been selected because of their wind firmness and it is understood that this character (or its surrogate, root architecture) is a major selection criteria in the region. There have been reports in southern China regarding benefits of closer spacing (>2000 stems/ha) as a means of offering protection against typhoon damage and that older plantations (>3 years) are more susceptible to typhoon damage (Chen, 2002). This latter impact is reported to be one reason for local farmers favouring very short rotations for eucalypts however the observation may be related to large crown size at an early age. There remains some debate about the interpretation of these results as they conflict with experience in other parts of the world. Typhoons remain a feature of the Guangxi environment and Stora Enso has responded to the risk in a number of ways by:

- Including wind resistance as one criterion in clone development. Such clones would be mainly used in coastal areas, whereas different clones may be used in more sheltered inland regions.
- Modifying silviculture at establishment through deep ripping to foster rapid development of strong root systems and wider spacing to achieve larger stem dimensions.

Monitoring of Plantation Growth; Permanent Sample Plots. Permanent sample plots (PSP) are an essential tool in the monitoring and efficient management of modern plantations. Strategically and systematically located throughout the plantation estate, they are used to offer critical inventory information on growth rates and survival and for monitoring site conditions such as soil quality and undergrowth composition. Stora Enso has established a system of PSP throughout its plantations. Within each compartment, these plots are used for assessing soil characteristics (texture, pH, organic matter, total N, total P, available P, total K, exchangeable K and available B). Ground vegetation is assessed into general classes at the time of PSP establishment.

Use of chemicals and fertilizers. Stora Enso does not use internationally banned pesticides or herbicides. The inorganic fertilisers used in the plantations are commonly available and widely used in China and are stored carefully to avoid theft. No environmental issues were identified relating to the storage, transport and application of fertiliser.

The only herbicide reported used in Stora Enso's plantations was glyphosate, a compound which is widely used in global agriculture and which, if used correctly, is considered benign. The costs of weed control using Glyphosate is about one half that of hand-weeding and avoids the risks associated with soil disturbance. Evidence for toxic effects of glyphosate on amphibian larvae is still equivocal, but abiding by best practice to minimize the amounts used will both reduce any downstream impacts

and reduce costs to the company. The company has detailed directions in its management plan concerning glyphosate use but how these directions are communicated to contractors and field supervisors was unclear. Considering the local context, monitoring of storage, use and disposal of waste will be important to ensuring compliance.

Within the Company nursery, a broader suite of chemicals is used. The directions for storage and use of nursery chemicals are consistent with international practice and with Stora Enso obligations for the environment and occupational health and safety. At the time of preparation of the ESIA report, these directions were being placed into operational manuals. Appropriate safety equipment and clothing, if not available locally, has been brought from Finland.

Harvesting and Transport. Harvesting and transport of raw material are expensive and critical parts of the supporting operations for a pulp mill. Maintenance of adequate quantities of wood is essential if capital intensive pulp mills are to run efficiently and profitably. Wood must be available to the mill every day, in all weather and throughout cultural calendars. The projected mill of 600 000 ADt/a requires a sustainable daily supply of 7500 - 8000 m³ of pulpwood (2.5 mill m³ per year) on a 6 working days per week basis, evenly distributed over the year and at internationally competitive costs.

Stora Enso regards harvesting and transport as critical operations, ones that are expensive and where considerable savings can be made if done efficiently. The company has extensive experience in this area through its plantation operations in Brasil and Portugal. Stora Enso's harvesting and transport operations are still some years away from implementation in Guangxi and the ESIA team did not see these activities in operation. The Company's specialists are developing detailed plans based upon their considerable experience elsewhere and in collaboration with local managers and engineers and in consultation with communities. Key considerations are communication, training needs, efficiency, local employment opportunities, worker and community safety, cost effectiveness, monitoring, and alignment with corporate operating principles. In this process, it has become obvious that traditional Chinese systems for harvesting and transport will have to be changed because:

- They are currently more expensive than international norms and present safety issues.
- To deliver wood in the quantities required by the mill would need a labour force of 25 000 using traditional methods. This is too large to effectively manage and presents risks, primarily through the uncertainty of available labour throughout the year.
- The longer rotations proposed by Stora Enso (7 years vs. current 5 years) will result in larger logs which will be difficult to harvest manually.
- Issues of worker and community safety when harvesting and transporting large quantities of wood.

Environmental considerations for harvesting operations include slash retention, erosion of snig tracks, soil compaction around log dumps and loss of nutrients if bark is removed from the site. Eucalypt logs can be difficult to debark if the bark is allowed to dry on the log. This and the efficiency gained through not transporting significant weights of bark influence most modern commercial operations to debark at site. Slash retention is important in maintaining soil moisture and nutrients between rotations and the systems proposed by Stora Enso will minimise soil disturbance and erosion.

It appears likely that two systems will be developed; one around sites below 15° slope which will adopt a mechanized approach and longer log lengths and the other for steeper sites which will modify the current manual techniques and use shorter log lengths.

Transport and roading are important for both the community and the company. The community regards roads as an opportunity to improve access to markets and other social infrastructure and facilities such as schools and hospitals. The company recognises the social importance of roads and acknowledges the risks associated with large trucks travelling on narrow roads through small villages. Stora Enso is currently assessing a range of possible routes and is seeking to use roads which avoid towns, market places and concentrations of people. To prevent additional impacts to native biodiversity from habitat fragmentation, routes should also try to avoid crossing remaining blocks of

natural habitat or protected areas, or passing between blocks of habitat that are near to each other, such as isolated karst hills.

It is in close discussion with District engineers to identify which roads and bridges must be upgraded. It is likely that a combination of small 4 – 6 tonne trucks and larger 25 tonne trucks will form the basis for the log transport system. Whether this operation will be conducted by the company or through selected contractors has not been decided. Sites for soil and rock mining for upgrading and maintenance of roads should be chosen in compliance with internationally accepted environmental safe-guards. In addition to the technical and economic challenges surrounding an efficient trucking system, the social issues surrounding trucking will be important considerations for Stora Enso; issues such as *ad hoc* development of truck stop facilities, environmentally friendly disposal of oils and grease and trucking routes as vectors for the transmission of human disease will all need to be considered.

Key points of the Chapter:

- Stora Enso has long and successful experience in establishing and managing commercial sustainable eucalypt plantations in a number of countries.
- Stora Enso's detailed corporate management plan for its Guangxi plantation eucalypt operations offers clear standards and operational guidelines which are consistent with their corporate principles for sustainable wood and fibre procurement and land management.
- The standards are based upon Stora Enso's experience and best practice and experience in China, and are supported by a program of R&D.
- Operational processes and challenges for plantation management are discussed in the context of Stora Enso's management guidelines and the realities of implementation in China and Guangxi.
- A strong case is made for Stora Enso to support the establishment of a eucalypt breeding cooperative in China.

Part III

Environmental Impact Analysis

Part III analyzes the potential environmental impacts of Stora Enso's plantation project and suggests strategies, when relevant, for avoiding or reducing these. Chapter 5 introduces the methodology used in environmental analysis. Chapter 6 covers the impacts of eucalypts on water resources and water quality. The chapter begins with a history of the controversy on the amount of water used by eucalypts and then moves to present scientific findings on the topic from around the world and from South China, in particular. The chapter then covers the factors regulating water use of eucalypts. In its closing sections, the chapter summarizes the impacts of eucalypts on water quality and availability and provides an analysis of the impacts on water balance in the five climatic regions in Guangxi in which the Stora Enso project has or will have plantations. Chapter 7 analyzes the impacts of eucalypts and the project on soil fertility and productivity. It begins by examining the issue of retaining litter and harvest residues for soil fertility, a relevant topic given that local people often collect these for fuel. The chapter then examines, in turn, the impact of site preparation and fertilizer on the soil. It closes by assessing the potential impacts of the project on soil fertility in project areas. Chapter 8 provides estimates of the project's potential role in sequestering carbon dioxide from the atmosphere. Chapter 9 analyzes biodiversity impacts of the project. It begins with a presentation of baseline information on landscape and biodiversity in project areas. It next discusses the biodiversity of eucalyptus itself, followed by an assessment of species diversity in eucalypt plantations. The chapter closes by analyzing the changes the project will make in the local landscape as compared to what existed just before implementation.

Chapter 5. Environmental Methodology

Following principle of the ecosystem approach, a framework has been set up for environmental and biodiversity assessment. The ecosystem approach is a strategy for the integrated management of land, water, and biological resources that promote conservation and sustainable use in an equitable way. An ecosystem approach is focused on levels of biological diversity, which encompasses the essential processes, functions and interactions among organisms and their environment. It recognises that human is an integral component of ecosystems and the interactions between human beings and the environment affect on ecosystems (CBD 2004; Sloomweg 2005).

The guiding principles of the environmental impact assessment in the ESIA are facts and science from the scientific literature, empirical research, and experiments. Expert testimonies using the Leopold Matrix and questionnaires, designed as supplementary instruments to obtain the opinions of experts in various fields, were used to help identify and analyze the impact of eucalypt plantations on the environment and biodiversity.

The Leopold matrix is the best known matrix methodology available for predicting the impact of a project on the environment. The Leopold matrix involves a four-step process to estimate the magnitude and importance of impacts. First step is to consider all the interactions recognised by the experts interviewed; Second step, the experts evaluates each impact by applying a number from 1 to 10 (the minimum and the maximum) to register the magnitude of the interaction. It represents the scale of the action relative to the theoretical maximum. Third step is to mark from 1 to 10, the actual importance of the impact for the project under consideration. The fourth step is to integrate points of individual experts who have been interviewed with questionnaires from expert testimony and the Leopold matrix. The Leopold matrix then gives an evaluation of the extent of the environmental impact according to the assessor's judgement.

Questionnaires were also distributed, together with Leopold matrix, to ask experts how they view the impacts of eucalypt plantations. Both the matrix and questionnaire were designed as instruments to help identify and analyse the impact of eucalypt plantations on the environment and biodiversity. Once the matrix was completed and the questionnaires are analyzed, the EIA could focus detailed analysis on those impacts that shows large numerical values for magnitude and importance in the Leopold matrix. Thus, the discussion can focus on impacts that are judged to be particularly significant or sensitive. See Appendix IV and V for details of the questionnaire and for the completed Leopold matrix.

In addition to the questionnaires and matrix, several groups of officials from a variety of government agencies, scientists and professors were interviewed during the process of scoping and implementing the ESIA. Through these interviews, a large amount of additional information and data were collected, and attitudes towards the GXSE forest plantations were better understood by the assessment team.

It is important to note the results of this analysis depend on the expertise, experience and even attitude of the experts who choose to respond. In this study, three foresters, three technical officers, three forest farm managers, one forest scientist, one agronomist, one

ecologist and one environmentalist were interviewed. While there was a general consensus between the experts on many issues, the wide disparity of responses to certain questions indicated that there are some issues that would benefit from additional research and monitoring. These issues, such as water consumption, forest pests and disease, and land use patterns, are considered in detail below.

Chapter 6. Water Use and Impacts of Eucalypt Plantations

6.1 History of the Controversy on Water Use of Eucalypt Plantations in China

It has been argued since 1980s that eucalypts take up a greater amount of water from the soil and lower the ground water table more than other forests or tree plantations in China.

Zhou Guoyi *et al* (1995a) made a comparative study of ground water table observation at Xiaoliang in western Guangdong (the province neighboring Guangxi), and found that ground water table was 9-11 m depth under eucalypt plantation, 1-4 m depth under bare land and 3-5 m depth under rehabilitated mixed forests. Zhou Guoyi *et al* (1995b) reported at the same sites that markedly lower runoff from the mixed forest was associated with the presence of an understorey, litter layer and uncrusted surface soil. Studies at this site were also reported by Yu Zuoyue *et al* (1996), who associated the soil crusting without litter cover due to litter collection and consequent high runoff from the eucalypt plantation with larger raindrop sizes under the eucalypt canopy.

During 1990s, the area of eucalypt plantations in the Leizhou Peninsula, Guangdong, which has similar conditions to Guangxi increased rapidly. At the same time, ground water was lowered significantly, partly due to increasing demand for agricultural irrigation. The eucalypt plantations were then blamed by some for the reduction of ground water in Leizhou. Due to lack of scientific data on water use patterns of eucalypt plantations in South China, water use of eucalypts in some semi-arid countries such as India is often cited. When eucalypt forests were cleared and the lands were used for agriculture or pasture in Australia, the ground-water table rose and reached the soil surface in valleys, and consequently caused salinity on these low lands. Eucalypts were often planted again on the low land to transpire more water into the atmosphere and reduce salinity. In such cases, eucalypts were called “water pumps”. It was reported that annual water use of eucalypts was 3600 mm, when these had unlimited access to ground water on a site where the rainfall was only 800 mm (Greenwood *et al*. 1985).

6.2 Scientific Findings on Water Use of Eucalypt Plantations in the World

As a general rule, trees tend to use more water than grasses or shrubs. Zhang *et al*. (2001) found an average difference of 345mm in evapotranspiration between grass and forest for a rainfall of 1500 mm. When grasslands or shrub lands were replaced by alien trees, the overall water use by the vegetation increased, leaving less water for the streams (Dye *et al*. 1995). Typical examples of the results obtained include an 82% reduction in streamflow in the KwaZulu-Natal Drakensberg 20 years after planting pines (Bosch 1982); a 55% reduction in streamflow in Fynbos catchments in the Western Cape 23 years after planting pines (van Wyk 1987); and the total drying up of streams 6–12 years after completely replacing grassland catchments with pines and eucalypts in the Mpumalanga Province (van Lill *et al*. 1980). Clearing the trees resulted in equivalent increases in water availability in South Africa. For example, clearing a dense stand of pines and wattles from river banks in Mpumalanga Province resulted in a 120% increase in streamflow within a short period after clearing (Dye and Poulter 1995).

Most of Brazil's commercial eucalypt plantations have been established in areas of tropical and subtropical sub-humid climate (some in savannas) rather than high rainfall, humid areas. These large areas of tree plantations did not affect water yield as much as in South Africa because annual rainfall in most areas for eucalypt and pine plantations in Brazil is over 1000 mm, higher than in South Africa. It was found that pine plantation used more water than eucalypt plantation in Brazil (Walter de Paula Lima, *pers. comm.*). Soare and Almeida (2001) reported a water balance study in a 9 years old plantation of *E. grandis* in Brazil, and showed that annual transpiration was 1116 mm and evapotranspiration was 1347 mm where annual rainfall was 1396 mm. A study carried out since 1994

in a watershed in Aracruz-ES showed eucalypt trees consumed water more economically than the native trees over eight years of measuring a eucalyptus forest and stands of neighbouring native species (Atlantic Rainforest). The evapotranspiration was close to precipitation when the precipitation was close to the annual average (Auro and João 2003).

In Australia, most eucalypt plantations have been established in areas with a rainfall between 650-900 mm annually. It was found that fast growing forests reached maximum water use faster and an increase in water yield has regularly been observed as forest matured. Difference in leaf area of tree plantations affected water use more than difference in species. According to Zhang *et al.*'s model (1999), pine plantations usually used more water than eucalypt plantations due to high leaf area index and interception.

India has the largest area of eucalypt plantations in the world. A micrometeorological study by Kallarackal (1992) of *E. tereticornis* water use in Kerala, south India recorded daily water use of 5 to 8 mm/day in the dry season, with no evidence of restriction by soil moisture deficit or stomatal closure at high vapour pressure deficit. In the early 1990s, there were several studies on water use of eucalypts in India. It was concluded (Calder *et al.* 1992):

- In the dry zone, the water use of young eucalypt plantations was no greater than that of indigenous dry deciduous forest.
- The annual water use of eucalypt plantations and indigenous forest was equal to the annual rainfall.
- Annual water use of forest was higher than that of annual agricultural crops.
- On sites with deep soils in the dry zone, there were indications that the water use, over the three years of measurement, was greater than the rainfall (model estimated 3400 mm with rainfall 2100 mm in 3 years).
- There was no evidence of root abstraction from the ground water as recorded in Australia on sites with shallow ground water tables.

6.3 Recent Scientific Findings on Water Use of Eucalypt Plantations in China

In 1999, scientists from the Research Institute of Tropical Forestry, Chinese Academy of Forestry, and their Australian research partners established a water balance study at Jijia and Hetou in Leizhou, Guangdong province, where the climate and geographical feature are similar with that of southern Guangxi. It was found that annual water use of the 3-4 year old plantation of *E. urophylla* (tree spacing was 3 × 2.5m at Hetou and 3 × 1.5m at Jijia) assessed by heat pulse was 542mm at Hetou and 559mm at Jijia, respectively (Morris *et al.* 2004). Estimates of the water balance at the two sites found evapotranspiration ranged from 969–1150 mm per year, and was relatively stable at each site over a 2-year-period despite a 20–30% increase in rainfall in year 2. The difference in total evapotranspiration between the sites was partly attributable to higher soil evaporation at Jijia, where fine textured soils exhibited far greater water holding capacity and hence evaporative availability than the coarser textured soils at Hetou (Patrick *et al.* 2004). Drainage rates were 26 and 35% of annual rainfall at Jijia and Hetou, respectively, in year 1, and increased to 52 and 49%, respectively, in response to higher rainfall in year 2. Although evapotranspiration exceeded rainfall during the dry season, indicating the plantations abstracted water from storage in the soil profile, it was much smaller than water infiltration into soil profile in wet season and water recharge to ground water in the two sites was very obvious. It was concluded that the eucalypt plantations did not pose a threat to water resources in that region. The study results also imply that water use by plantations on soils with high water availability and in areas of high vapour pressure deficit may be reduced by wider spacing.

6.4 Factors Regulating Water Use of Eucalypt Plantations in South China

Water use of eucalypts is related to soil, climate and lateral redistribution of water. Water transpiration rates by eucalypt plantations reported by Mahmood *et al.* (2001) and Morris *et al.* (1999) were 1100 and 1700 mm respectively at Pacca Anna and Tando Jam in Pakistan, and 1200 mm at

Dong Bung, North Thailand. These rates were about twice the transpiration rates at Jijia and Hetou, China. The main reasons for the low transpiration in south China are:

High incidence of cloud and solar radiation and energy income were lower in the summer comparing with the other 3 sites. Summer solar radiation in Leizhou, a location very close to southern Guangxi, was much lower than the Pakistani sites or in northern Thailand. Summer humidity is much higher in Leizhou than the other sites making it more difficult for water to evaporate from stoma of tree leaves.

Most forest lands in southern China are on hilly and mountainous lands with almost all low lands committed to agriculture. Despite the Indian experience, it appears impossible for trees to use ground water in south China as ground water levels in most of forest lands were deeper than 8-10 m. Transpiration by eucalypt trees in winter was lower, about 1 mm per day, though humidity was lower in winter than that in summer because of water limitation and low temperature retraining tree physiological activity.

Leaf area of eucalypt plantations in south China was lower than that in other countries (Xu et al, 2002) due to soil limitations. Most eucalypt plantations in south China had a leaf area index about one half of that recorded in other countries. Consequently, eucalypt plantation in south China used less water than in other main eucalypt planting countries. Above all, transpiration rate by eucalypt plantations in south China was much lower than that in semi-arid climates and less than 600 mm annually. Annual evapotranspiration in eucalypt plantations more likely was between 900-1200 mm. Another study of tropical mountain rain forest in Jianfenglian, Hainan showed that annual evapotranspiration was 1422 mm with 508 mm transpiration by top trees (Chen Bu Feng, *pers. comm.*).

Rainfall over the land surface provides the input for recharging the soil with water, replenishing ground water and providing runoff in streams and rivers. Some of this rainfall will be evaporated back into the atmosphere before it can reach either water courses or ground-water. This evaporation occurs via 3 pathways: interception, transpiration and evaporation. In addition to plant transpiration, interception is an essential part of evapotranspiration. The key parameter governing interception loss is that canopy storage capacity, which will depend on leaf area and canopy architecture. Comparing with other tree plantations, eucalypt plantations have a low interception by the tree canopy due to small leaf area and smooth leaf surface (Table 6-1). Generally conifer plantations have a higher evapotranspiration than broad-leaved tree plantations due to high interception.

Table 6-1
Interception by Tree Canopy of Different Forests

Source	Location	Species	Rainfall (mm)	Interception %
George (1978)*	Dehra Dun, India	Eucalypt hybrid	1670	12
Dabral&Subba Rao (1968)*	Dehra Dun, India	<i>Pinus roxburghii</i>	1670	27
Feller (1981)*	Maroonda, Australia	<i>E. obliqua</i>	1200	15
Feller (1981)*	Maroonda, Australia	<i>Pinus radiata</i>	1200	25
Feller (1981)*	Maroonda, Australia	<i>E. regnans</i>	1660	19
Patrick et al. 2004	Jijia, China	<i>E. urophylla</i>	1525	16.2
Patrick et al. 2004	Hetou, China	<i>E. urophylla</i>	1525	19.8
Wen Yuanguang et al.	Guangxi, China	Chinese Fir	1366.5	26.9
Li Fei et al.	Jiangxi, China	<i>Pinus massoniana</i>	1460	20.8
Cui Xianghui	Dinghushan, Guangdong	Over-green forest	1839.3	19.9

Source: *Growth and Water Use of Forest Plantations*, edited by I.R. Calder, R.L. Hall and P.G. Adlard, 1992. Wiley, Chichester, England.

The evaporation from the forest floor and transpiration by understorey vegetation (relatively small) are not so different with different tree plantations. The study in Leizhou showed that soil evaporation under 3-4 year old *E. urophylla* was 14 and 9% of rainfall, and 23 and 16% of evapotranspiration at Jijia and Hetou, respectively (Patrick *et al.* 2004). The maximum daily rate was 2.77mm at Jijia and 1.37mm at Hetou. Particularly at Jijia, soil evaporation reached 49mm per month in July 2000. The greater water holding capacity at Jijia provides a near surface store for soil evaporation which was much higher than at Hetou. Soil evaporation is particularly pertinent for plantations where tree spacing and suppression of weeds, shrubs and understorey may leave substantial areas of bare soil. If litter collection for fuel occurs, soil evaporation could be much higher on lands with a high clay content in the top soil.

6.5 Impacts of Eucalypt Plantations on Hydrological Process and Water Quality

The impacts of large area eucalypt plantations on hydrology at a regional level can be understood through water balance studies of eucalypt plantations. A catchment study in Gaoyao County, Guangdong showed that there was 107,900 t of rainfall in the first half of this year, and the water yield in the 10 ha catchment was 50,200 t, about 46 % of rainfall (Xu *et al.* unpublished). This was similar to another nearby catchment with natural secondary forest. There are no long term observation data available on impacts of land use change on the hydrology of large catchments in south China. Generally, forests or plantations can sustain and reduce water to a river and reduce high flow in wet season. High forest coverage could reduce flood levels. Forests and plantation usually can reduce low flow (dry season flow) in low rainfall area, such as South Africa and Australia. The increased transpiration and increased dry period transpiration from forests will increase soil moisture deficits and reduce dry season flows. But in a high rainfall area, increased infiltration under forests or plantations will lead to higher soil water recharge and increased dry season flows. Most Chinese forest hydrologists believe that forests or plantations increase low flow in winter dry season in humid climate in south China; however there are no well recorded measurements to prove this. Large areas of eucalypt plantations may not affect hydrological process significantly if the former lands were also occupied by tree plantations. If large area plantations of fruit and sugar cane are transferred into eucalypt plantations, soil and water erosion in wet season will be significantly reduced, but it is difficult to predict low flow change and the change could be site-specific and rely on the amount and intensity of annual rainfall.

The results of a comparison between catchments covered by eucalypts and native forests located in the municipality of Imperatriz, Brazil, showed that water quality from the catchments were similar in terms of the following variables: K, Ca, Mg, Conductivity, pH and Peak flow (C. D. Camara, M. C. Calijur *pers. comm.*). There have been no comparative studies on water quality from eucalypt plantations in China so far. Generally, forest operations affect water quality more than forests or tree plantations themselves. Total soil tillage will affect soil erosion and increase nutrient contents in water runoff to the river system.

6.6 Impacts of Eucalypt Plantations on Water Balance in Stora Enso project Areas in Guangxi

According to Stora Enso's plan, eucalypt plantations have been or will be established in 5 regions (Beihai, Yulin, Nanning, Dongmen and Fangchenggang). The impacts in the 5 regions will not be the same because of differences in rainfall patterns and quantity and existing vegetation cover.

In the Beihai Region

Stora Enso aims to establish 40,000 ha plantations in Beihai city and 26,667 ha in Qinlian State Forest Farm (most of the farm's land in Beihai and some in Qinzhou City). Annual rainfall in the Beihai-Qinzhou region is around 1700 mm (1250-2100 mm) with 70% of total rainfall in the monsoon season (from May to September). In the coastal region, there are two reservoirs, Hepu reservoir with 1.2 billion t water storage and 0.65 billion t of water supply capacity and Hongzhaojiang reservoir with

0.6 billion t water storage and about 0.4 billion t of water supply capacity, to supply water for main requirement of agricultural irrigation, industry and peoples' living. Of the total land area of 337,000 ha, there are 120,000 ha forest land and 100,000 ha forests in Beihai. About 20,000 ha forests was already classified as ecological forests which are distributed along the coastline, railways and main highways, and around reservoirs and rivers. Beihai's forestry bureau plans to expand ecological forests to 30% of forests. Most of its 60,000 ha of commercial forests are eucalypt plantations and others are pine and acacia plantations. Potential grass, shrub and agricultural lands that could be transferred into eucalypt plantations are about 20,000 ha.

This region is near Leizhou peninsular with a similar climate pattern, but Hepu and Qingzhou are little more humid than Leizhou with about 100-200 mm higher annual rainfall and lower vapour pressure deficit. The evapotranspiration of eucalypt plantations established by Stora Enso in Beihai will be about 1000 mm annually. Therefore, it unlikely that establishment of eucalypt plantations in this region will affect water balance. Unlike the situations in South Africa and Brazil, there has been very little land use change in the region so far and eucalypt plantations will be less than 5% of the total land area by 2015. It is impossible for eucalypt trees to use ground water as low lands are committed to agriculture in this region. Therefore, it is unlikely that establishment of large areas of eucalypt plantations by Stora Enso in this region will affect hydrological processes.

Water use by plantations and the impact to hydrological process in the region can be slightly improved by management options. As Stora Enso adopts a better site preparation methods (such as deep ripping) in this region instead of total soil tillage, water surface runoff could be less than before. This will be helpful to recharge ground water and increase drainage in dry season. The spacing used by Stora Enso's plantation is 2 x 4 m, larger than other farmer's spacing (2 x 3 or 1.5 x 3 m), and this could lead to a lower transpiration in the plantations, but the longer time between planting and canopy closure could increase soil evaporation. Maintaining soil cover on the plantation floor is another approach to reduce water evaporation. Harvest residue and litter retention are strongly recommended. This will influence practices of fuelwood collection and it is suggested that only woody branches and harvest residues are collected, and leaf litter should be left to protect the soil surface. Ensuring this at sites near villages that have lost their former sources of fuelwood to plantations may require regular monitoring and patrolling.

In the Yulin Region

Stora Enso plans to establish 22,000 ha eucalypt plantations in Yulin region (11,333 ha in Bobai State Forest Farm, 6667 ha in Yulin and 4200 ha in Liuwan State Forest Farm). The landscape in this region is hilly or mountainous. Annual rainfall is about 1500-1700 mm. There are 727,300 ha forest land of the 1,283,800 ha total land, and 686,000 ha forests with a forest coverage of 53% in Yulin. About 254,700 ha forest are classified as ecological forest, 35% of forest lands, and 472,600 ha land have been classified as commercial forests. Of commercial forests, 32,000 ha are Chinese fir, 57,300 ha eucalypt and acacia, and 154,400 ha of economic tree plantations, such as Litchi, Longan, Aniseed and Cinnamon. It planned to establish 100,000 ha of fast growing tree plantations (half with eucalypts and acacias and half for pines). About 33,000 ha lands are planned to be transferred from fruit trees into forest plantations before 2015. The evapotranspiration of eucalypt plantations there is more likely less than 1000 mm annually due to low vapour pressure deficit with a higher elevation. The water in all catchments mainly goes to Pearl River and a river to Beihai. In this region, common site preparation on steep slopes is hole planting. Though rotation period of eucalypt plantations is 7 years, shorter than the former pine and acacia plantations (8-20 years), regeneration of second rotation of eucalypt plantations will be coppice and will not need site preparation again. Soil disturbance in eucalypt plantations will not be much different to that for longer-rotation pine and acacia plantations and soil erosion will be almost the same as other tree plantations. In general, vegetation determines the infiltration and properties of soils and affects the hydrological functioning of catchments through surface runoff generation, recharge, and seasonal flows. The transfer of large areas of uneconomic fruit orchards to eucalypt plantations will reduce the incidence of surface runoff and reduce erosion transport through higher infiltration rates in plantations. Therefore, it will reduce high flows and reduce flood levels in rivers. It is difficult to predict the impact of the land use change on low flow in

streams or rivers in the region. If there is a reduction of low flow, it will be very small with almost no impact on water supply. Fertilization in eucalypt plantations could increase N and P content in water runoff slightly, but this will be less than that from fruit orchards and agricultural lands. More study on impact of fertilization on the nitrogen and phosphorus content of water runoff is needed to reliably predict impacts on water quality.

In the Nanning and Fangchenggang Regions

Stora Enso plans to establish 12,000 ha eucalypt plantations in Qipo State Forest Farm, Gaofeng State Forest Farm and Liangfengjiang State Forest Farm. All of the 3 farms are located around Nanning region with annual rainfall around 1500 mm. The lands for eucalypts used to be occupied by pine, Chinese fir and acacia plantations. There will be no change to water use and water balance in this region. Another 6667 ha eucalypt plantations are planned for Fangchenggang. The climate there is more humid with a 2000-2500 mm annual rainfall. Stora Enso's management to eucalypt plantations will be helpful to reduce soil erosion on this site.

In the Dongmen Region

Stora Enso plans to establish 5333 ha in Dongmen State Forest Farm, 3800 ha in Paiyangshan State Forest Farm and 3333 ha in Chongzuo County. Annual rainfall around Dongmen region is about 1250 mm because some humid air from ocean is blocked by Shiwandashan. Therefore, evapotranspiration of eucalypt plantations more likely is close to rainfall. It indicates that eucalypt trees may use some water storage in the deep soils during dry season. As almost all lands in Dongmen State Forest Farm are occupied by eucalypts and lands in Paiyangshan State Forest Farm are covered by tree plantations already, no change for water balance is expected. The establishment of eucalypt plantations in Chongzuo may use some other open shrub or crop lands, and it may affect the amount of waterflow to streams or drainage to basin agricultural land. Therefore, any land transfer from open shrub or crop lands into eucalypt plantations in this area should be approached with caution.

6.7 Discussion and Recommendations

The results of a review of available literature and experience are consistent with the experts' testimonies. All 13 experts agreed that eucalypt plantations will not affect water resource and water quality in the region and will be helpful for soil and water conservation. Ten of the 13 experts agreed that eucalypts use less water to produce same amount of wood than pine, Chinese fir and other tree species.

However, from the household surveys conducted for the social analysis portion of this work, 73 percent of households in group A (households renting private land to Stora Enso) believed that eucalypt plantations reduced water resources. The households in groups C (state farm workers in project areas who have worked on Stora Enso land) and E (state farm workers in project areas, but who have not worked on Stora Enso land) who believe that eucalypt plantations reduce water resource, were 28 and 69 percent, respectively. The households in group D (villagers living near state farm and working on Stora Enso land on that farm) who believe it are 52%.

Experts have good access to recent research findings and understand water balance of eucalypt plantations well. Professionals working for the project will have better access to new knowledge and understand the issues better than the people who are not involved. The general impression of people in villages on water use of eucalypts may be from the dispute during the 1990s. Therefore, Stora Enso should set up a demonstration study on catchment water balance to educate local people and clear their concerns on water resources.

The ESIA team concludes that eucalypts do not consume more water than equivalent biomass of *Pinus massoniana*, *P. elliottii* or Chinese fir. Eucalypt plantations will not negatively affect the amount or quality of water resources in the project region. In contrast, they will play a positive role in soil and water conservation. No scientific evidence was found to support local beliefs that eucalypts produce toxic substances that pollute water sources. However, possible minor impacts on water

quality by fertilizer and herbicides may take place and is recommended that this be monitored as part of the R & D program.

Key points of the Chapter on water use and impacts:

- Significant public debate is fuelled by perceptions of excessive water use by eucalypt plantations in China and other countries.
- The impacts of eucalypts on local hydrology vary with rainfall patterns and quantity, humidity, soil type and management.
- Some very detailed scientific studies on eucalypt water use have been recently completed in southern China, at sites close to Stora Enso eastern plantations and with similar climate conditions.
- The authors of this study at Leizhou concluded that it would seem the eucalypt plantations do not pose a threat to water resources in the region.
- Water use will vary with sites and caution should be exercised if converting shrubland or crop lands to eucalypts on sites where evapotranspiration is close to rainfall.
- The EIA recommends that Stora Enso establishes a demonstration catchment as a part of public education relating to eucalypts and water use.

Chapter 7. Soil Sustainability in Eucalypt Plantations

To sustain soil fertility and productivity of eucalypt plantations, it is essential to maintain or improve soil physical and chemical properties. Lal (1997) reviewed the soils of the tropics and their management for plantation forestry and indicated that tropical soils are mostly of low fertility and subject to limitations to sustained intensive cropping, including acidity, nutrient imbalance, compaction and erosion. However, appropriate management can restore degraded soil quality and enhance productivity, while protective ground cover and runoff management will help mitigate the high erosion risk on upland soils. A review of soil and stand management for short-rotation plantations by Gonçalves *et al* (1997) suggests that intensive production demands an understanding of the interactions between soil water and soil nutrients, since fertiliser effectiveness depends on water availability. Nutrient loss at harvest and through site disturbance must be minimised by conservative practices, minimum cultivation and recycling of biological materials.

The major constraint to productivity of eucalypt plantations in south China is low soil organic matter. Of 112 fixed sample plots in Stora Enso, only 24 plots have a top soil organic matter content higher than 2%. Most of the lands available for eucalypts in south China have been degraded over recent centuries with extensive loss of A horizon. The low productivity of eucalypt plantations before 1990s and soil degradation in south China were a consequence of poor management of forest soil fertility in the past, including inadequate site preparation which increased soil erosion, over-harvesting of organic materials from forests and inadequate fertilisation (Xu 1996).

7.1 Impact of Retaining Litter and Harvest Residue on Soil Fertility and Productivity

As mentioned above, a common practice by rural people in south China before 1980s was to harvest litter and understorey from forests to meet their fuel needs. The average amount of annually harvested litter and understorey is 3.3 t ha^{-1} , which can be as much as 55% of litter and understorey production (Brown *et al.* 1995). It was calculated that the harvest of litter and understorey removed a substantial quantity (about 44-73%) of the nutrients that could be potentially recycled (Mo *et al.* 1995). Before the 1990s, the eucalypt plantations in south China used to be established on flat degraded coastal lands with a high population density. Poor rural families had public access to collect fuelwood materials. During harvest, forest farmers removed the main stem of the trees and local villagers then collected the harvest residue (leaves and branches) and cut the understorey as fuel. Tree roots were also collected after soil tillage. This resulted in serious soil erosion. It caused losses in soil organic carbon and resulted in poor structure. A study (Xu *et al.* 2002) at Gaoyao, Guangdong showed that nutrient loss by whole tree harvest in a 4.5 year old plantation of *E. urophylla* was more than 2 times of a stemwood-only harvest (Table 7-1) which are internationally accepted practice for eucalypt plantations. To maintain soil fertility and productivity of eucalypt plantations on this degraded land without retaining litter and residue on site in south China, fertilisation is essential.

Like most trees, eucalypts have the capacity to acquire available nutrients from the soil and to conserve them in biomass. The withdrawal of many nutrients from the biomass, through efficient internal cycling during the formation of heartwood, is an effective strategy for maximising the use of limited nutrient pools by eucalypt plantations (Florence 1996; Saur, Nambiar and Fife 2000). But eucalypt trees in short rotation plantations (4-5 years) in south China are harvested before such nutrient withdrawal from tree tissues can become available for new growth. Therefore, improved practices for retaining slash on site are needed to improve soil chemical and physical properties and nutrient cycling, and support to sustain or increase productivity of eucalypt plantations in south China. It is concluded that replacement of this organic matter by slash was helpful in slowing the loss of organic C and removal of all organic materials is likely to have increased topsoil erosion and soil

temperature resulting in faster decomposition in south China. A harvest residue management study in Yangxi, Guangdong showed harvest residue management intensity had a significant impact on the amount of nutrients retained on site (Xu *et al.* 2000). Retaining harvest residue (bark was not included) and double slash increased tree volume by 25% and 46% over all above-ground biomass harvest treatment, respectively. This result was similar with the experiment for coppice of *E. saligna* x *E. robusta* hybrid in Brazil (Miranda *et al.* 1998), but the effect of slash on productivity in this study was smaller compared to the 86% increase in production on the windrows of slash in Brazil. The reason for the small effect in this study could be the small amount of slash compared with other studies.

Table 7-1
Comparison of Nutrient Loss (kg ha⁻¹) from 4.5 Year-old *E. urophylla* Trees with or without Phosphorus Fertiliser with Four Harvesting Strategies

Harvest strategy	200 p/ha was applied					No P was applied				
	N	P	K	Ca	Mg	N	P	K	Ca	Mg
Scenario 1 ^a	77.6	4.6	51.6	38.6	4.2	12.8	0.6	5.4	4.2	0.5
	41*	34	29	20	40	30	26	18	11	25
Scenario 2	108.7	7.4	116.2	128.1	4.7	19.7	1.1	15.8	21.3	0.6
	57	54	65	67	44	45	48	52	56	28
Scenario 3	162.2	11.7	160.9	169.8	9.3	34.8	2.0	27.1	31.9	1.7
	85	86	90	88	88	80	88	89	83	83
Scenario 4	181.8	12.9	173.2	184.8	10.1	39.9	2.2	28.9	35.8	1.9
	95	95	97	96	96	92	95	95	94	92

*Percentage of total tree accumulation; ^a Scenario 1 = stem-wood only harvesting, 2 = bole only harvesting, 3 = all aboveground harvesting, 4 = all above ground plus tap-root harvesting.

Source: Xu *et al.* 2002.

7.2 Impact of Site Preparation on Soil Fertility and Productivity

As the root system of most tropical fast-growing eucalypts is quite shallow (Yu, 1999; Gonçalves 2000), physical improvement of the topsoil is predicted to improve tree growth. Soil tillage generally reduces soil bulk density, increases the oxygen content of soil air and accelerates soil organic matter decomposition so that available nutrients are increased in the top soil (Prasad and Power 1997). Trees, therefore, develop more efficient root systems after soil tillage. However, it is likely that tree growth will decline when their roots have fully explored the tilled topsoil and the available nutrient pool in the topsoil becomes depleted (Yang *et al.* 1996). Thus, in the long term, tillage exposes organic matter to microbial action, and the more a soil is tilled, the greater the loss of soil organic matter (Prasad and Power 1997). Total soil tillage or double soil tillage has been used for site preparation on the flat coastal lands for a long time. A study in Yangxi, Guangdong (Xu *et al.* unpublished) showed organic matter, N, P and K losses were about 3 times that of hole planting (Table 7-2). Another study in Yangxi (Xu *et al.* unpublished) showed that soil erosion in first year after total soil tillage was about 13 t/ha, and 3 years after double tillage, clay content in top soil was reduced and sand content was increased significantly due to soil erosion (Table 7-3). When ripping is used for site preparation, soil and water erosion will be reduced dramatically and organic matter in top soil will be increased gradually.

Table 7-2
Organic Matter and Nutrient Loss in First Year after Site Preparation (kg/ha)

	Organic matter	N	P	K
Hole site preparation for eucalypt	107.3	4.7	0.7	27.8
Total tillage for eucalypt	301.4	14.3	2.0	105.3
Hole site preparation for acacia	117.0	4.6	0.8	32.6
Coppice	87.5	3.9	0.6	22.1

Source: Xu *et al.* unpublished

Table 7-3
Soil Content Change after Different Site Preparations (%)

Site preparation	1-2 mm	0.5-1 mm	0.25-0.5 mm	0.05-0.25 mm	0.02-0.05 mm	0.02-0.002 mm	<0.002 mm
Total tillage	14.4 c	10.4 b	13.4	6.3 b	1.7	13.9	40.0 a
Band tillage	13.4 bc	9.8 a	13.3	6.1 b	1.8	13	42.7 ab
Hole planting with band clearing	12.6 ab	9.6 a	13	2.5 a	2.5	14.4	45.5 b
Hole planting	11.4 a	9.3 a	12.5	2.5 a	1.5	13.4	49.5 c

Source: Xu *et al.* unpublished

7.3 Impact of Fertilisation on Productivity and Soil Fertility

The soils for eucalypt plantations in south China are generally lateritic and lateritic red earths (Oxisols and Ultisols) which are acidic in reaction (pH_{water} 4-6), highly leached, generally heavy-textured and deeply weathered (Li 1983; Wang and Zhou 1996). Stewart *et al.* (1991) has shown that Oxisols and Ultisols are high acidic (pH range of 4.5-5.5) and low in available P and other nutrients. Phosphorus may be the primary macro-nutrient limiting the growth of eucalypts in southern China, since, without P application, *E. urophylla* did not respond to N fertilizer at Dongmen (Chen *et al.* 1996). The use of inorganic fertilisers in forestry is quite new (mostly in the 1990s) in China (Wang and Zhou 1996) because fertiliser production in China was, until recently, not able to meet the agricultural demand for food production. Phosphorus response in south China is very high and the response in the southeast is higher than in the southwest because soils in the southeast have lower pH and available P than in the southwest (Table 7-4).

Table 7-4
Summary of Results of P Application in South China

Location	Species and age (year)	P applied (kg ha ⁻¹)	Increment over control	Soil Ph
Baoshan *	<i>E. globulus</i> , 5	31-62	39-64%	5.8 (H ₂ O)
Chuxiong	<i>E. globulus</i> , 3	13-300	15-66%	4.8 (KCl)
Dongmen *	<i>E. grandis</i> x <i>E. urophylla</i> , 6-8	50	40-67%	5.7 (H ₂ O)
Gaoyao	<i>E. urophylla</i> , 4.5	20-200	470-740%	3.2(KCl)
Leizhou *	<i>E. urophylla</i> , 4.6	15-58	160-320%	4.2 (H ₂ O)
Yangxi	<i>E. urophylla</i> , 3.7	32.5-65	130-460%	4.4 (H ₂ O)
Kaiping	<i>E. grandis</i> x <i>E. urophylla</i> , 6.3	13-312	160-370%	3.3(KCl)
Kaiping *	<i>E. urophylla</i> , 4.5	43-130	130-210%	4.6 (H ₂ O)#

Source: Xu *et al.*, 2002.

A key issue for improving P efficiency in highly weathered soil is whether applying large amounts of P once is an efficient strategy for optimizing P uptake and crop yield or, alternatively, whether applying small amounts of P once to alleviate low productivity to an intermediate level is a better strategy. The validity of applying large amounts of P once requires that applied P remains available over time. Dias *et al.* (2001) found that after a rotation of eucalypt plantation soil available P was largely increased by phosphorus application 9.5 years ago in a Brazil Oxisol. Harding and Jokela (1994) demonstrated that P fertilisation increased aboveground organic matter accumulation of a 25 years-old slash pine plantation and extractable soil P in north Florida. Evidence from pine indicated that uptake beyond immediate tree requirements increased the rate of P recycling by increasing available P released from litter and soil organic matter over long period (Polglase *et al.* 1992).

Phosphate management recommendations for high P-fixing soils often consider P fertilisation as a long-term investment which can be amortised over several cropping cycles (Folster and Khanna 1997).

Slash management has a significant effect on the amount of inorganic P made available to the following rotation. Bekunda *et al.* (1990) showed, for example, that retention of slash of *P. radiata* increased inorganic P in the soil and was adequate to sustain high early growth in the following rotation. A study in Kaiping, Guangdong (Xu *et al.* 2002) showed that tree growth in second rotation coppice was also increased by P application in first rotation. Productivity of high P treatments was about twice that of coppice in without P. A further study in second rotation coppice of *E. grandis* x *E. urophylla* showed that refertilisation with N, K and B significantly increased coppice growth (Figure 7-1).

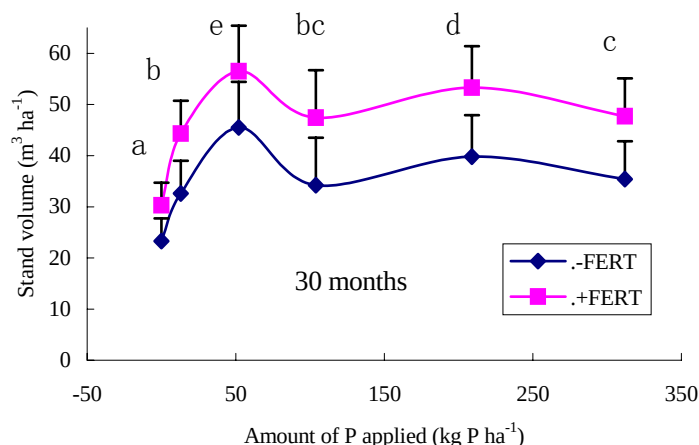


Figure 7-1.

Effect of P Fertilization in First Rotation and Refertilisation of N, K and B in Second Rotation Coppice of Eucalypts on Tree Growth

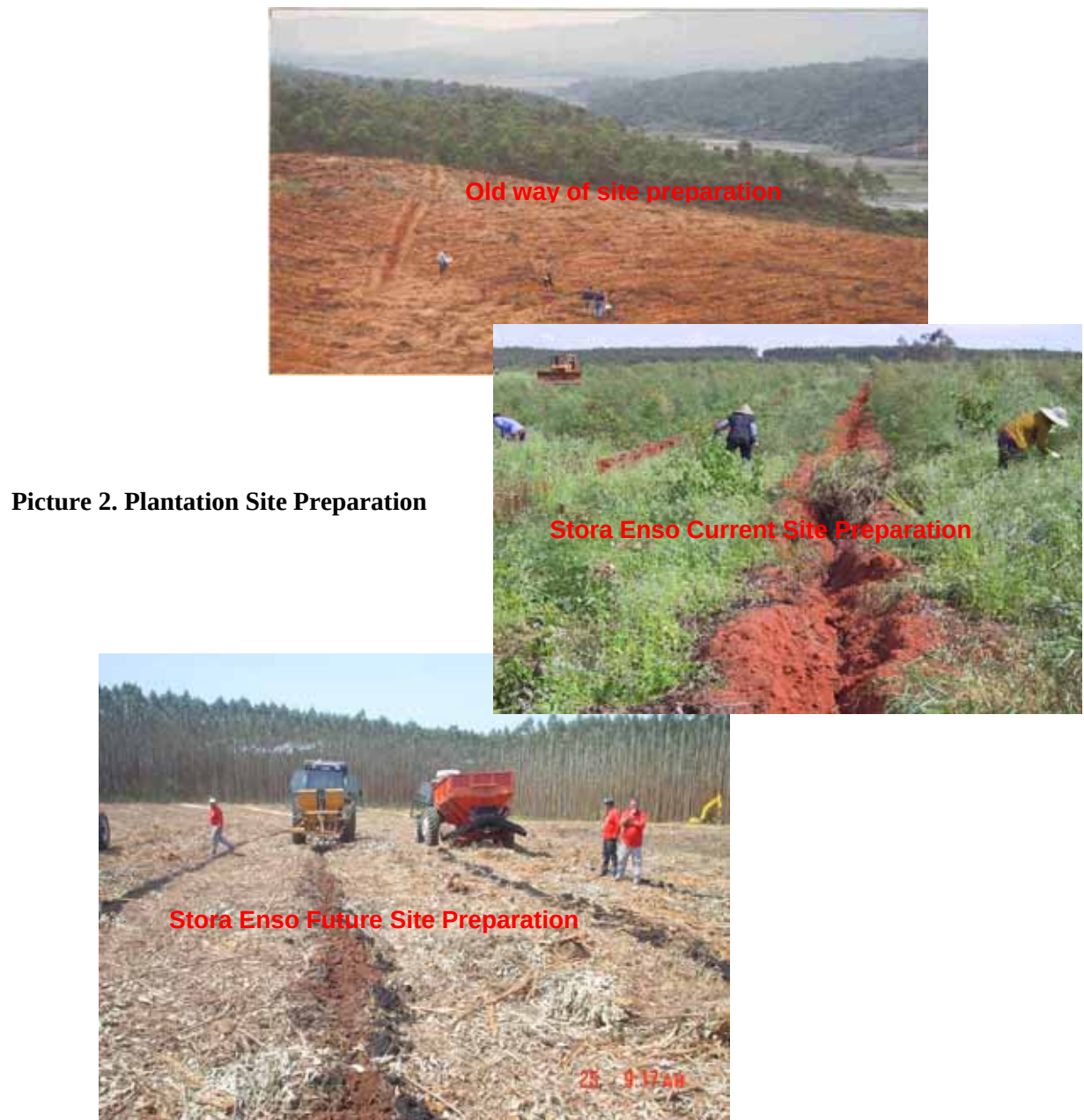
Source: Xu *et al.*, 2002

Another study in Yangxi, Guangdong showed that coppice was more productive than replanting for the second rotation up to 46 months old (Xu *et al.* 2000). Response of coppice trees to fertilisation was much lower than for the replanted trees. This suggests that well-developed root systems may have better assisted the coppice to acquire soil nutrients than the smaller root systems of the planted trees. The coppice probably used more nutrients from the soil than from fertiliser and did not rely so much on fertiliser. Productivity of the second rotation coppice on this poor site was slightly higher than the productivity in first rotation. Gonçalves *et al.* (2000) and Bouillet *et al.* (1998) reported that replanted trees were usually better than coppice in Brazil and Congo. However, it is recommended that coppice should be adopted for the second rotation of eucalypt plantations on poor sites unless better genetic material is available for planting in south China.

Most of the N uptake by eucalypt trees is from the mineralization of organic N (Binkley *et al.*, 1997). Because organic material in the topsoil and at the soil surface is usually low, N uptake by eucalypts in south China is driven closely by N fertilisation. Several experiments demonstrated that N fertilisation combined with phosphorus increased tree growth in south China (Chen *et al.*, 1996; Wu *et al.*, 1996; He *et al.*, 1999). Therefore, N could be another constraint after P contributing to the small canopy of plantation eucalypts in south China. Nitrogen application increases productivity initially by increasing the photosynthetic efficiency of foliage (Reich *et al.*, 1994), and later through increased foliage production (Xu *et al.* 1996). Furthermore, improved N nutrition lowered summer water stress in trees and this contributed to increased productivity (Fife and Nambiar 1997).

Responses of tree growth to K application are generally not as obvious as for N and P applications that have been shown to increase tree growth in Guangdong and Yunnan. However, in Enping, Guangdong, 50 kg K/ha promoted tree growth (in the presence of adequate N and P) (Zhou 1995). On

some sandy soils on the coast lands in south China, without K application eucalypt trees can not grow well.



Picture 2. Plantation Site Preparation

Micronutrient deficiency is common in some plantation eucalypts in south China (Dell and Malajczuk 1994; Xu and Dell 1998). Micronutrient deficiency is related to soil pH, soil parent rock, soil organic matter and soil texture (Liu *et al.* 1990). According to current experiments in Yunnan and Guangdong, B deficiency is common for plantation eucalypts on sandy soils.

7.4 Soil Fertility Sustainability in Stora Enso's Plantations

Stora Enso's manual for plantation management prescribes tractor ripping for site preparation on flat lands in the Beihai region and Dongmen, and hole site preparation for hilly or mountainous lands. As total soil tillage is not used in Stora Enso's plantations and all roots of former plantation are also kept

at site, soil erosion will be substantially reduced. The less soil disturbance will be helpful to keep original soil profile and improve soil physical properties. Sustaining the chemical properties of soils will be very important for Stora Enso's plantations.

In Beihai and Dongmen Regions

Stora Enso aims to retain litter and harvest residue, and debark at site. However, it is difficult to stop the collection of litter and harvest residue by local villagers in the eucalypt plantations because the survey showed that most of households renting land to Stora Enso need 1-2 t fuel from forests annually. As village populations decrease in the future due to urbanization and family incomes increase due to economic development in the region, it is anticipated that the demand for fuelwood will decline. Based on the field survey in the region, the higher income in a family, the more electricity and gas is used. If the area of eucalypt plantations is expanded in the future, people should be asked to only collect dead branch litter from the plantations and leave leaf litter at site. This may require regular monitoring and patrolling in areas where fuel for household use is scarce. Erosion control depends on this critical phase of the plantation cycle when soils become vulnerable to erosion and exposure to erosive factors is high. It also will affect water loss by soil evaporation.

With a good fertilization regime, soil fertility can be sustained on flat lands such as those described above, although the cost will be higher. As the rotation period for Stora Enso's eucalypt plantations is 7 years, 2 years longer than normal practice, internal nutrient cycling will be enhanced and nutrient loss at harvesting reduced. However, the longer rotation requires nutrient improvement in mid-rotation. According to Stora Enso's manual for fertilization, 150 g CMP with 18% of P_2O_5 and 100 g NPK compound fertilizer with 16% of N, 12% of P_2O_5 , 12% of K_2O and trace elements are applied as base manure, and 300 g of compound fertilizer is applied 1-2 months after planting, then 500 g of compound fertilizer 8-10 months after planting per tree. Under such a regime, the fertilizer 1-2 months after planting could be over-supplied, as seedlings just start to grow and the rainy season is coming. It is predicted that some of the nutrients will be leached, especially N and K, into deep soil or water. To minimize leaching and the associated impacts on water quality, it is recommended to try 150 g of compound fertilizer applied 2-3 months after planting, 300 g of fertilizer applied 8-10 months after planting and 400 g of fertilizer applied 20-22 months after planting. Quantities of fertilizers used in Dongmen should be less than in Beihai. Water quality of run-off should be monitored.

With Stora Enso's fertilizer regimes over one or two rotations, the nutrient supply capacity of plantation soils will be improved. Ongoing experiments in nutrition should be a feature of Stora Enso's R&D program to establish most appropriate fertiliser regimes. Given experience in China and in other countries, no problems were identified for Stora Enso's eucalypt plantation program to sustain or improve soil fertility in successive rotations. It is predictable that amount of fertilizers applied will be slightly reduced in long term.

In Yulin, Nanning, and Fangchenggang Regions

Soil fertility in most parts of these 3 regions is better than in Beihai. However, competition from understorey on the hilly or mountainous lands could be more severe than in Beihai. Current weed control by StoraEnso seems adequate. Litter and harvest residue retention are more likely to be easy in the regions due to long distance from villages and wider access to fuel from other forests. The sustainability of soil fertility on hilly or mountainous lands could be improved if soil erosion can be kept at a low level. The fertilizer regime should be reviewed as recommended for Beihai to reduce nutrient losses early in the rotation. Sustaining or improving soil fertility and productivity in the regions can be achieved with an adequate fertilization regime over one or two rotations. Again, ongoing experiments in nutrition in these areas should be a feature of Stora Enso's R&D program along with a program to monitor water quality under commercial plantation management.



Picture 3. Future Land Management of Sotra Enso

In general, it is concluded that eucalypts do not consume more soil nutrients than *Pinus massoniana*, *P. elliottii* and Chinese fir in producing equivalent biomass. Moreover, if properly managed, eucalypt plantations can facilitate soil and water conservation. Most of the experts interviewed agreed on this point. They indicated, however, that decline in site productivity of eucalypt plantations may occur depending on the biological traits of the species, especially when incorrect silviculture or management is used.

Key points of the Chapter on soil and impacts:

- Retention of litter and harvest residues are critical to long-term site productivity. This need can conflict with local practices at some sites of collecting leaf litter for fuel.
- If woody biomass (branches) only is removed and leaf litter is retained it is likely that the fuelwood demands of local communities can be met without compromising site productivity.
- Site preparation practices can influence soil movement and nutrient retention.
- Adequate fertiliser regimes are a vital part of sustained productivity.
- Nutrition should remain an important part of Sotra Enso's R&D program and water quality of runoff should be monitored.

Chapter 8. Carbon Sequestration

Atmospheric carbon dioxide (CO₂) levels have increased from 250 ppm in pre-industrial times to 370 ppm now, a 30% increase. The Intergovernmental Panel on Climate Change (IPCC) has identified increasing levels of atmospheric carbon dioxide as a major cause of global climate change (Prentice *et al.* 2001). The Kyoto Protocol has set the collective target of reducing greenhouse gas emissions of industrialized countries by 5% of 1990 levels by 2008-2012. Net emissions of greenhouse gases can be reduced by several methods including: improving the efficiency with which energy is used (e.g. cogeneration), using non-carbon or carbon-neutral sources of energy (e.g. renewable energy), increasing use of less carbon intensive fuels (e.g. coal to gas), reduce release of carbon stored in vegetation (i.e. reduce deforestation) or establish vegetation sinks (i.e. enhance afforestation and reforestation). The total amount of carbon contained in all the world's forests is a significant part of the global carbon cycle. The Clean Development Mechanism (CDM) of the Kyoto Protocol will allow afforestation and reforestation projects to be established in developing countries to assist industrialized countries reach their emission reduction targets.

Table 8-1
Calculation of Carbon Sequestration for Stora Enso's Plantation Base

Item	Fast-growing eucalypt in this project	Pines in project area	Chinese fir in project area
Wood Production per hectare each year (m ³)	24	8	10
Biomass (Dry mass) of Wood per hectare each year (tonne)	24*0.55=13.2 (Note: one cubic meter wood will content 0.55 tonne biomass for eucalypt in this project)	8*0.4=3.2 (Note: one cubic meter wood will content 0.4 tonne biomass for pines in project area)	10*0.33=3.3 (Note: one cubic meter wood will content 0.33 tone biomass for Chinese fir in project area)
CO ₂ sequestration for permanent fixation per hectare each year (ton) (Note: one ton biomass will absorb 1.84 CO ₂)	13.2*1.84=24.3	3.2*1.84=5.9	3.3*1.84=6.1
Total annual amount of CO ₂ sequestration for permanent fixation ⁴ in this project (tonnes) (6/7 * 120,000 ha)	2,499,000	607,000	627,000

In this project, pines and Chinese fir plantation in project area were set as baseline. The assumption is that pines and Chinese fir plantation were kept or would be planted in the project area if this project was not present in the region. Additional carbon sequestration could be credited for plantations established on lands with low soil fertility for which other land uses are economically unattractive. Because most of the carbon in residues of the forest will return to the atmosphere as carbon dioxide through burning or decomposition, only the woody part of the biomass was used in the calculation. The calculated results in Table 8-1 (along with Figure 8-1) show that fast-growing eucalypts of this project will sequester 2.5 million tonnes of CO₂ annually, about 4 times that of pines or Chinese fir. The current price for CO₂ in the international market ranges from USD 3-7 per tonne of CO₂.

⁴ The assumption is made here that this carbon remains sequestered for a significant period of time (ie., much greater than 30 years), as would occur without harvest, or if wood is used in production of long-lived wood products, or if paper products were destined for burial in land fill after use. If the residues are eventually burned, then the balance sheet might favour other forest types with longer rotation or plantations that produce wood products rather than pulp. If it is burned and the energy is recovered in a co-generation arrangement, substituting for fossil fuel, then the residues might again qualify for additional carbon credit.

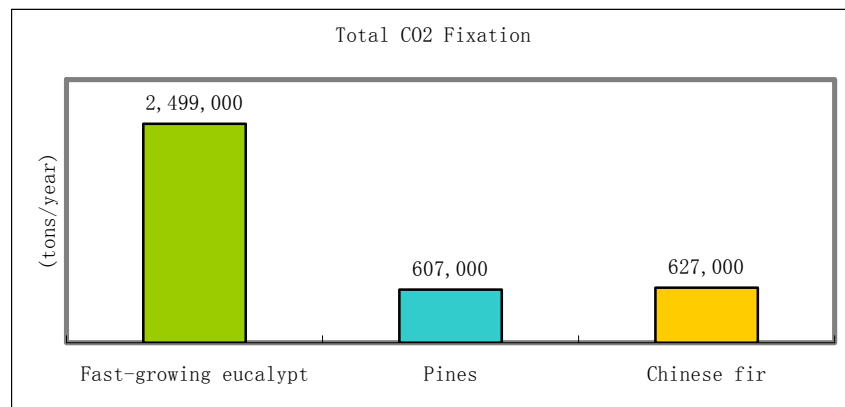


Figure 8-1
Total Amount of CO2 Fixation for Different Forest Types in Project Areas

The short rotation cycle of eucalypt plantations (7 years in this case) makes it unlikely that this biocarbon can actually qualify for sale as Certified Emission Reductions (CERs) and be marketed under current schemes. A typical crediting period for sequestration by forests is much greater than 30 years. The Kyoto Protocol also calls for activities based on sustainable development, and creating large exotic monocultures solely for the purpose of carbon sequestration is not currently considered to meet this criterion. However, if plantations could be combined with downstream utilization of the wood produced, for example, in regional power plants replacing fossil fuels and improving rural living standards, it might be possible to make the case that this did qualify as sustainable development.

Key points of the Chapter:

- The Clean Development Mechanism of the Kyoto Protocol accepts reforestation projects in developing countries as a legitimate method of reducing CO2 emissions.
- At full production, the project will sequester 2.5 mill tonnes of CO2 annually.

Chapter 9. Biodiversity Assessment

9.1 Introduction

Biodiversity (or biological diversity) is defined in the Convention on Biological Diversity (CBD) as 'the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complex of which they are part; this includes diversity within species, between species and of ecosystems'. The CBD, to which China is a signatory, considers environmental impact assessment (EIA), of which biodiversity assessment is a vital component, as a tool for achieving goals of the convention. Article 14 of the CBD requires contracting parties to introduce appropriate procedures for EIA of proposed projects, which are likely to have significant impacts on biological diversity, in order to promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings (CBD 1992).

GXSE has a strong commitment to sustainable management of forest plantations and the responsibility for conserving biodiversity as declared in their principles for land and ecosystem management that conserves biodiversity, soil and water resources and safeguards the health and ecological functions of ecosystems, and requires ESIA to be carried out in its management plan.

Biodiversity and other environmental issues often create controversial situations between the development of plantation forestry and conservation of natural resources. The industrial plantations established in large scale in other parts of China with introduced species have attracted a great attention of scientific and public communities as increasingly concerns are paid to the environmental issues, especially the impact of planted forests with exotics on biological diversity. As elsewhere in the world, the Chinese people also ask what threats or benefits to biodiversity we can expect from the increasing growth of eucalypt plantations and what we can do with plantation forestry to meet different purposes including biodiversity conservation. Potential risks in biodiversity conservation and opportunities to prevent or mitigate them could be identified and addressed through impact assessment, which can help ensure the company to be able, in a safer manner, to manage their plantations in a sustainable way (Athanas 2005).

9.2 Baseline of Biodiversity of Southern Guangxi

Guangxi Zhuang Autonomous Region is located in southern China, adjacent to Vietnam in the south. Southern Guangxi, including regions of Beihai, Hepu and Yulin where eucalypt plantations will be established by GXSE, is geographically ranged in the northern tropics with humid tropical and subtropical climates. Summer is hot and humid and winter relatively cooler and dry. Annual mean temperature is ranged 17-22 °C, annual mean rainfall varies from 1,250 mm to 2,100 mm.

Topography is largely a karst landscape, featuring swarms of weathered limestone outcrops rising from flat plains alternating with areas of undulating clay hills. Main soil types are red soil or laterite with pH values ranging between 4.5-5.5. A typical landscape in southern Guangxi is comprised of a variety of human-influenced ecosystems, including rice fields, sugarcane plantations, fragmented native forest stands, patches of bush communities, and exotic forest plantations of pines, eucalypts and acacias. Visually, the plantations of sugarcane and eucalypts dominate the landscape.

Guangxi is well-known as an area of China with rich biological diversity, second only to Yunnan and Sichuan provinces. It is estimated that wild vascular plants comprise 8,354 species belonging to 1,717 genera and 288 families, accounting for 30.8%, 50.6% and 79.2% of those in the whole country. Of these plants, 48 species are gymnosperm and 7,406 species are angiosperm. Guangxi is not only rich in flora, but also in fauna. 916 species of terrestrial vertebrates have been recorded so far, of which 536 are birds, 166 mammals, 157 reptiles and 84 amphibians. These biological resources provide

society with commodities, services and ecological benefits. However, the habitats for most of these species have been steadily declining, due to forest clearance, draining of wetlands, pollution of aquatic ecosystems, and conversion of natural habitats to agriculture and plantation forestry. Over-hunting and over-harvesting has led to the decline of many wild species. The result is that a large proportion of Guangxi's native species are threatened with local or global extinction.

Table 9-1
Guangxi's species biodiversity

Taxon	China's total	Guangxi's total	Proportion (%)
Vascular plants	27,142	8,354	30.8
Mammals	581	166	28.6
Birds	1,244	483	38.8
Reptiles	376	157	41.8
Amphibians	284	84	29.6
Fish	3,862	700	18.1

Source, Guangxi Provincial Forestry Department(in lit.), 2005.

The original vegetation types of Guangxi were tropical rainforest in the valleys and seasonal rainforest on slopes below altitudes of 500 m. Forest vegetation in Guangxi is classified into five broad categories, namely, coniferous, broadleaved and bamboo forests and, bush and grass communities, including 369 formations. Most of the remaining natural forest resources are distributed in northern and eastern Guangxi and characterized by fragmentation which is mainly caused by agricultural activities, urbanization, highway systems and other infrastructure (Wen et al. 2004). Today, small fragments of the original rainforests in southern Guangxi can only be seen in protected areas. There, these forests are mainly dominated by *Hopea chinensis*, *Madhuca subquincuncialis* and *Eberhardtia tonkenensis*. Their remnants in the project areas of StoraEnso can also be found around villages, especially, small stands of *Canarium album*. Mangrove communities occur on the beach around river mouth connecting with ocean, common species are *Avicennia marina*, *Aegiceras coniculatum*, *Bruguiera gymnorrhiza*, *Kandelia candel* and *Hibiscus tiliscus* etc.

Much of Guangxi's remaining biodiversity is located in a network of nature reserves that cover 6.7 percent of the province's land area. However, a large rural population who use the resources of these areas for their subsistence needs surrounds all of the nature reserves. Direct threats to the forests of the province's nature reserves take the form of agricultural encroachment, logging, fuelwood collection and livestock grazing. Other associated factors which have had a negative impact include fire, hunting, and harvesting and trade in particularly valuable species of wild animals and plants. Despite a strong commitment to biodiversity conservation by the province, few if any of Guangxi's nature reserves are able to control these threats effectively.

All of the original native communities of Guangxi are protected in conservation areas, although many of these communities are poorly represented, with areas too small to maintain genetic diversity or viable populations of key rare or wide-ranging species. A good example is the Shankou Mangrove Community Nature Reserve close to Shankou Forest Farm where eucalypt plantations have been established by StoraEnso. This reserve protects a remnant of a key forest type with economically important native species and valuable genetic diversity, but it is only 8,000 ha in size. The lowland tropical rainforest community is particularly poorly represented in Guangxi, with isolated patches of original vegetation in traditionally-protected *fengshui* forests perhaps the last refuges of many species.

There are a great number of plants and animals which are threatened in Guangxi., Appendix IV lists 137 nationally threatened native woody species from Guangxi, of which 116 are in the 1984 Red List of Endangered and Threatened Plants for Conservation by Environmental Conservation Committee, the State Council, China and 21 are listed by the State Forestry Administration and the Environmental Conservation Committee, Guangxi Autonomous Region. These include the tree fern, *Alsophila spinulosa*, the Silver fir, *Cathaya argyrophylla*, and the Golden camellia, *Camellia chrysantha*. The number of protected plant species in Guangxi is second only to Yunnan Province.

Many rare and endemic species, which may be valuable for medical and other special uses, are poorly known have not been fully studied yet.

Of the 137 protected plant species listed in appendix IV, about 20 are currently or were formerly distributed in the project areas of StoraEnso, some are endemic with scientific value, such as *Bhesa sinensis* and *Camellia chrysantha*. *Aquilaria sinensis* and *Morinda officinalis* and others are of value for traditional Chinese medicine, while, some species contribute high quality timber traditionally used as ‘rosewood’ for furniture and durable uses. Examples are *Erythrophleum fordii*, *Ormosia henryi*, *Burretiodendron hsienmu*, *Garcinia pausinervis* and *Mesua ferrea*. *Dimocarpus longan* and *Litchi chinensis* are wild germplasm for breeding cultivars of sub-tropical fruits. There are also some multipurpose tree species for non-wood forest products and uses in agroforestry systems, for example, *Cinnamomum cassia* and *Illicium verum*, *Toona ciliata*, *Eucomia ulmoides* and *Ilex latifolia*.

Guangxi is particularly rich in threatened plants, hosting over 60 species of globally threatened plants, including the endemic fir, *Abies yuanbaoshanensis*, the dipterocarp *Hopea chinensis*, as well as the tree *Reevesia rotundifolia*, Westland’s dutchmanspipe, *Aristolochia westlandii*, and the orchid *Dendrobium officinale*, all five of which are considered critically endangered globally and are therefore of highest conservation concern.

Table 9-2
Guangxi’s Globally Threatened Species in Comparison

Countries/Regions	Mammals	Birds	Reptiles	Amphibians	Subtotal	Plants
China, mainland	80	82	31	86	279	443
Viet Nam	41	41	24	15	121	145
Taiwan Province	11	29	8	8	56	78
Hong Kong	1	20	1	3	25	6
Macao	0	2	0	0	2	0
Guangxi*	7	3	4	0	14	62

Number of species recorded in one or more of 7 national nature reserves in Guangxi. A minimum estimate of the total threatened species for the province. CR = Critically Endangered, EN = Endangered, VU = Vulnerable, according to the criteria of the World Conservation Union IUCN Red List. Source: Guangxi Provincial Forestry Department, 2005.

Karst regions such as those in southern Guangxi support underground limestone ecosystems that are particularly rich in unique biological types. Much of this fauna is poorly known, but preliminary surveys suggest that Guangxi has an extremely rich cave fauna of specialized species such as bats, fish, insects and other invertebrates. Many of these species have extremely restricted distributions, such as the six species of blind cave fish known only from the underground waters of Guangxi.

Within or close to the project areas of StoraEnso, there are five conservation areas set up by the provincial government with targets for protection are elements of mangrove communities, migratory birds and dugong. One set up by the central government is the Golden Camellia Nature Reserve in Fangchenggang, established to conserve the golden camellia, *Camellia chrysantha*. In Chongzuo Municipality, where the project may be active, two small provincial reserves were recently combined and expanded to create the proposed White-headed Black Leaf Monkey National Nature Reserve, which comprises a cluster of protected karst hills with a total area of 38 100 ha and a combined Core Zone of 13 600 ha.

At genetic level of biodiversity, more attention should be paid to conserving the outstanding provenances of *Pinus massoniana*, a valuable timber species. Populations located in Damingshan district, called ‘tongmiansong’, have been integrated into a national plan of forest tree seed production. The genetic superiority of these populations has been demonstrated through a range of provenance trials in southern China. Seed collected from these natural stands are widely used in planting programmes.

A number of animal species are endangered or approaching extinction in southern Guangxi because the habitats in which they used to live have been degraded or lost. Of the nature reserves which were set up before 2005, many were designed for protecting certain animal species or their habitats in forest or marine ecosystems, including dugong, Crocodile-lizard (*Shinisaurus crocodilurus*, a restricted range species known only from Guangxi and one other site in Vietnam), rare salamanders, White-headed black leaf monkey (*Trachypithecus leucocephalus*), Tonkin black leaf monkey (*Trachypithecus francoisi*), macaques, pheasants and other birds and reptiles. Several species which were present in Guangxi as recently as 100 years ago are now believed to be extinct, including the Dugong (*Dugong dugon*), Asian elephant, South China tiger and the Critically Endangered Eastern black crested-gibbon (*Nomascus nasutus*), one of the world's rarest ape species. This last species still persists in a small reserve in Vietnam adjacent to the border of southern Guangxi, Jingxi County, and probably disappeared from Guangxi within the last decade. Efforts are under way to secure habitat and restore forest for the species so that it can be returned to Guangxi.

Another major reason for the loss of wild species is hunting and over-harvesting. Local people love eating wildlife so much that illegal hunting of wildlife have never been effectively controlled in Guangxi. Hunting for market is also common, and legal protected status seems to confer little protection. Protected leaf monkeys, including the Critically endangered White-headed black leaf monkey, are poached to provide the raw materials for a traditional Zhuang medicinal wine known as wuyuanjiou. The valuable Chinese three-striped box turtle, *Cuora trifasciata*, is still found in Guangxi, but is globally Critically Endangered because of market hunting, and three other turtle species found in Guangxi are also globally endangered.

The presence of 6,000 to 7,000 migrant workers on the future plantation sites, about half of whom are expected to be Miao and Zhuang minorities, raises the issue that the project may lead to increases in hunting and collection of natural products throughout the region. This would be particularly of concern where plantation sites are near nature reserves.

It is anticipated that there may be an increased demand for fuelwood as a result of rental of forest lands now used for fuelwood production. Interviews suggested that renters may choose to purchase fuelwood from local markets, with a potential doubling in demand (from 12.7% of households now buying fuelwood in markets to an anticipate 29.0%). An influx of migrant workers could increase demand further. If not mitigated, this increase in demand for fuelwood could lead to poaching of fuel from nature reserves and other protected areas, leading to degradation of habitat and impacts on biodiversity.

9.3 Landscape Diversity

The results of expert testimony presented in Appendix II-A. Of the 13 experts responding, 10 think that eucalypt plantations have no impact on the local vegetation. All of these experts recognize that the types of vegetation and patterns of landuse had been changed long before the eucalypts arrived. They all agree that eucalypt plantations can be managed sustainably, therefore, most of them would choose eucalypts for establishing industrial plantations if they were in the position of a decision maker of either state-owned or private forestry enterprises.

It was found in the the Leopold matrix presented in Appendix II-B that all marks given by the experts are low, however, relatively, they are more concerned with the changes of indigenous vegetation and landuse patterns, and this is in in accordance with the results of the expert testimony.

There has been some public concern expressed at the changing landscapes which eucalypt and other plantations of exotic species bring and the impacts that this may have on traditional culture. Many introduced species can be found in ecosystems in southern China. More than 670 000 ha of sugarcane plantations were grown there in 2002 (the yearbook of Guangxi, 2003). From the 1960's, *Pinus elliottii*, *P. taeda* and *P. caribaea* were extensively planted to replace production forests of native *P.*

massoniana, and acacias were used for rehabilitation of degraded lands. *Casuarina equisetifolia* was planted along the coastline of South China Sea to form a ‘Green Great Wall’. In recent years, eucalypts have become a dominant component of the landscape, however, in historical perspective, the landscape changed long before the arrival of these exotics. The exotic species are the result of not the reason for the change of landscape in southern Guangxi.

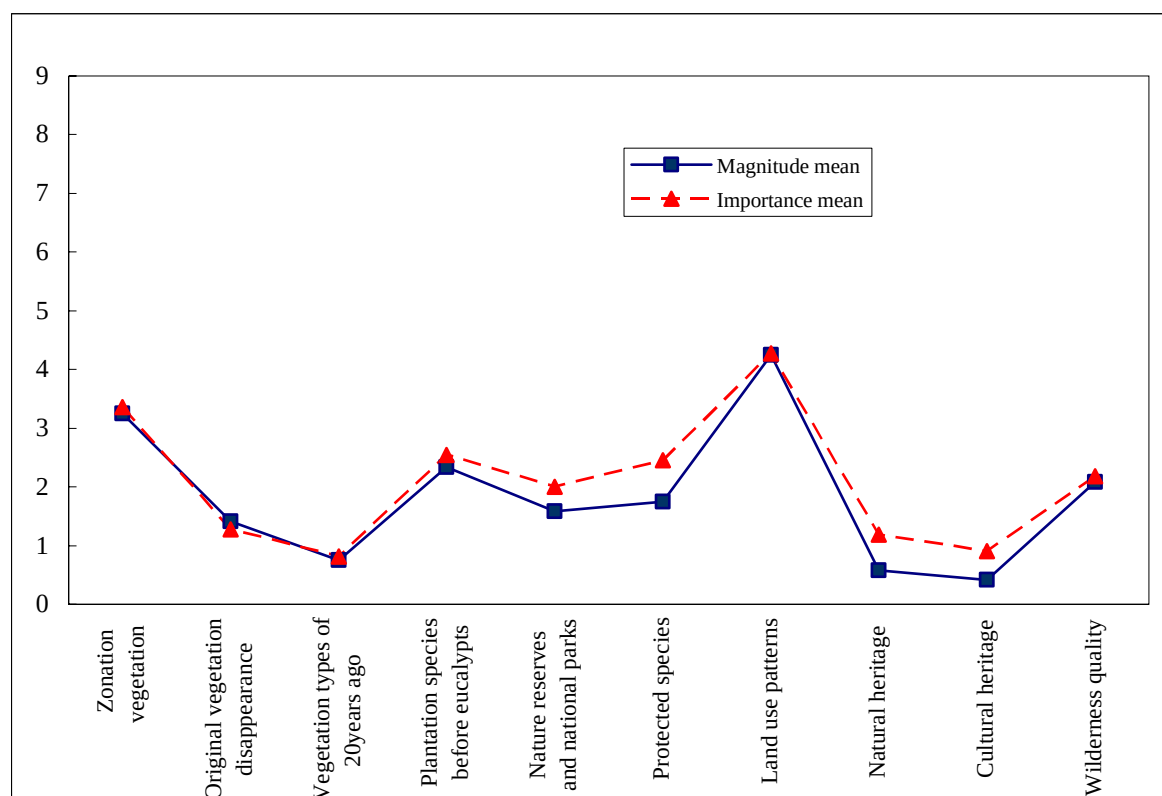


Figure 9-1. Integrated Analyses of the Leopold Matrix: The magnitude and importance of eucalypt plantation impacts on various elements: Landscapes and landuse patterns are considered to be slightly impacted.

Based on historical accounts, before the 16th century, the land in Guangxi was almost totally covered by dense forests. However, the forest coverage was dramatically reduced to about 39% by 1700. After that time, forest cover decreased further and by 1950 only 3.79 million ha remained, covering 16% of the province (Li Zhiji 2001). The 6th forest inventory conducted in 1995-2000 reported that of Guangxi’s total land area of 23.8 million hectares, 41% was covered by various forests, including plantation forests (Monitoring Centre of Forest Resources of Central-southern China and Guangxi Forestry Bureau, 2001, Figure 9-2).

The forestry development plan of the provincial forestry bureau has a goal that the area of forest, including bush vegetation, will be increased to 10.5 million ha by 2005, accounting for 51% of the land area. Of the forest resources, commercial forest plantations are 3.0 million ha, and public ecological forests and nature reserves are 5.5 million ha, accounting for nearly 30% and over 50%, respectively. The area of intensively managed forest plantations established with species of *Eucalyptus*, *Acacia* and *Pinus* will reach 1.0 million ha by 2010 (Guangxi Forestry Bureau, 2001).

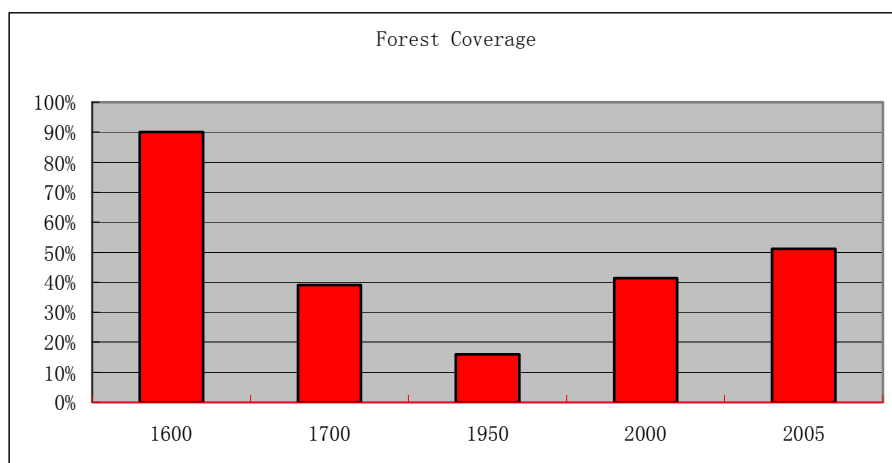


Figure 9-2 Historical Changes in Guangxi's Forest Coverage

The dramatic disappearance of the original forest vegetation began about 100 years ago as forested land was converted for agricultural purposes, and local farmers started growing corn, cassava and aromatic plants, *Cinnamomum cassia* and *Illicium verum*, among others. In order to develop the rubber industry, *Hevea brasiliensis* was introduced during the 1950's. At this time, *Eucalyptus exserta*, *Corymbia citriodora* and *Acacia* spp. were also introduced to establish shelterbelts and roadside plantings. The remaining or plantations of these species can be seen quite frequently today when travelling in these regions. Exotic pines introduced from northern and central America in 1960-70's, mainly *Pinus elliottii* and *P. caribaea*, were extensively planted, replacing a native pine, *P. massoniana*, which was seriously suffering from insect pests on sites below altitude 500m (Li Xiangdong, personal correspondence 2005)).

The coastal areas of Beihai and Yulin in southern and south-eastern Guangxi were historically a part of Guangdong Province in administration. Since these areas developed early, the economy changed more quickly than the rest of Guangxi. This resulted in profound changes to landuse, with landscapes becoming dominated by agricultural ecosystems, for instance, rice fields and vast plantations of sugarcane and cassava. Forest vegetation has been severely fragmented, with small patches and corridors of remnant native forests and bush communities left on hills, in isolated valleys and along water courses. Small remnants of the original forests, locally called 'fengshui forest' are sometimes found in villages and around areas of cultural significance. These contain old indigenous trees from the original forest and represent a rich storehouse of biodiversity. In many cases, *Baeckea frutescens*, *Rhodomyrtus tomentosa*, *Eriachne paiiescens* and *Dicranopteris linearis* are common in the bush and grass communities. The fragmented native forests and poorly growing pine plantations coexist in a mosaic with agricultural field. Generally, plantations of *P. massoniana* and *P. elliottii* and eucalypts stand on the top of hills, however, the most prominent components in the landscape are monoculture plantations of sugarcane and eucalypts, extending horizontally and endlessly.

Although Guangxi is rich in biodiversity, remaining patches of natural habitats are generally small, fragmented and isolated from each another, and this presents serious challenges for maintenance of rare or wide-ranging species. A key issue for conservation of Guangxi's native biodiversity is the maintenance of connectivity and avoidance of additional fragmentation of remaining natural habitats. Active government programs for restoration of forests on degraded lands currently provide opportunities for increasing the size of remaining blocks of natural habitat and restoring connectivity, provided that these lands are not converted to other uses, such as plantation forestry.

Many of the karst areas of southern Guangxi have cave systems with associated specialized fauna that are poorly known, but are believed to be rich in endemic species. Any changes in the quantity or quality of ground water could have impacts on these underground ecosystems. Seepage of pesticide residue into underground reservoirs, or large decreases in the level of ground water could have

devastating effects on endemic underground species, many of which are entirely restricted to a single cave system.



Picture 4. Typical Landscape in Southern Guangxi

Landscape changes can have indirect impacts on native biodiversity by affecting ability of animals and plants to disperse from one patch of suitable habitat to another. For example, the establishment of eucalypt plantations in Chongzuo, depending on their location in the greater landscape, may be of interest to conservationists working to save the White-headed black leaf monkey. This species is rated as globally Critically Endangered by the IUCN, and is only known from a restricted range in Chongzuo Municipality south of the Zuo River. This charismatic monkey has recently been adopted as the “Panda of Guangxi”. It lives in small territorial family groups on limestone forests on steep tower karst hills, which are now isolated in a matrix of agricultural fields, plantations and shrub lands. The ability of these monkeys to disperse from one habitat island to another is considered critical to the survival of the species. Replacing sugar cane fields with eucalypts in areas between these habitat islands might conceivably facilitate these movements. On the other hand, it is conceivable that replacing shrub lands or pine forests with intensively-managed eucalypt plantations could somehow interfere with dispersal of the monkeys. Increased road traffic in these areas might also be of concern.

The native landscape of Guangxi has been substantially changed. These changes in landuse have created impacts on biodiversity because the habitats which used to support indigenous species are now occupied by plantation of exotic species. However, in a higher regional overview, an intricate mosaic of agricultural ecosystems and native and planted-forest ecosystems co-exist and shape the landscape with various forms and colours in southern Guangxi. This landscape variation is very diverse and, to some, aesthetically attractive. The planted forests of exotics make an important contribution to biodiversity at landscape level by adding species and structural complexity to otherwise simple shrub communities and agricultural landscapes (Carnus et al. 2003; Cossalter and Pye-Smith. 2003). Judgment of the contribution of exotic plantations is dependant upon the location from where the landscapes are viewed – from inside the plantations, one would say the landscape has been totally changed by exotics whereas, observed from a regional perspective, one can observe the positive contribution exotics make to landscape diversity.

9.4 Biodiversity of the Eucalypts

Eucalypts refer to all species of the three genera, *Angophora* Cav. , *Corymbia* K. D. Hill & L. A. S. Johnson and *Eucalyptus* L'Herit.; in total approximately 1,000 species in Myrtaceae family (Pryor and Johnson 1971; Hill & Johnson 1995). All of these species but *Eucalyptus urophylla* and *E. deglupta* are naturally distributed in Australia, forming the diversity of forest ecosystems (Pryor 1976) . It is demonstrated by a numerous species/provenance trials and research in molecular genetics that there exist significant genetic variations within and between species which offer a great deal of opportunities for the selection of better genotypes for the use of establishing forest plantations (Eldridge et al. 1993).

Worldwide, eucalypts have been used for the purposes of wood production, land reclamation, agroforestry and landscape design. As pointed by Pryor (1981) that eucalypts had become universal. It was not until the end of 19th century that eucalypts arrived in Guangxi. An individual tree of *Eucalyptus tereticornis* Sm. was planted in Longzhou in southern Guangxi in 1890. About a half century late, Shankou Forest Farm was established to grow *E. exserta*, it is very interesting that the forest farm has become a partner of StoraEnso at present. Guinan Eucalypt Forest Farm specialized in growing eucalypts was set up in 1963 in Hepu County, where is also a main area for StoraEnso to develop their eucalypt plantations now. Windbreak systems were established by 1966 using *E. exserta* in Hepu to protect rubber plantations and agricultural crops from the damage of typhoon. A great deal of genetic materials of eucalypts have been transferred directly to Guangxi from Australia since 1982 when the Dongmen Afforestation project commenced. The eucalypt species which have so far been introduced to Guangxi are estimated to be some 100, these materials make up the biodiversity of eucalypt plantings at genetic and species levels. The plantation forestry with eucalypts in Guangxi would not have been so developed without the efforts in germplasm transfer. 1980's saw the boom of planting eucalypts in southern Guangxi which was much affected by the Dongmen afforestation project assisted by Queensland State government, Australia. Since 1990's clonal forestry has been rapidly developed with intensively managed eucalypt plantations as seen everywhere at present. This is a short story about how the eucalypts came into Guangxi. It is estimated that over 200 species of eucalypts have been introduced to China, however, only a few are used in the establishment of plantations.

Currently, species which are used by Guangxi StoraEnso in their plantations are as follows: *Eucalyptus grandis*, *E. urophylla*, *E. tereticornis*, *E. camaldulensis* and hybrids between these taxa. Because of the ease of hybridisation and vegetative propagation, a number of clones have been developed, selected and deployed in plantation forestry. StoraEnso obtained selected materials from Dongmen Forest Farm, Guangxi Forestry Institute and the Tropical Forestry Institute, Chinese Academy of Forestry, 3-5 clones of the hybrids between *Eucalypts grandis* x *E. urophylla* or *E. urophylla* x *E. tereticornis* and U6 are currently used. U6 is a clone selected from a planted population of *E. urophylla*, it has been planted across landscape in southern China and shows some morphological traits of hybridisation of *E. urophylla* x *E. tereticornis*, however, its origin has yet to be revealed. It has been recognised widely that intensively selected clones give more increment in wood production in unite time for plantations. As a fundamental component of biodiversity, genetic diversity is more critical for the success of plantation forestry because the genetic diversity controls adaptability and resistance to the physical environment and biotic disturbances. However, little attention has been paid to the genetic diversity in contrast to the biodiversity at species, especially, at landscape level.

9.5 Species Biodiversity in Eucalypt Plantations

Expert testimony and the Leopold matrix indicated a consensus that no element of the flora or fauna was likely to be seriously impacted by eucalypt plantations. Considering fauna, birds were considered

to be relatively more sensitive than mammals and reptiles. No information was available about impacts of eucalypt plantations on beneficial invertebrates, such as earthworms, spiders, parasitic wasps, and insect predators, or on valuable insects such as rare butterflies. On the other hand, insect pests and diseases are conserved to be major biological agents affecting the growth of eucalypts.

The Critically endangered White-headed Black Leaf Monkey is endemic to Guangxi and only occurs in Chongzuo Municipality south of the Zuo River. The species is restricted to karst hills that are generally unsuitable for production plantations, and it is not expected that the project will impact this species directly. However, the needs and plans for conservation of this species should be considered when siting plantations in Chongzuo. No other endangered species, either of plant or animal, were found to be endemic to the project area.

The eucalypt plantations of Guangxi Stora Enso are a small proportion of the total ecosystems which comprise the landscapes of southern Guangxi. They will not have a direct negative impact on existing biodiversity at landscape level and they will make a positive impact to regional landscapes through creating more diverse spatial and temporal structures in combination with other forest and agricultural ecosystems. No evidence was found through the expert testimony that eucalypts biologically invade indigenous ecosystems or disrupt functions and elements of native flora and fauna through genetic or habitat erosion (see figures 9-3 and 9-4).

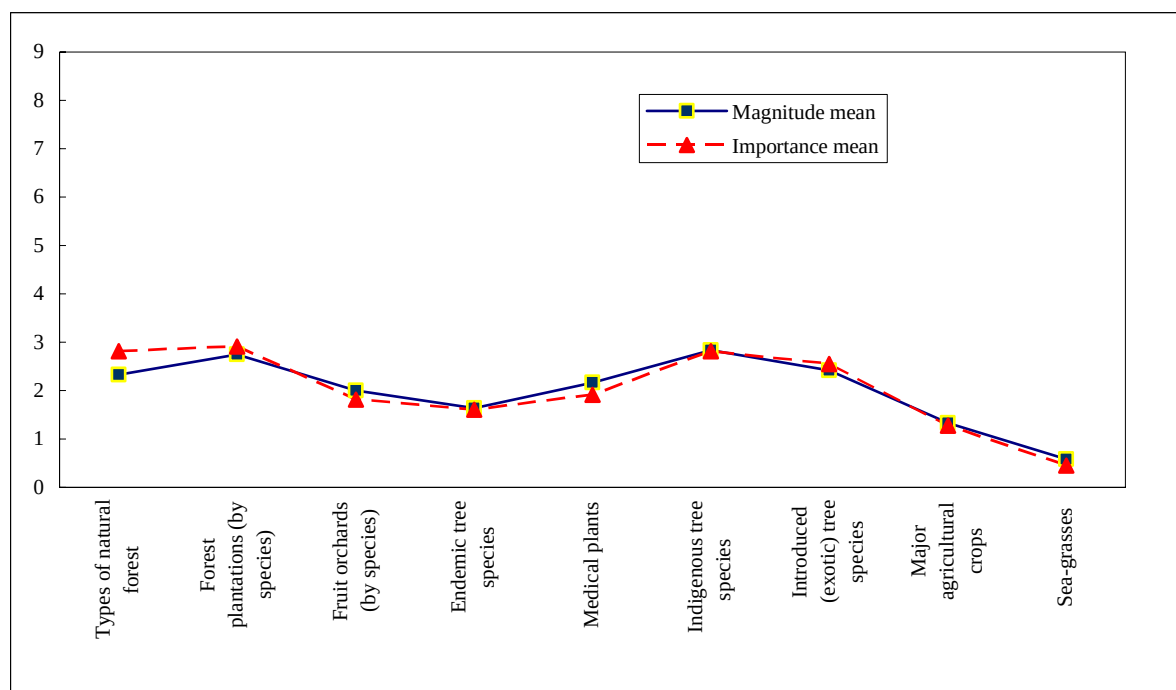


Figure 9-3. Integrated Analyses of the Leopold Matrix: The magnitude and importance of eucalypt plantation impacts on and with each elements of the local flora.
No element of the flora is significantly impacted

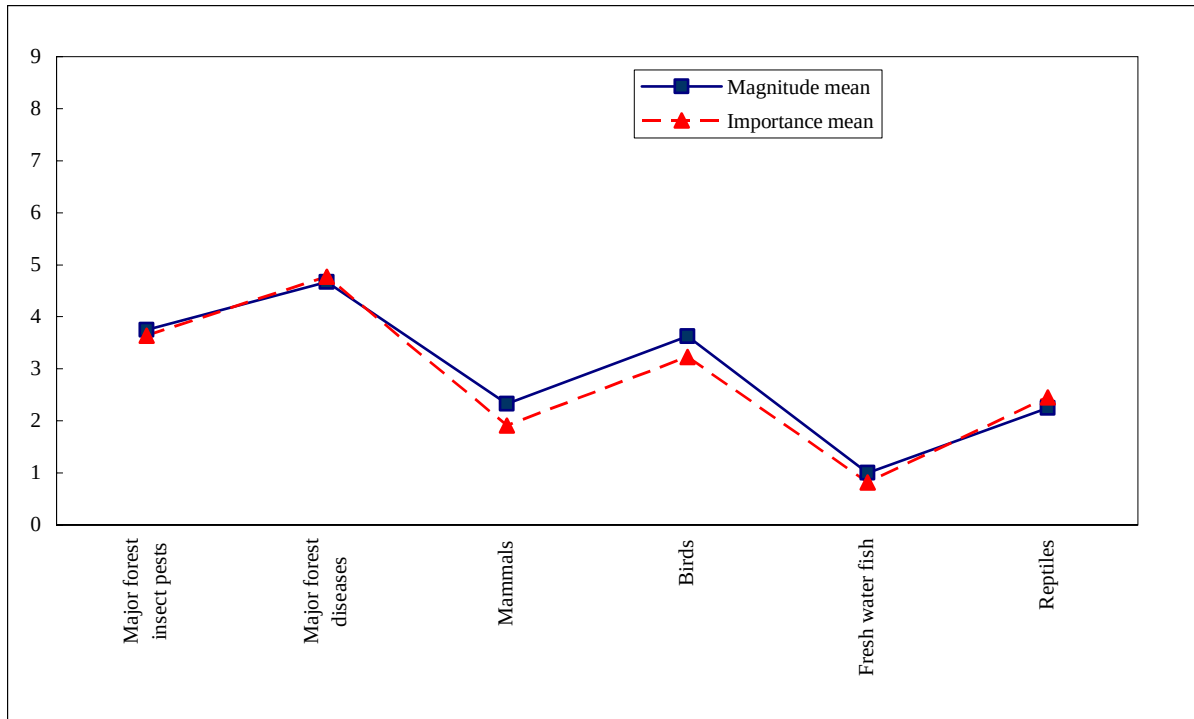


Figure 9-4. Integrated Analyses of the Leopold Matrix: The magnitude and importance of eucalypt plantation impacts on the local fauna. Birds are more affected by eucalypt plantations than mammals and reptiles, however insect pests and diseases are the major biological agents affecting eucalypt growth

It is recommended that the plantation project support biodiversity conservation programs in southern Guangxi proposed or implemented by the government, scientific communities, international organizations or NGOs. The company can organise training courses or other activities, in cooperation with local environmental protection and forestry authorities, on environmental conservation, to improve knowledge of the local people in the project areas. The company could also support and participate in local monitoring, research and training that would improve local capacity to carry out biodiversity assessments and to predict ecological impacts of plantation forestry..

In the project area, old-growth lowland rainforests are richer in biodiversity than any other plant ecosystems in southern Guangxi. Land conversion from old-growth forest and other indigenous ecosystems into intensively managed mono-genotype industrial plantations is certainly not desirable from the point of view of biodiversity conservation (Carnus et al. 2003). Native forests contain much richer biodiversity than any planted forests, not only eucalypt plantations. However, analyses of the impact of eucalypt plantations on biodiversity based on comparisons with natural forests, especially, rainforest, is inappropriate. Stora Enso Guangxi has made a commitment not to convert any biodiverse native forest to plantations. More realistic comparisons can be made with the vegetation which was present on the land immediately before planting of eucalypts. Table 9-3 shows that plantations of *E. urophylla* rank the same in species richness as plantations of an indigenous pine, *Pinus massoniana*. Plantations of both eucalypts and pines are richer in biodiversity at species level than bush and grass communities and, agricultural ecosystems (rice, cassava, sugarcane), are so low that they are not comparable to any of the forest ecosystems.

The sites to be converted to eucalypts by the project are currently occupied by pine plantation, sugarcane fields, or degraded shrubland or grasslands communities. Table 9-3 indicates that these communities are generally depauperated in biodiversity, relative to the native rainforests that they replaced. In general, eucalypt plantations have plant species richness that is comparable to or exceeds the plant communities that they will replace.

Table 9-3
Species Diversity of Different Plant Communities in South Guangxi

Plant ecosystem	No. of species	No. of woody species	No. of herbaceous species	Typical community
Valley rainforest	150-200	80-100	50-60	<i>Hopea chinensis</i> forest
Seasonal rainforest	50-80	40-50	20-30	<i>Castanopsis hystrix</i> forest
Pine plantation	10-20	5-10	1-10	<i>Pinus massoniana</i> plantation
Eucalypt plantation	10-20	5-10	1-10	<i>Eucalyptus urophylla</i> plantation
Bush community	1-10	1-5	1-5	<i>Rhodomyrtus tomentosa</i> bush
Grass community	1-10	0-5	1-10	<i>Dicranopteris linearis</i> grass
Agricultural crop field	1-5	0	1-5	Rice, sugarcane and cassava

Source: Forest Institute of Guangxi University (2005).

A distinction should be made between intensively management short-rotation pine plantations and sparsely stocked aerial-seeded woodlands of *Pinus massoniana*. The latter may have significant native biodiversity, and can be an important stepping stone towards restoration of native forest (Ma Keping, pers. com.). If such sites are offered for rental, a site visit by competent experts and a supplemental assessment of baseline biodiversity should precede the decision to rent and clear the land for planting, to insure compliance with the company's CSR policy.

The transfer of large areas of unecomonic fruit orchards (an anticipated 8% of private household lands and 13% of collective village lands) to eucalypt plantations may remove significant wildlife habitat. Fruit orchards, especially if poorly tended and not subject to heavy hunting pressure, can support significant populations of wildlife, including wild pig, viverids, rodents and their predators, such as wild cats of various species and large snakes. This may be of particular concern in Yulin.



Picture 5. Clonal plantation of Stora Enso on Shankou Forest Farm

Research results indicate that understory plant species composition can change in different rotations of eucalypt plantations on the same site. Appendix VI provides a list of 95 species, of which 45 are woody and 50 herbaceous plants, which were recorded in same plot set up within the first rotation plantations of *E. urophylla* x *grandis* in Dongmen Forest Farm. The total number had reduced to 44 by the second rotation (Wen Yuanguang, pers. comm. 2005). The research indicates that eucalypt plantations can support a certain amount of biodiversity and this biodiversity is dynamically changing with development of plantations.

The team has noted at Qinlian Forest Farm that, to increase biodiversity, a great deal of operational and research effort had been made to establish mixed plantations of eucalypts with other hardwoods such as *Acacia mangium*. Similar attempts have been made in the same way in other parts of China, for example Leizhou Forestry Bureau, to try to establish mixed plantations of eucalypts with acacias and indigenous species. Unfortunately, no productive models have been identified yet for application in industrial plantations because a number of difficulties in terms of both biology and operational silviculture.

It is quite possible to maintain some of the existing native stands, to establish plantations with other species on special sites or to establish mixed plantations in a mosaic fashion. Maintenance of corridors of natural vegetation and undergrowth along streams can also greatly increase the value of plantation forests for biodiversity and provide corridors for movement of fastidious species through plantations. They may also provide a refuge for beneficial insectivorous insects and birds. Some countries have regulations that require such practices, but this is not the case in China. Such approaches, while offering greater biodiversity, will lower commercial wood production and require additional areas of plantation to be established to meet needs for wood. This is a dilemma to be addressed by foresters and land managers who seek to enhance biodiversity and simultaneously maintain or increase productive capacity over time.

Data are not available on the dynamics of animal populations and microbes in plantation forests in south China. However, the local people believe that species and number of birds and reptiles have been reduced since eucalypts and other exotics were planted on a large scale. While the overall species composition of forests in Guangxi has changed dramatically, this is caused by many factors. Over-harvesting, hunting, habitat fragmentation and over-use of pesticides on agricultural lands all have had impacts on wild species.

Impacts of pesticides, leachates or silt from project sites will be a concern if there are sensitive aquatic habitats downstream. For example, anuran larvae (tadpoles) may be particularly sensitive to glyphosate in run-off. There is a nature reserve in Beihai Bay of the South China Sea, set up by the National Environmental Protection Bureau, to protect dugong, although this marine mammal has not been seen by local people for many years. A small nature reserve for mangrove communities, established by the National Ocean Bureau, is located around a river mouth within Shankou Forest Farm where 2,000 ha of eucalypt plantations have been established by StoraEnso.



Picture 6. A Mangrove Researve Program nearby Shankou Forest Farm

As noted above, run-off from eucalypt plantations is comparable or less of a concern than run-off from lands use from other production purposes, such as sugar cane fields. The expert testimony and questionnaire suggests that eucalypt plantations do not have major impacts on aquatic plants or animals, or on the marine environment. However, monitoring of sensitive indicator species in downstream aquatic ecosystems is recommended.

9.6 Management of Biodiversity

Most of StoraEnso plantations will be established in the Beihai and Yulin areas. The land sources available for Guangxi StoraEnso are divided into three categories:

- Existing low production plantations of pines, eucalypts and acacia which need to be improved;
- Patches of degraded forest land covered by sparse native shrubs and grasses, and
- Marginal agricultural land converted to forestry, including some sugarcane plantations and fruit orchards.

The project area of StoraEnso approximately accounts for 16.0% of the total area that has been planned by the government of Guangxi for developing commercial forest plantations and nearly 5% of the total land area of the four counties involved with the project; Beihai, Yulin, Fangchenggang and Chongzuo. The proposed plantation area of StoraEnso is a small proportion of the land use in these areas. However, Guangxi StoraEnso is not the only company planning to grow eucalypts. Several other companies and private investors also have active plantation programs to be established with eucalypts and it is expected that, in total, eucalypt plantations will account for around 40% of the total commercial plantations in Guangxi. Management of diversity at a landscape level and genetic diversity at a stand level will remain a vital consideration for StoraEnso for the long-term sustainability of its eucalypt plantations.

At landscape level, management of the eucalypt plantations as part of a spatial mosaic of an array of ecosystems comprising eucalypts, indigenous broadleaved species or exotic acacias and pines, as possible and appropriate, will increase ecosystem biodiversity at landscape level. Another option to increase landscape diversity is to maintain the remnants of existing plantations of *Pinus massoniana*, *P. elliottii* or early introduced acacias and increase their productivity through stand improvement. Coniferous and broadleaved species, either indigenous or introduced, can be arranged aesthetically along highway systems or around public spots to reduce the visual impact of the eucalypt plantations. Structurally diverse ecotones around plantations can provide conditions for conservation and also enhance the visual integration of the plantations into the landscape (Carnus *et al.* 2003; Sayer *et al.* 2005).

Native forest stands fragmented by human disturbance and islands isolated by agricultural ecosystems, 'fengshui' woods and other patches of native vegetation should be kept for species conservation. Allowing for these to be connected through corridors in the eucalypt plantations will movement of animals and dispersal of plants, ensuring some gene flow and allowing recolonization. Allowing corridors of uncleared understory vegetation to develop within a strip of 5 meters beside perennial streams can also create corridors and greatly enhance biodiversity value of plantations. Whenever there is an alternative, the project should avoid creating barriers to movement of species by not locating plantations between blocks of nature reserves or other patches of natural habitat. Transport routes should be chosen so as to minimize traffic through or beside nature reserves or other protected areas.

It would be inappropriate to encourage increased species diversity in the understorey of intensively managed eucalypt plantations, as this would compete with the eucalypts and is not consistent with the need to achieve maximum wood production. Despite having a biodiversity conservation function, eucalypt plantations must be managed in a fashion which offers high wood production.

70 nature reserves and national parks have been established by the central and local governments in Guangxi and more are planned for the future, including 11 at the national level (Annex V). Some of these conservation areas, for instance, Shiwandashan Nature Reserve and Forest Park, Shankou mangrove communities, and the proposed White-headed Black Leaf Monkey National Nature Reserve, are close or adjacent to StoraEnso's project area. GXSE can offer assistance, financially and technically, to conserve habitats and save endangered species to enhance the functions of these conservation areas, which are also valuable storehouses of genetic diversity.

Guangxi's forestry development strategy, classifies 35-40% of the provincial forest resources as public ecological forests which provide services of soil and water conservation, biodiversity conservation, forest recreation and other environmental benefits. Guangxi StoraEnso has the technical skills and capacity to propagate seedlings of indigenous species, which are endangered or threatened, and appropriate and effective methods should be found to distribute these valuable genetic materials to be planted in and around nature reserves, in watershed protection forests, recreation areas and in villages.

The sustainability of clonal plantation of eucalypts as practiced in Guangxi will depend upon the effective management of genetic diversity within the plantations. Currently GXSE mainly relies upon clones and genetic material obtained from others and cannot fully control the genetic quality of planting stocks. Lack of data and background information for some hybrid clones and a small range of available clones are of concern. At least 8-10 clones should be deployed in plantations with further 30-50 clones as back-up genetic base in case of insect or disease problems.

Despite Guangxi's rich native flora, there are few indigenous species which could be used as alternatives to eucalypts for pulp and paper manufacture. Many possible indigenous species are elements of rainforest ecosystems and the complex process of domestication has yet to commence. A critical factor limiting their uses in plantation programmes is seed availability. Possible species are *Pinus massoniana*, *Alniphyllum fortunei*, *Broussonetia papyrifera*, *Castanopsis hystrix*, *Betula alnoides*, *Alnus nepalensis*, *Mytilaria laosenensis*. Several provenance trials have demonstrated that the seed origin of *Pinus massoniana* in southern Guangxi is superior to other provenances.

9.7 Conclusions and Recommendations

The eucalypt plantations of Guangxi StoraEnso are a small proportion of the total ecosystems which comprise the landscapes of southern Guangxi. They will not have a negative impact on existing biodiversity at landscape level and they will make some positive impact to regional landscapes through creating more diverse spatial and temporal structures in combination with other forest and agricultural ecosystems. No evidence was found through the expert testimony that eucalypts biologically invade indigenous ecosystems or disrupt functions and elements of native flora and fauna through genetic or habitat erosion.

While intensively management short-rotation pine plantations have little biodiversity value, sparsely stocked woodlands, some of which have been aerial-seeded with *Pinus massoniana*, may have support significant native biodiversity, especially if near less-disturbed natural forests. Efforts should also be made to insure that plantations do not foreclose on opportunities to expand or connect fragments of existing natural habitats. Degraded forest lands adjacent to nature reserves or that connect two patches of natural habitat are prime candidates for natural forest restoration for biodiversity conservation. If such sites are offered for rental, a site visit by competent experts and a supplemental assessment of baseline biodiversity should precede the decision to rent and clear the land for planting, to insure compliance with the company's CSR policy.

Plantation operations should be managed with the needs of biodiversity in the surrounding landscape in mind. Migrant workers should be requested not to hunt or collect forest products off-site, either for

consumption or sale. Where work sites are near nature reserves, plantation managers should cooperate with local authorities, including forest police, to enforce any bans on hunting and on possession of hunting rifles, traps or snares.

Allowing local people to collect fallen branches and woody harvest residue from the plantations could mitigate increased demand for fuelwood from markets (see below). The company may also choose to support other alternative sources of fuel, either by providing subsidies or technical extension for biogas pools, fuel-saving stoves or fuelwood plantations. In addition to eucalypts, techniques for growing household plantations of *Quercus grifinith* and *Q. acutissima* already exists in the region. These oaks can also be coppiced, which can provide a widely-accepted source of preferred fuel suitable for use with fuel-saving stoves.

At the site level, while the company has a commitment to biodiversity conservation, there are limits to what can be achieved on a plantation estate, the primary function of which is to produce wood, not to support biodiversity or provide ecological services. However, maintaining or creating structurally diverse ecotones around plantations can significantly contribute to landscape and community level biodiversity. Proper soil management and best-practice for use of pesticides and fertilizer can minimize impacts on downstream ecosystems, and also reduce costs.

It is recommended that dynamics of plants and animals should be monitored within the project areas, including in selected sites adjacent to plantations. Monitoring should focus on a few easy to monitor, sensitive indicator species. For example, monitoring of frogs downstream from plantation sites can provide a simple indicator of the impacts of management practices on downstream water quality. The project management plan should include a simple biodiversity monitoring plan, which should begin with a baseline study of a sample of plantation sites, with a focus on sites that are adjacent to natural forest patches or potentially sensitive wetlands.

It is recommended that the plantation project supports biodiversity conservation programs in southern Guangxi proposed or implemented by the government, scientific communities, international organizations or NGOs. Stora Enso may also choose to become involved with support of high visibility project for the conservation of charismatic flagship species or habitats found near the project area, such as the White-headed black leaf monkey, the Eastern black-crested gibbon, the Golden camellia or the native mangrove forests of Shankou. The company can organise training courses or other activities, in cooperation with local environmental protection and forestry authorities, on environmental conservation to improve knowledge of the local people in the project areas. Stora Enso could also support research and capacity building to improve local capacity to assess biodiversity and to predict ecological impacts of various plantation interventions..

Stora Enso's considerable expertise in nursery development could be used to support efforts for conservation of local biodiversity. Stora Enso may also wish to become involved in the conservation of rare tree species by contributing technical expertise to establishment of nurseries of these native species. Target species should include rare and endangered species from lowland rainforests communities that are now largely restricted to small traditionally protected "*feng shui*" forests, such as *diperocarps*. Stora Enso may also wish to engage local communities to plant rare native species around villages in its project area.

Efforts to restore natural habitats in Guangxi could be also be assisted by improved nurseries of hardy "framework" species that can provide a matrix for reestablishment of native forests. For example, the protected native tree *Zenia insignis* is relatively easy to establish on bare karst hills, and planting this tree can speed up the process of forest recovery on these sites. Its leaves can also provide fodder for goats, which can then be paddocked and prevented from ranging freely, facilitating reforestation.

Tree domestication activities can be initiated to assess indigenous species suitability for fibre production as alternatives to eucalypts. Priority species recommended for gene conservation programmes and alternatives for eucalypt plantations are as follows: *Bhesa sinensis*, *Camellia*

chrysantha, *Aquilaria sinensis*, *Erythrophleum fordii*, *Burretiodendron hsienmu*, *Garcinia pausinervis* and *Mesua ferrea*. *Cinnamomum cassia* and *Illicium verum*, *Toona ciliata*; and *Pinus massoniana*, *Alniphyllum fortunei*, *Broussonetia papyrifera*, *Castanopsis hystrix*, *Betula alnoides*, *Alnus nepalensis*, *Mytilaria laosenensis*.

Key points of the Chapter on biodiversity and impacts:

- Guangxi is home to some of China's richest biodiversity, but many species are threatened and most remaining natural habitats are small and fragmented.
- The native landscape of Guangxi has been substantially changed over the past 200 years. Guangxi's forest coverage plummeted from 39% in 1700 to 16% in 1950 and this increased to 41% in 2000.
- Exotic tree plantations make a contribution to the maintenance of landscape diversity in southern Guangxi.
- There is enormous diversity within the genus *Eucalyptus* which can be harnessed to ensure productive sustainability.
- Species diversity within eucalypt plantations is broadly comparable to that in the pine plantations and exceeds that in the shrubland, grass communities and agricultural fields that will be converted to eucalypts.
- Potential impacts on biodiversity in nature reserves and other biodiverse forests near plantation sites may occur as a result of hunting by migrant workers and fuel collection by renters facing fuel deficits.
- Stora Enso is encouraged to support biodiversity conservation programs in the project area.

Part IV

Social Impact Analysis

Part IV presents and assesses findings on the socio-economic environment and impacts of Stora Enso's project. Presentation of results from the large-scale survey is combined throughout with the team's findings from fieldwork. Many tables of results from the survey are included directly in the text, but those that are not are referenced in the text and can be found in Annex VII. Part IV consists of five chapters. Chapter 10 introduce the methodology used in social analysis. Chapter 11 provides information gathered on the various types of groups affected by the project. It also makes estimates of the numbers of persons in each group and describes briefly the nature of the project's impact on them. Chapter 12 focuses on land rental issues. It begins with a review of land use and tenure in project areas. The chapter then covers, in turn, the decision to rent and associated transparency issues, benefits of rental, opportunity cost, rental terms and payment, and preferred forms of cooperation of groups involved. Chapter 13 examines employment impacts, covering the groups involved, benefits accrued, and opportunity costs. It also assesses key employment issues, including contracts, minimum wage, labor disputes, and health and safety, and presents results on special migrant labor issues. The chapter closes with a brief assessment of total employment generation of the project. Chapter 14 presents findings on special populations associated with the project and also presents results on other special topics. The special populations covered are women, minorities, and the poor; and the special topics are information flow to affected groups, special risks, benefits to fiscal revenues, and development needs.

Chapter 10. Social Analysis Methodology

10.1 Main Methods Used in Social Analysis

Social analysis work used two main methods: (1) an extensive questionnaire-based survey of stakeholders and (2) in-depth interviews and other fieldwork by an expert team. In addition, the social team gathered inputs from various government departments in Guangxi at the provincial, prefectural, and county levels. The social team also consulted extensively with Stora Enso staff and environmental team colleagues. In both the survey and in-depth interviews, emphasis was put on maintaining ethical standards of respondent and interviewee anonymity and voluntary participation.

The questionnaire-based survey had several modules. The largest module consisted of a 1,000 household component in Guangxi, including households of local villagers, state farm workers, and migrant workers. Other, smaller modules included surveys of (a) leadership (both township governments and state forest farm management) and (b) small groups (both in villages and on state forest farms), the latter consisting of gatherings of several stakeholders to discuss survey questions. Each of the aforementioned modules included respondents in both project areas (the majority of respondents) and (as a control) non-project areas. A small survey module focused on (c) households in migrant villages of origin (in Yunnan and Northwest Guangxi) and (d) small groups in these villages. More details on the survey and its modules are given below and in Annex III, which includes "Notes on Survey Procedure", "Instructions for Social Survey," and Information Sheet Distributed to Survey Participants." The majority of survey work was conducted by the Guangxi Statistical Bureau, under management of China's National Bureau of Statistics. A team from China Agricultural University conducted the survey of migrants at project sites as well as that of households and small groups in their villages of origin.

Six social team experts conducted the in-depth interviews. Interviewees included most of the same types of stakeholders addressed in the questionnaire-based survey as well as others. Interviews had two main purposes: (1) gathering more in-depth information on the topics covered in the survey and (2) gathering information on special topics not covered (or only minimally touched upon) in the survey. The latter, special topics, included: (a) middle-persons involved in land rental, (b) contractors, (c) forestry "da-hu" (farmers with over 50 mu of forestland), (d) women, (e) minorities, (f) the poor, and (g) different models of company-community cooperation.

10.2 Survey Groups

Table 10-1 below summarizes the nine sub-groups for the household module, which made up the largest component of the survey. The original target of a 70:30 ratio between households in project and non-project areas for the first seven groups was achieved overall, though this ratio varied considerably among the three sub-groupings shown in the table.

Table 10-1
Target Groups for Household/Individual Questionnaires and No. of Respondents Achieved for Each

Location	Survey Code	Target Group	Number of Respondents
		Villagers renting land (and corresponding control group)	
Project area (village land)	A	Households in villages renting private land to Stora Enso, some of whom are also renting collective land to Stora Enso	244
Non-project (village land)	B	Households in villages targeted for land rental to Stora Enso in the future or households in non-project areas	196

		State farm workers	
Project area (state forest farm)	C	Households of state farm workers on state farms renting land to Stora Enso. The interviewee has worked or is currently working on Stora Enso land on the state forest farm.	181
Project area (state forest farm)	E	Households of state farm workers on state farms renting land to Stora Enso. No member of the household has worked on the Stora Enso land.	143
Non-project area (state forest farm)	F	Households of state farm workers on state farms that are either targeted land rental areas for Stora Enso or non-project areas	68
		Villagers living near state forest farms	
Project area (state forest farm)	D	Households in villages not renting land to Stora Enso, but near a state forest farm that is renting land to Stora Enso. The interviewee has worked or is working on state farm land rented to Stora Enso	136
Non-project area (state forest farm)	G	Household in village not renting land to Stora Enso and living near a state farm that is either a targeted land rental area for Stora Enso or non-project area	32
		Total of Above	1,000
		Migrant workers	
Project area (village or state forest farm)	H	Migrants working in project areas, either in villages or on state forest farms	50
Migrant Place of Origin	I	Households in Yunnan and Northwest Guangxi villages of origin of migrants working on Stora Enso land	100

Table 10-2 below summarizes the nine sub-groups for the leadership and small group modules of the survey. The original target of a 70:30 ratio between targets in project and non-project areas is achieved for the leadership module and the small group module overall (excluding migrant place of origin groups), though this ratio varied considerably among the two main sub-groupings shown in the table for each module.

Table 10-2
Target Groups for Leadership and Small Group Questionnaires
and Number of Respondents Achieved for Each

Location	Target Group	Number of Responding Leadership Teams or Small Groups
	Township Governments	
Project area (village land)	Township government (each interview aimed to have 3 township government officials involved) in township in which village land is rented to Stora Enso	12
Non-project area (village land)	Township government (each interview aimed to have 3 township government officials involved) in township in which village land has not been rented to Stora Enso	10
	State Farm Management Teams	
Project area (state forest farm)	Management teams of state forest farms that have rented land to Stora Enso	23
Non-project area (state forest farm)	Management teams of state forest farms that have not rented land to Stora Enso	5
	Village Small Groups	
Project area (village land)	Groups of villagers, including some village leaders, in villages renting land to Stora Enso (average 5.5 persons per group)	15
Non-project area	Groups of villagers, including some village leaders, in	11

(village land)	villages that had not rented land to Stora Enso (average of 5.6 persons per group)	
	State Farm Small Groups	
Project area (state forest farm)	Groups of state farm staff (including some management personnel) of farms that have rented land to Stora Enso (average of 5.6 persons per group)	20
Non-project area (state forest farm)	Groups of state farm staff (including some management personnel) of farms that have not rented land to Stora Enso (average of 5.3 persons per group)	4
	Migrant Worker Place of Origin Small Groups	
Migrant Place of Origin	Groups of residents of villages in Northwest Guangxi and Yunnan that are places of origin of migrants working Stora Enso land	10

Chapter 11. Affected Groups

Stora Enso's plantation project affects a number of different types of individuals in Guangxi. These groups are affected primarily by (1) project land rental and/or (2) project employment or (3) business opportunities. To a lesser extent, they may also benefit from public goods resulting from increased tax revenues. Stora Enso rents land in villages and on state forest farms, so that two major affected groups are local villagers and state forest farm staff. Other affected groups include middle men involved in land rental, local government and village leaders, contractors that carry out plantation development for Stora Enso, and migrant workers.⁵ This section briefly introduces each of these groups, providing background on their incomes and other basic characteristics. A rough estimate of the number of persons affected in each group is also provided. The nature of benefits and other impacts of the plantation project on each group are, in addition, briefly touched upon as a preface to the more detailed analysis given in subsequent sections.

11.1 Farmers in Villages Renting Land to Stora Enso

Farmers in villages renting land to Stora Enso are affected by both land rental and employment opportunities associated with the project. These farmers may rent their "private land" and/or be part of a group of households renting collective land to the company. "Private land" is here defined as land for which the household has been granted individual use rights by the collective. "Collective land" as used here may refer either to land for which a lower level of collective unit (e.g. villager's small group) has been granted use rights by a higher level collective unit (e.g. administrative village) that owns the land or to land that is owned directly by the same level of collective as that using the land. Accurate figures for the number of Guangxi households involved in individual and collective land rental to Stora Enso are unavailable. Field estimates and observations, however, suggest that the total number of farmer households directly affected by one or both of these types of rental at present (with Stora Enso total holdings of 20,000 ha) is of the order of magnitude of 18,000, representing a population on the order of 90,000 (details on assumptions, provided by Stora Enso Guangxi, and estimation methods provided in subsequent footnotes). For comparison, population of the counties and municipalities involved was over 5 million in 2003. Households affected through the arguably more substantial impacts of individual land rental (on the order of 2,000 households) are much fewer than those affected by collective rental. Individual land rental, however, does make up a more significant proportion (roughly estimated at forty percent) of total village land rental than these numbers suggest. It is probable, incidentally, that a majority of the households renting private land are also a part of collectives renting land. Assuming (based on Stora Enso input) that the eventual ratio of state forest land to village land is 60:40, Stora Enso's scale-up to its target of 120,000 ha in the region suggests a final number of village households affected by private or collective land rental on the order of 133,000 and an affected total population on the order of 650,000.⁶ For comparison, the

⁵ The more general population (in counties or prefectures collecting taxes associated with the project) that may benefit from increased fiscal revenues and ensuing public goods is not treated in this section.

⁶ These order of magnitude estimates are based on the following assumptions (provided by Stora Enso Guangxi) and rough, back-of-the-envelope calculations: Assume 1/3 (or 100,000 mu) of 20,000 ha acquired to date is village land (note: 1 ha = 15 mu). Assume 60% (60,000 mu) of village land is collective and 40% (40,000 mu) is private. Then, assume typical area of private village rental is 20 mu (expert field work yielded cases of 10 mu, 20 mu, and 30 mu, while survey indicates an average of 24.5 mu), so that $(40,000 \text{ mu} \div 20 \text{ mu/household}) = 2,000$ households are involved in private rental. Assume average area of collective rental is 100 mu (expert field work yielded cases of 100 mu and 200 mu, while survey yielded average of 62 mu) and average number of households in collective is 30 (expert fieldwork yielded examples of 25 and 30 households per collective renting land; Stora Enso staff suggested 40 or 50), so that $(60,000 \text{ mu} \div 100 \text{ mu per collective}) = 600$ collectives involved, consisting of a total of $(600 \text{ collectives} \times 30 \text{ households/collective}) = 18,000$ households that are a part of collectives renting land to Stora Enso. Using 4.88 persons per household (average household size for household survey in village project areas), total persons affected by individual rental are $(2,000 \text{ households} \times 4.88 \text{ persons per household}) = 9,760$ and total persons affected by collective rental are $(18,000 \times 4.88) = 87,840$.

counties and municipalities in which land rental will be occurring had a total population of over 10 million in 2003.

Clearly, Stora Enso Guangxi will face substantial challenge in connecting and communicating with the roughly 133,000 households that will be affected by village land rental. Nevertheless, as revealed in subsequent chapters, a critical need exists to improve the flow of information from the company to its "village rental" stakeholders. Thus, it is recommended that Stora Enso upgrade its information systems in this regard. The company might choose to maintain a database including, to the extent possible, the name, location, and nature of rental, of each and every household involved. The database might also keep a record of company liaison with and information flow to each of these households. Alternatively, the database could at least include record of such activity with the broader population (e.g. not only leaders) in each of the involved villages.

Most of those renting land do not appear to be benefiting significantly from employment opportunities generated by the project; and it is not clear whether this will change in the future. Only 4 percent of the households surveyed in village project areas have worked on Stora Enso land to date (see Table 11-1). Either the opportunity has not been available or it has not been of interest to them. Sixteen percent of respondents, however, planned to work on Stora Enso's land in the coming year and a full 64 percent said they might or did not know whether they would (see Annex VII, Table 1).

Table 11-1
Has anyone in your household been hired to work on "the company's" forestland? (Households in Project Villages)
(Survey Type A)

Response	Respondents	Percent
Yes	9	3.8
No	227	96.1

N(A)=244, response rate (A) = 96.7%

While Guangxi is one of China's poorer provinces, the project areas on average are better off than the province's poorer areas. This is evidenced by migration patterns, whereby migrants from poorer areas of Guangxi come to the project areas for work opportunities that are not attractive to some locals, who, meantime, out-migrate further afield to Guangdong Province and other places for higher salaries. According to the survey, average per capita net income (defined as cash income minus food costs) in project villages, was 2,484 yuan (US\$306) in 2004 (see Table 11-2 below for income distribution of survey group). While somewhat lower than China's average net per capita rural income (2,936 yuan or US\$362) that year, the figure is higher than the 2004 average for rural Guangxi (2,300 yuan or US\$283).⁷

Based on information gathered in fieldwork and through the survey, the agricultural sector, on average, is responsible for the largest component of rural net income in the project's village areas. Farmers in project areas generally have rice paddy for self-consumption and grow cash crops, such as peanuts, sugarcane, and cassava, on their dry land plots. With 75 percent of respondents indicating income from forestry of less than 1,000 yuan per year, forestry is not, for the population as a whole, the main source of agricultural income in village project areas. Fruit trees (classified as "economic forest" in China), such as longyan, litchi, and orange trees, are, however, popular cash crops for some

Assuming that the majority of private land renters are also part of collectives renting land to Stora Enso (based on input of Stora Enso staff), then 18,500 can be taken as the total number of households affected and (x4.88=) 90,280 as the total number of persons affected. Assuming that at full scale (120,000 ha), the ratio of village land to state forest farm land shifts to 40:60 as planned, village land will be 48,000 ha, of which (assuming 40% private), 19,200 ha (288,000 mu) is private and 28,800 ha (432,000 mu), collective. Using same assumptions as above, private renters of village land will be 14,400 households and collective will be 129,600 households. Assume overlap, so that total households involved are about 133,200, representing a population of 650,000.

⁷ National figure from National Statistics Bureau; provincial figure from Guangxi Statistics Bureau.

farmers in the area. The population's low dependence on forestry for income, despite substantial forestland resources, suggests room for further development of the forestry sector in project areas, both for the company and villagers themselves. Animal husbandry (e.g. pigs and chickens) was found in the surveys to make up a significant portion of project village agricultural income (ranging from 44 percent on average in the project area township survey to 21 percent on average in the project area village small group survey – see Annex VII, Tables 2 and 3). Out-migration for work is a significant source of income in project villages, with 46 percent of respondents indicating per capita out-migration income in the 1,000 to 2,000 yuan range (see Table 11-2). Twenty-one percent of those surveyed, in fact, had a family member out-migrating to another province for work in 2004 (see Annex VII, Table 4).

Table 11-2
Annual Household Net Per Capita Income, Forestry Income, and Out-Migrant Income, 2004, for
Households in Project Villages (survey Type A)
units: respondents and percent of respondents per income range

Income range in yuan	Cash Income		Sources of Income			
	Number/percent of households in income range		Forestry		Out-migration for employment	
	Respondents	Percent	Number/percent of households with forestry income in range given		Number/percent of households with out-migrant income in the range given	
			Respondents	Percent	Respondents	percent
<1000	16	6.6	132	75	30	27.3
1000 to 2000	64	26.2	35	19.9	51	46.4
2000 to 3000	123	50.4	5	2.8	21	19.1
3000 to 4000	26	10.7	4	2.3	6	5.5
4000 to 5000	11	4.5	0	0	1	0.9
>5000	4	1.6	0	0	1	0.9
Total	244	--	176	--	110	--

N(A)=244, responses (A_income) = 244, responses (A_forestry) = 176, responses (A_out-migration) =110

Survey data on main expenditures (see Annex VII, Table 5) and ownership of durables (see Annex VII, Table 6) provide further insights on households in project areas. On average, food makes up over half of household expenditures, a typical trend for low-income households. Yet, 96 percent of village project area respondents have televisions, 32 percent have gas stoves, and 59 percent have motorcycles, suggesting rising living standards.

11.2 Middle-Persons in Village Land Rental

The Stora Enso project has two main types of middle persons (or organizations) involved in the village land rental process: (1) The first is a person (or organization) who is able to assist Stora Enso in securing village land for rental. For the purpose of this discussion, this type of person is called a "land-securing middle person." This land-securing middle person is paid a one-time fee (on a per mu basis) for facilitating rental land for the company. (2) The other sort of middle person (or organization) rents land from villagers and then re-rents the land to Stora Enso. This type of person or organization is called a "re-renting middle person." Re-renting middle persons may have initially rented the re-rented land several years ago for their own purposes or may have just recently rented the land for the specific purpose of re-renting to Stora Enso. These re-renters of land benefit from the difference in the rate at which they rent land from village inhabitants and the rate at which they re-rent the land to Stora Enso.

Land-Securing Middle Persons

The land-securing middle person (or organization) may either be: (1) township government officials acting on behalf of township governments or (2) influential and well-connected persons outside of government, such as retired government officials or successful farmer-businesspersons. Some township government officials confirmed to the expert team that they received from Stora Enso "introductory fees" (for example, 12 yuan per mu in one typical case), which went into government coffers, for their assistance in securing land. Others indicated they helped in land acquisition, but did not receive this fee. According to Stora Enso field staff, almost all village land acquisitions involve the assistance of land-securing middle-persons. Survey data indicates an average area of Stora Enso land rental per township of 4,460 mu (~300 ha), so it might be assumed that in cases for which there is no independent middle person involved, the township government assists with much of this area (see Annex VII, Table 7). One independent land-securing middle person with whom the team spoke was an influential retired township government official with a background in forestry. He was helping Stora Enso and two other companies in the area acquire land across a number of townships. Since 2004, he had secured 4,000 mu for Stora Enso. He was paid 10 yuan per mu (US\$18.5/ha) for this assistance, which he shared with a network of village-level associates in this business, such as collective team leaders. It is likely that many of the land-securing middle-persons work with village level people in this way, though detailed information on this issue was not collected.

Assuming acquisition of 4,000 mu per middle-person or township government and assuming an average of two persons involved per township government, we make a rough estimate of about 37 land-securing middle persons at present and 270 to achieve full-scale operations of 120,000 ha. These numbers do not include persons that may be cooperating with these middle persons at the village level. For these "associates" of middle persons, assuming one small team leader is involved for each collective, estimates suggest 600 village level people involved at present and 4,320 at full-scale.⁸

The benefits of land-securing middle persons are examined in the next chapter. Generally, findings suggest that their introduction fees are only a small fraction of rental contract values. Rather than egregious profit-taking, then, the greater concern regarding land-securing middle persons is whether over-zealous convincing on their part plays a negative role in farmers' ability to decide objectively and in farmers' ultimate satisfaction with rental decisions.

Re-renting Middle Persons

Field research identified a number of different types of middle persons who rent land from farmers or others and then re-rent it to Stora Enso at a higher price. During the expert team's discussions with Guangxi officials, some concern was expressed about the problem of speculative land renters benefiting at the expense of uninformed local farmers. Middle person re-renters identified in field research, however, did not appear to be speculators. In addition, both field research and the survey results indicate that middle person re-rental of land is a limited phenomenon in project areas and thus makes up only a small portion of Stora Enso's total holdings. For example, while 19 percent of households surveyed in project villages confirmed that there was rental of land in their village to parties other than Stora Enso, only 18 percent of these (or about 4 percent of the full group of respondents) indicated rental to others who then re-rented the land (see Tables 11-3 and 11-4 below). Instead, sugarcane (44 percent of those noting rental to others) and direct development of timber plantations (34 percent) were the top two purposes given for other parties renting village land. Similarly, while 11 of 12 project area township governments surveyed indicated that parties other than Stora Enso had rented village land in their townships, only one of these respondents indicated that re-

⁸ As in preceding footnote, based on Stora Enso Guangxi input, 100,000 mu (1/3 of holdings) is used for estimate of village land at present and 720,000 mu (40% of holdings) for final area of village land. We assume that half of the land-securing middle person work is done by township governments, with an average of two officials directly involved. We assume the other half of the work is done by individual middle persons. For village level associates of these land-securing middle persons, we use figures in previous footnote for collective land area (and land rented per collective) to calculate number of collectives involved. We assume one local level leader ("small team leader") involved per collective.

rental had been the use of land rented by others. Instead, timber plantation (7 respondents) and fruit trees (6 respondents) were the main uses identified (see Annex VII, Table 8).

Table 11-3
Have you (or your village) rented out land to others besides "the company"? If so, what was the rental rate? (Households in Project Villages) Survey Type A

Response/Question	respondents	percent (%)
Yes	47	19.3%
Average rental rate	13.1 yuan/mu/year	
No	197	80.7%

N(A)=244, response rate (A) = 100%

Table 11-4
If you or your village rented land out to others besides "the company", what did these others use the rented land for? (Households in Project Villages) Survey Type A

Use of land rented by others	respondents	Percent (%)
Fruit trees	1	1.6
Sugarcane	27	44.3
Grow plantations for timber	21	34.4
Grazing land	0	0
Rent out to third party	11	18.0
Other	1	1.6
Total	61	100

N(A)=244, response rate (A) = 25%

The main examples of re-renting middle persons (or organizations) identified in field work were township officials, a "da-hu" (prosperous farmer), and a state forest farm. The township officials identified rented land in their own, individual names for the express purpose of re-renting to Stora Enso. Their actions, however, do not appear highly speculative in nature. One township official, for example, rents 200 mu from individual households at 30 yuan per mu and re-rents to Stora Enso at 35 yuan per mu. The official explained to the team that most households in his township have direct contracts with Stora Enso, but that the households he rented from did not trust the company (with a main concern being that they would not be able to receive rental payments as promised) and even asked him for a special document to guarantee he would pay his rent. (This lack of trust may be due to previous experience. In the past, an American food products company had rented village land in the township, but had later pulled out. The government transferred the land to a Hong Kong company without consulting the people.) It seems, then, that the official's rental mark-up serves as a sort of insurance service to the households. The "da-hu" identified rented a township (collectively owned) forest farm of over 1,000 mu in 1994, which he had planted with pine and other trees. He rented this farm from the township government and has recently re-rented the land to Stora Enso, because he did not have enough investment funds to improve the farm himself. Finally, the case of a state-farm as "middle-person" was a branch of a state forest farm that rented a total of 5,000 mu to Stora Enso. Of the 5,000 mu, over 4,000 mu were actually rented from nearby villages.

While survey results given above indicate re-rental of project area village land makes up only a small proportion of the total, re-rental cases involving state farms as the re-renter would not have been detected in the village survey. Instead, such re-rented village land would have been classified by the survey as project area state forest farm land. Follow up work to this study, then, might investigate the scope and nature of state farm re-rental of village land, with attention to potential equity concerns. Preliminary findings, however, suggest that it is common for state forest farms to have initially rented land from nearby villages for the purpose of direct plantation development. In the case of re-rental to Stora Enso, then, such village land has likely not been rented for the express purpose of re-rental, but has been in the hands of the state forest farm for sometime. In addition to rental fees, Stora Enso also pays the state forest farm a one-time fee for trees standing on such village land.

"Da-hu"

During fieldwork, the expert team investigated the hypothesis that forestry "da-hu" (farmers who have a relatively large scale of operation and who may rent land from other farmers) play a significant middle-person role in rental of land to Stora Enso. Findings indicate, however, that "da-hu" most often choose to develop the land they rent themselves and are not major re-renters of land. (There are, however, some cases of "da-hu" re-renting land to Stora Enso, such as that mentioned in the preceding sub-section.) Also, the area of land they control is generally too small to meet Stora Enso's economy of scale requirements, unless it is packaged with other nearby land holdings. As Stora Enso expands its land acquisitions in Guangxi, however, the involvement of "da-hu" in land rental might be monitored to see if there are any changes in the current situation. Also, it is possible that "da-hu" could become a group affected by the Stora Enso project in other ways, such as cooperation in production or (more likely) provision of market pulpwood to the company.

Field interviews indicate that there are a number of "da-hu" in project areas that are involved in eucalypt plantation development. These "da-hu" operate on a large scale (over 100 mu) compared to typical farm households and are able to derive strong profit margins from their economies of scale. "Da-hu" interviewed by the team include those with land holdings of 200 mu, 600 mu, and over 1,000 mu, respectively. "Da-hu" must manage a number of different aspects of their business, such as land acquisition, labour, sapling acquisition, fertilizer application, harvesting, and transport, and have therefore developed good management skills and accept considerable risk. While most "da-hu" prefer to plant eucalypts themselves if they have enough funding, some expressed a willingness to cooperate with Stora Enso or other companies if the conditions were right.

11.3 Collective and Village Leaders and Township and County Officials

With strong provincial-level support, local government at the county and township levels, as well as village leadership (e.g. village chief and collective small team leaders), receive strong encouragement from above to support Stora Enso's land acquisition efforts. These local officials and leaders are, to some extent, held responsible for achieving results. Fieldwork at the township and village levels indicates that township officials, village leaders, and collective small team leaders all play an active role in supporting the project and experience increased workload as a result of it. A key component of the work of these officials and leaders is to reason with farmers and convince them to rent their land through what the former often refer to as "sixiang gongzuo" (thought work).

While their workload has increased, some of these officials and leaders may benefit through direct income associated with the project and/or through increased fiscal revenues in government coffers. As mentioned, township officials may play a role of land-securing middle persons, with one-time "introduction" fees accruing to the township budget on a per mu basis. Village and collective small team leaders might work together with land-securing middle persons and be given a direct portion of the "introduction" fee. In some cases, village leaders may serve as contractors (see next section) developing Stora Enso plantation land, though this was more often found not to be the case among villages visited. Also, as mentioned, some township officials have been found to play the role of re-rental middlemen, renting land specifically for re-rental and thereby earning a margin. The main government revenues that will be generated by Stora Enso's plantation project will be fees on harvesting, which are based upon the wood's equivalent sales price for fast-growing plantations. For plantations on village land, harvesting fees will be paid to county forestry departments. Officials from one township in Beihai, the prefecture in which Stora Enso's planned pulp mill is to be located, told the team that the Beihai Government had promised to reward them for their hard work in supporting the company's plantation development by redistributing the value-added tax (VAT) on the pulp back to the township/county according to its contribution to the wood used in production. There is however, considerable uncertainty about the level of taxes, fees and other administrative imposts facing plantation projects. The officials believe that, if this comes to pass, they will get a raise in their salaries. Finally, village and collective small team leaders and some township leaders generally

participate in the project as do other farmers, through rental of their own land or that of their collective.

Rough estimates for township and county officials involved are 62 at present and 360 at full scale. These figures overlap, in part, with the estimates for land-securing middle-persons. Rough estimates of involved village and collective small team leaders suggest a total of 660 in project villages at present scale and 4,752 at full scale. These figures, of course, overlap with those given for village-level associates of land-securing middle persons.⁹

11.4 Contractors

Stora Enso Guangxi does not directly handle the work of preparing, planting and managing the land it rents, but instead contracts this work out to other parties, which we will refer to henceforth as "contractors." (Stora Enso does currently include contractors in its accident reporting system; and, later in this report, we recommend that a more extensive contractor auditing system be instituted.) The future role of contractors in the harvesting and transport operations is currently being assessed. Contractors may contract either individual stages of work in plantation development or the entire process (start to finish) and generally must hire and manage workers (at minimum, 10-plus workers per contractor) to complete the task. Contractors on village land are generally local (though by no means necessarily from the village in which they contract to do work), well-established people, some farmers and some retirees from regular, long-term jobs. They tend to have a decent education level by local standards and also possess a certain level of experience in organizing and managing workers. Contractors on village land encountered in fieldwork include a "da-hu", a woman living in a township seat and retired from the local credit cooperative, and a village chief (contracting in a part of his own village).

Contractors on Stora Enso's state forest farm land may also be such persons from outside the farm, but are most often state forest farm staff, acting either independently of the forest farm as individual businesspersons or on behalf of the state forest farm (as the entity that has signed the plantation development contract with Stora Enso). Data from the survey indicates that state forest farm staff, acting as independent business persons, are the most common type of contractor on Stora Enso's state forest farm land. Forty-eight percent of respondents that are state farm staff who have worked on Stora Enso's state farm land indicated that their "boss" in this work was a state forest farm employee working independently as contractor. Another 21 percent indicated that the boss was a state farm employee working on behalf of the farm as contractor, while 25 percent indicated contractors affiliated with neither the state farm nor nearby villages (see Table 11-5 below).

The scale of work undertaken and number of workers hired by contractors vary. One interviewee had a contract to develop 650 mu of village land. She had about 16 workers from Guizhou, 11 from Yunnan, as well as a local team. Working on a much larger scale, a forest farm staff interviewed had a contract to develop 15,000 mu and employed 180 workers.

The benefits derived by contractors will be discussed in the chapter on labor. While profits are difficult to calculate, there is a general feeling among those familiar with contractors that they would not become involved in this work and take on the necessary risk of initial outlays were the payback

⁹ Assuming 100,000 mu total of village land at present and 4,400 mu per township yields 23 townships or, assuming two involved township officials per township, 46 township officials. Adding in 16 county officials (2 for each of 8 counties), total township and county officials are 62. At full-scale, 720,000 mu of village land suggests 163 townships or 326 township leaders. Adding 34 county officials (17 counties) at full-scale gives a total of 360 township and county leaders. From previous calculations, assuming 60,000 mu of collective land at present and 100 mu/ collective, there are 600 collective team leaders. Assuming 20 collectives per administrative village and 2 village leaders involved per village yields 60 village leaders for a total of 660 village or collective leaders. At full scale, 432,000 mu of collective village land, with an average of 100 mu/collective, suggests 4,320 collective small team leaders and 216 administrative villages (or assuming 2 involved leaders per village), 432 village leaders for a total of 4,752 village and collective leaders.

not good. One source indicated a contract rate of 100 yuan per mu, with labor costs of 80 yuan per mu. While Stora Enso provides and delivers seedlings, equipment, and fertilizer as close to the site as possible, there are be additional expenses in transporting materials up the hills, assembling the labour teams and meeting associated costs.

Table 11-5
When you have worked on "the company's" plantations, who has your boss been? (Project area
state farm staff that have worked on Stora Enso land)
Survey type C

Contractor/Boss	Respondents	Percent
Independent contractor not affiliated with state farm and not from local village	33	25.4
state farm employee working independently of state farm	63	48.5
state farm employee working as representative of state farm	27	20.8
local village chief	1	0.8
local villager (but not village chief)	0	0
Other	6	4.6

N (C) =181, response rate = 72% (130 respondents)

The size of Stora Enso's group of contractors at 20,000 ha was 92 contractors on village land (for an average of 1,000 mu per contractor) and 17 on forest farm land (with an average of 12,000 mu per contractor). These figures, in congruence with the two cases sited above, indicate that, on average, contractors on state forest farms are running much larger scale operations (requiring larger investment and more employees) than those contracting for Stora Enso on village land. While difficult to predict, we estimate that the number of each of these types of contractors will double by 2010. The area to be worked annually will more than double, but it is expected that future work may be less time-intensive than initial land preparation and that some contractors can increase their scale. Our estimates, then, suggest about 184 village land contractors and 34 state farm contractors once full-scale is achieved.¹⁰

11.5 Forest Farm Employees and Retirees

In addition to affecting the overall operations and profit/loss situation of the state farms themselves, Stora Enso's rental of land on state forest farms may affect the employees and retirees of these farms. Both current staff and retirees are affected by the distribution of benefits from rental (in salaries, pensions, and other benefits given them by the farm). Current staff may also be affected by: (1) changes in the nature of the work they do for their employer and (2) opportunities to participate in work on Stora Enso land as a worker or contractor, independent of formal work assignments at the farm.

¹⁰ Estimates are further complicated in that some land acquired (and, possibly, to be acquired) is already planted with eucalyptus. Nevertheless, assuming that Stora Enso has been able to develop 100,000 mu of village land in two years (50,000 mu per year) and that at steady state for 120,000 ha (7-year rotations), planting and harvesting of village land will each be about $(120,000 \text{ ha} \times 0.4 \times 15 \text{ mu/ha} \div 7 =) 100,000 \text{ mu}$ annually, the total area to be worked at steady state each year will be 4 times that worked at present. However, the work may require less time than initial land preparation; and some contractors may increase in scale. Thus, we assume the number of village contractors will roughly double. For contractors on state forest farms, we assume 200,000 mu of state forest farmland has been developed over the past two years (100,000 mu per year). At steady state, the annual area of forest farm land to be planted and that to be harvested will each be about $(120,000 \text{ ha} \times 0.6 \times 15 \text{ mu/ha} \times 1/7 =) 150,000 \text{ mu}$, so that the total area to be worked each year will be 300,000 mu, or triple that in initial years. Again, we assume that this work will be less time consuming than initial land preparation and that some contractors will increase their scale, so that a doubling in the number of contractors on state forest farm land can do the job. Trends in Australia, Brazil, South Africa, and elsewhere have been from many small contractors to fewer larger, more efficient contractors who offer high standards and stability and see contracting as a long-term business rather than a short-term opportunity.

Stora Enso currently rents land from five forest farms in Guangxi. Three of these are divided into a total of 23 sub-farms (averaging about 8 sub-farms each), while the other two do not have sub-farms. Based on field interviews and survey results, we assume an average of 100 staff and 100 retirees per sub-farm (or per farm for those without sub-farms) matched by an equal number of retirees. (See Table 10-6. Also, examples from field interviews include: Qinlian Forest Farm, with 9 sub-farms, has 900+ staff and 1,100 retirees. Shankou with no sub-farms has 203 staff and 218 retirees. A branch of Bobai Forest Farm has 48 staff.) Based on these assumptions and an average multiplier of 3.3 population per staff and 0.86 households per staff (some households have more than one staff member), we estimate a total of 2,500 forest farm staff and total population of 8,250, spread among 2,150 households (multipliers derived from Table 11-6). Retirees are also estimated to be 2,500, though we assume these to overlap with the general forest farm population if they are still living on-site.

Table 11-6
State Farm Staff and Population
(from State Farm Leadership Questionnaire, project areas)

	Average per sub-farm (or farm without sub-farms)
Number of state employees	113
Total household	97
Total population of permanent residence	373
Of which state employees	113

N = 23, Response Rate = 100%

Forest farm management personnel and "line staff" (workers) may be affected by Stora Enso's project in different ways. Due to the business challenges faced during reform of state-owned enterprises (which include forest farms), many of the farms or sub-farms are no longer paying salaries to their "line staff." The survey indicates that over 40 percent of forest farm staff in project areas are no longer being paid salaries, though the vast majority have tenures at their farms of either 10-plus or 20-plus years (see Tables 11-7 and 11-8). Instead, the farms have often given these staff a certain area of land on which they can plant fruit trees or other cash crops, such as cassava, and handle their own profits and losses. Forest farm staff who are no longer being paid salaries do have the opportunity to work on Stora Enso land (or other forest farm projects) and are paid according to the work done. Management staff, in contrast, still receive salaries; and retired workers reportedly receive their pensions. Both of these groups, then, might benefit more directly from state forest farm rental income than line staff, if this is used to raise salaries or pensions. In addition, management staff are much more likely than line staff to take on the role of contractor for Stora Enso.

Table 11-7
How long have you been an employee of this state forest farm?
(Staff of state farms in project areas)

Survey Types C and E

Years of employment on state forest farm	C: Forest Farm Staff Working on Stora Enso Land		E: Forest Farm Staff Not Working on Stora Enso Land	
	Respondents	percent (%)	Respondents	Percent (%)
<2years	2	1.1	5	3.5
2 to 5 years	7	3.9	6	4.2
5 to 10 years	21	11.6	11	7.7
10 to 20 years	100	55.3	56	39.2
>20 years	51	28.2	65	45.5
Total	181	100	143	100

N (C) =181, response rate of (C) = 100%; N (E) =143, response rate of (E) = 100%

Table 11-8
Are you still paid your salary as a state forest farm employee? What other benefits do you receive?
(Staff of state farms in project areas)
Survey Types C and E

Are you still paid salary by state farm?	C: have worked on Stora Enso land		E: have not worked on Stora Enso land	
	respondents	%	Respondents	%
Yes	98	56	74	56
No	78	44	59	44
If no, years since salary has been paid	8.16 years (average)		9.04 years (average)	
What other benefits do you receive? (check all that apply)	respondents	%	Respondents	%
Health insurance	118	67	95	71
Housing for free or with some priority	126	72	104	78
Free or reduced-price access to land and materials for developing cash crops	87	49	64	48

N (C) =181, response rate (C) = 97.24%; N (E) =143, response rate (E) = 93.11%

While state forest farm staff in project areas are by no means wealthy, their average per capita incomes are over 65 percent higher than those of neighbouring villagers and than those of households in project villages.¹¹ In 2004, according to the survey, average per capita income of staff working Stora Enso land on project forest farms was 4,236 yuan per year and that of staff (also on project forest farms) not working Stora Enso land was 4,194 yuan per year (see Table 11-9 below for per capita income distribution of respondents across various ranges). As would be expected on a forest farm, agriculture (including forestry) makes up over 80 percent of the income structure on project farms surveyed (see Annex VII, Table 9), though animal husbandry (in contrast to neighboring villages and also to be expected) plays only a minor role, making up less than one percent of agricultural income.

Table 11-9
Annual Household Net Per Capita Income for State Forest Farm Employee Households in State Farm Project Areas, 2004
(Survey Types C and E)

per capita net income range (yuan)	C: Have Worked on Project Land		E: Have not Worked on Project Land	
	respondents	percent (%)	respondents	Percent (%)
<1000	2	1.1	0	0
1000 to 2000	39	21.6	17	11.9
2000 to 3000	58	32.0	37	25.9
3000 to 4000	26	14.4	25	17.5
4000 to 5000	15	8.3	37	25.9
>5000	41	22.7	27	18.9
Total	181	100	143	100

N (C) =181, response rate (C) = 100%; N (E) =143, response rate (E) = 100%

Informal work (aside from formal state farm jobs and aside from work on Stora Enso plantations) appears to be significant for state farm staff and their households. Survey results indicate that 27 percent of farm staff respondents in project areas that worked Stora Enso land had a family member accepting this type of informal work. The figure is 44 percent for farm staff respondents in project

¹¹ The per capita income of neighbouring villagers used is derived from the survey of neighbouring villagers working on Stora Enso's land on state forest farms and thus may be biased to those who choose to pursue this work.

areas that did not work Stora Enso land. For both groups, the proportion with a household member out-migrating to work in another province was about 10 percent (see Annex VII, Table 10).

Data on project area state farm staff expenditures and ownership of appliances and other durable items is given in Annex VII, Tables 11 and 12. Almost 60 percent of consumption expenditures of state farm staff in project areas is spent on food, a figure similar to that of neighboring villagers working on the farm. Ownership of appliances and other durable items, however, is much higher than that of neighboring villagers working on the farm in many categories, including mobile phones, fixed line telephones, gas stoves, rice cookers, motorcycles, and washing machines.

11.6 Local Farmers Working Stora Enso Land on State Forest Farms

Stora Enso has estimated that among about 1,800 people working for contractors on its state forest farm land, about 550 (or about 30 percent) are local people from nearby villages. (The rest of the 1,800 workers on the company's state farmland are estimated to be 210 state farm staff and 1,100 migrant laborers.) We estimate that, assuming ratios between different types of workers are maintained, at Stora Enso's full scale, over double this number, or more than 1,100 local villagers, will be involved in Stora Enso-related work on state farm land.¹²

The average per capita net income of the group of 136 such villagers surveyed was 2,988 yuan per person, an amount significantly lower than the average per capita net income of their state farm staff peers, but higher than the provincial average. Table 11-10 below gives the distribution of the surveyed group across different income ranges. Working at informal jobs is very common among this type of household, with 39 percent reporting that a family member had worked at such a job (not including working on Stora Enso land) in 2004. Eleven percent of households had a family member out-migrating from the province for work that year (Annex VII, Table 13). Data on household consumption indicates that (similar to results given for some of the other groups above) food makes up on average 60 percent of expenditures, suggesting a relatively low standard of living (Annex VII, Table 14). Data on household durable items (Annex VII, Table 15) shows, given income levels, relatively high ownership of certain items (e.g. 58 percent of households reported owning motorcycles).

Table 11-10
Annual Per Capita Net Income in 2004 (Local Village Households with Member Working
on Stora Enso Land on State Forest Farm)
Survey Type D

yuan/year	number of respondents	percent of respondents
<1000	0	0
1000 to 2000	40	29.4
2000 to 3000	65	47.8
3000 to 4000	16	11.8
4000 to 5000	9	6.6
>5000	6	4.4
Total	136	100

N (D) =136, response rate (D) = 100%

11.7 Migrant Workers

Migrant workers are an important feature of work on Stora Enso's Guangxi plantations, where over half of those working for Stora Enso contractors are migrants. Migrant workers come from locales that are poorer than the project areas and are typically willing to work for less pay and do harder

¹² The same reasoning used for a doubling in the number of contractors on state forest farmland is used here (see previous footnote). While an increase in the scale of some contractors, however, may allow them to do a greater amount of work, they would probably have to increase their number of workers to do so. Thus, here we use a doubling of workers as only a lower limit.

physical labor than many project area inhabitants. Thus, they are prevalent at plantation development sites. Stora Enso estimates that 1,530 of 2,580 workers on its plantations on village land are migrants and that 1,100 of 1,860 workers on the company's state farm plantations are migrants. Thus, a total estimate for migrant workers on Stora Enso land at present is 2,630 persons. We project that this number will more than double (to 5,260 persons) when steady state production is reached, with a 7-year planting and harvesting cycle, at 120,000 ha.¹³

Migrant workers on Stora Enso land are most frequently from Northwest Guangxi and Yunnan Province. They also come from Guizhou, Sichuan and Hubei provinces. Fifty migrant workers were surveyed near their place of work. They included 15 persons from Yunnan and 35 from Northwest Guangxi (see Annex VII, Table 16). Trends in the background of survey respondents may offer insights on the overall group of migrants working Stora Enso land in Guangxi (see Annex VII, Table 17): First, the survey group has an average age of 30, suggesting migrants are relatively young people. Female migrant workers accounted for 22 percent of respondents, suggesting a relatively low proportion of females among the group. A considerable proportion of those surveyed (52 percent) are of ethnic minorities (Miao, Zhuang, and Yao), who are from mountainous, remote, and underdeveloped regions of northwestern Guangxi and Yunnan. Field interviews also confirmed significant numbers of minority migrants. Finally and perhaps most striking, the respondent group had an average of only 3.3 years of schooling; and 28 percent are illiterate.

Interestingly, all migrant workers surveyed said that they found out about the opportunity to work on Stora Enso land when they were back home. All indicated that their eventual boss is the one who informed them of the opportunity when they were back home (see Table 11-11). Generally, migrants work together in groups in which all members are from the same or neighboring villages.

Table 11-11
How did the Migrant Worker Get this Work Opportunity?
survey of 50 migrant workers

How did you get this work?	respondents	percent of respondents
Came here, then found it	0	0
Learned about it from relatives while still at home.	0	0
Called by a person (boss) while still at home	50	100
Other	0	0

N = 50, response rate = 100%

The migrant workers surveyed had a per capita net income of 1,993 yuan in 2004. This is a very low income level compared with the China's average rural household net income level of 2,936 yuan in 2004 and is also substantially lower than that in project villages or that of local villagers working on Stora Enso land on state forest farms. The distribution of the migrant group's income levels indicates that about 70 percent of the workers have a per capita net income of less than 2,000 yuan (see table 11-12). These migrant workers are from the poorer segment of China's rural population.

Most of these migrants' income (about two-thirds on average) comes from migrant work rather than from agriculture in their home villages. In addition, the higher the level of the migrant's household income, the larger the portion of income from migrant work (see Table 11-12). This may imply that agriculture in their home villages is less profitable than migrant work, although the wages for migrant work are relatively low. According to the survey, almost none of those surveyed had worked on Stora Enso plantation sites in 2004, so that almost no income that year was from this source. Table 11-13 shows that, accordingly, a large proportion of migrants now working on Stora Enso land had migrant experience doing other work in 2004. The data suggests that about two-thirds of those surveyed did

¹³ The reasoning for a more than doubling of migrant workers is the same as that used in a footnote in the preceding section to predict a more than doubling of local villagers working Stora Enso land on state forest farms.

other informal work in 2004 and, of those, most migrated outside of their home counties. Clearly, then, much of the migrant labor force working Stora Enso land consists of those already experienced in out-migration for work.

Table 11-12
Household Per Capita Net Income of Migrant Workers in 2004 and Role of Migrant Work in Overall Income

Survey of 50 migrant workers

Per capita net income range (yuan)	Respondents		Source of Income for those in net income range at left			
	Number	Percent	Migrant Work		Migrant Work at Stora Enso Site	
			Average (yuan)	percent of income	Average (yuan)	Percent of income
< 1000	14	28	163.14	30.1	0	0
1000~2000	21	42	706.24	54.6	41.29	5.9
2000~3000	3	6	2,133.33	83.1	0	0
3000~4000	5	10	2,266.6	71.6	0	0
4000~5000	1	2	3,333	80.0	0	0
> 5000	6	12	4,574	73.8	0	0
Average	50	100	1,312.5	65.9	17.37	0.9

N = 50, response rate (N) = 100%

Table 11-13
Informal Work Done by You or Your Family Members In 2004
(Other than that on Stora Enso land)

Survey of 50 migrant workers

Did migrant or household member do other informal work in 2004?	Number of Respondents	Percent of Respondents
Yes	33	66
Work in home township	3	6
Work in other townships of home county	5	10
Work in other county of home province	14	28
Work in other province	13	26
No	17	34

N = 50, response rate = 100%

Results for household expenditures and appliances and durable items owned are given in Annex VII, Tables 18 and 19. On average, over 70 percent of the surveyed migrants' household expenditures goes towards food, somewhat higher than for the groups of local farmers discussed in this chapter and evidence of their relative poverty. Migrants' possession of many household appliances is much lower than that of local villagers in project areas or near project state farms. For example, television set ownership is only 48 percent as compared to levels of 88 percent (local villagers working on state farms) and 95 percent (the rate for both villagers in project villages and state farm employee households). It is possible, however, that some interviewees interpreted this question to refer to their temporary homes in the field (many of which do not have electricity), rather than their permanent dwellings in their home villages. Eighteen percent of the migrant group did report possessing a mobile phone, the second most popular appliance rated. Workers with mobile phones explained that the phone is important in finding job opportunities, as they frequently change work.

11.8 Truck Drivers

Once harvesting begins, transport of pulpwood will become a major component of plantation activity and thus involve a significant number of truck drivers. (See section on transport for a more detailed discussion of related issues.) While it is not yet clear whether these drivers will be independent small

businesspersons (e.g. owning one or two trucks, as is common in China), employees of Stora Enso, or employees of a logistics company, it is quite possible they will come from the local area. Drivers in China receive higher pay than plantation workers, so that the migrant worker phenomenon is less likely to occur in the transport segment of plantation work. Assuming that, at full scale, 6,000 to 8,000 tons per day of pulpwood will be shipped to the mill in 4 to 6 ton trucks, and assuming that each truck driver can make two round trips to the mill per day, we estimate that 700 truck drivers will be employed. This figure will be revised as the transport system to be adopted by Stora Enso is developed and finalised.

11.9 Summary of Affected Groups: Numbers of People and Nature of Benefits

Based on the discussion above, the following two tables summarize (1) the number of affected persons in each group and (2) the nature of benefits for each group. From the first table, it can be seen that, by rough estimates, persons affected by Stora Enso's plantation project at present number over 100,000. At full-scale, estimates for affected persons exceed 660,000. While the impact on persons whose households or collectives rent land may be less than that on those who find employment associated with the project, in terms of sheer numbers, persons in the group associated with village land rental make up the vast majority of affected people, both at present and at full-scale.

Table 11-14
Estimated Number of Persons/Households in Each Type of Affected Group and Typical Per Capita Incomes

Type of Group	Number at present (55,000 ha)		Number when 120,00 ha reached		per capita income
	Households	Persons	Households	Persons	
Farmers in villages renting land to Stora Enso	18,500	90,300	133,200	650,000	\$306
Village land securing middle-persons	---	37	---	270	NA
Village-level associates of above middle-persons*		600	---	4,320	NA
Village land re-rental middle-persons*	---	NA	---	NA	NA
Township and county officials*	---	62	---	360	NA
Village and village small group leaders*	---	660	---	4,750	NA
Contractors on village land	---	92	---	184	NA
Contractors on state farm land	---	17	---	34	NA
Forest farm staff and management (project areas)	2,150	8,250	2,150	8,250	\$515
Local farmers working Stora Enso land on forest farms	---	550	---	>1,100	\$370
Migrant workers	---	2,630	---	>5,260	\$256
Truck drivers	---	0	---	700	NA
Total (subtracting out estimated overlap in groups)	---	101,913	---	665,978	---

*The persons in the indicated categories may overlap with those in others. In summing totals, overlap has first been removed.¹⁴

Table 11-15
Nature of Benefit for Each Type of Beneficiary

Beneficiary Type	Nature of Benefit
Farmers in villages renting land to Stora Enso	1. cash from rental of individual land 2. public goods and/or cash from rental of collective land 3. work opportunities (on plantations)

¹⁴ Township officials included in the figure for land securing middle-persons (2/3 of the land-securing middle person total) have been omitted from totals, since these overlap with the item "township and county officials." "Village-level associates of above middle-persons" has also not been included in the total, as these individuals are often the same as the small group leaders included in "village and village small group leaders". The group "village and village small group leaders," in turn, has also been omitted from totals as it is assumed that most of these people are a part of the group renting their own land (or collective land) to Stora Enso.

Middle-persons in village land rental	1. one-time "introduction fee" for securing land for rental OR 2. margin from re-rental of land
Village and village small group leaders in villages renting land to Stora Enso	1. same benefits as regular farmers 2. possibly additional benefits from control of collective funds, introduction fees, greater opportunities as contractors
Township and county officials	1. possibly, one-time "introduction fee" or re-rental opportunities 2. possibly, increased tax revenues resulting in raises
Contractors	1. profits from contract plantation work
Forest farm staff and management	1. work opportunities (on plantations) 2. contractor opportunities (most often for management personnel) 3. benefits from rental monies (increased salaries, public goods, etc.)
Local farmers working Stora Enso land on forest farms	1. work opportunities (on plantations)
Migrant workers	1. work opportunities (on plantations)
Truck drivers	1. work opportunities (hauling wood)

Summary of Chapter's Key Points on Affected Groups:

- Estimates suggest on the order of 133,000 households will be affected by Stora Enso's village land rental when the project reaches full scale. In order to improve the flow of information and tackle the challenge represented by such a large number of stakeholders, Stora Enso may wish to develop a targeted communications program for and database of all families involved, whether through private or collective rental. The database could include information on the nature of involvement of each household, as well as record past and planned company liaison with them.
- While Guangxi is one of China's poorer provinces, the project areas are somewhat better off than the province's average. The rural population in project areas have a low dependence on forestry for income, despite substantial forestland resources.
- Introduction fees paid to middle persons securing land for Stora Enso and margins for those re-renting land to the company are not egregious. Still, Stora Enso should monitor middle-person margins in future land acquisition and work directly with landholders whenever possible to avoid any possibility of promoting stratification of rural society in China.
- Forest farm management are much more likely than regular line staff to be Stora Enso contractors, though staff may find work opportunities on Stora Enso land. While management still receive salaries (which may be enhanced by Stora Enso rental), many line staff do not, but have instead been given use rights by the state farm to a piece of land. In sum, state farm management personnel may benefit more from Stora Enso rental than do line staff.

Chapter 12. Land Rental

This chapter examines impacts of Stora Enso's land rental on affected groups and reviews related equity issues. As background, it begins with an examination of land use and land tenure in project areas and presents results on proportional impact (by area) of Stora Enso rental at macro (township and forest farm) and micro (household and collective) scales. The chapter then moves on to discuss, in succession, several key aspects of our analysis of land rental impacts and issues: (1) It examines the decision to rent land and whether this is voluntary in the case of private land and whether participation is sufficient in the case of collective and state land. (2) It analyzes the nature of benefits from rental income and, in particular, assesses the incremental impact on income. (3) It examines opportunity costs and alternative uses of land, posing the question of whether farmers would have been better off choosing another option. (4) It discusses rental terms and affected groups' satisfaction with these. (5) The chapter closes with brief comments on alternatives to rental in company-community cooperation.

12.1 Land Use and Land Tenure

Survey of land use covers 12 Township Governments and 23 Forest Farm Management Teams in Project Areas. Survey results on land use indicate that land classified as "forest suitable land" (i.e. either forested land or bare land suitable to forest) makes up a major proportion of total cultivable land in project areas. Results also indicate that of the forest suitable land, the majority is forested land (actually having some degree of forest cover, even if sparse), rather than bare land. Bare land area, however, is not insignificant. In the project area townships surveyed, on average, 61.6 percent of cultivable land is forest suitable land; and about 14 percent of that forest suitable land is bare land. On the project area forest farms surveyed, on average, 96.8 percent of cultivable land is forest suitable land; and about 14 percent of that forest suitable land is bare land (Table 12-1). These results suggest that Stora Enso is developing its plantations in regions in which forest suitable land makes up the majority, by area, of cultivable land resources.

Table 12-1
Average Proportions of Land Types in Townships and Forest Farms¹⁵

Land Type	Average Proportion of Township Land	Average Proportion of Forest Farm Land
Paddy Crops	21.4 %	<0.1%
Dryland Crops	16.5 %	3.2%
Other agricultural land not accounted for	0.6 %	0 %
Forested land	47.5 %	84.4%
Bare land (unforested land suitable to forest)	14.1 %	12.4%

Response rates were 100%.

Based on survey data of 23 Forest Farm Management Teams, 12 Township Governments, and 244 Households Renting Private Land (all three surveys in project areas), preliminary analysis suggests that Stora Enso rental now accounts for a significant proportion of forest suitable land in project areas, but that the majority of such land is, at the project's present scale, still left for other uses. The impact on land use of individual households and collectives in project area villages is much greater, however, than that on their townships overall. The preliminary estimates suggest that, at current scale, Stora Enso land accounts for an average of 19 percent of forest suitable land on project area forest farms and 5.4 percent in project townships. (Depending on where additional land is sought, however, these proportions may rise substantially. Stora Enso's final target of 120,000 ha is six times its current holdings of 20,000 ha.) Surveyed households renting private land to Stora Enso rented, on average,

¹⁵ Percentages used in this table are based on survey data presented in Annex VII, Tables 20 and 21.

62 percent of their forest suitable land to the company. Their collectives rented, on average, 66 percent of collective forest suitable land to the company. These latter proportions are large, suggesting that Stora Enso rental has a substantial impact on overall land-holdings of both individual households and collectives. On the other hand, these results suggest that, while rented out proportions are large, on average, households and collectives have kept a significant proportion of their forest suitable land (over 30 percent in both cases) for alternate uses, such as developing their own tree crops or fuel wood collection.

Table 12-2
Proportion of Forest Suitable Land Rented by Stora Enso¹⁶

	Proportion Rented by Stora Enso at Present (%)
Macro-level: Proportion of Forest Farm Forest Suitable Land	19.0 %
Macro-level: Proportion of Township Forest Suitable Land	5.4 %
Micro-level: Proportion of Village Household Forest Suitable Land	62.3 %
Micro-level: Proportion of Village Collective Forest Suitable Land	65.7 %

Response rates were 100%.

Of the land that Stora Enso has rented, the proportion of bare land (15.8 percent) is similar to the proportion of bare land in project townships (14.1 percent) and on project forest farms (12.4 percent) overall. The majority of land rented by Stora Enso to date has already been planted, mainly with eucalypt or acacia (over 50 percent), other trees used for timber (mainly pine, often sparse, over 20 percent), and sugarcane (about 3 percent). Clearly, then, as a good proportion of land rented by Stora Enso does not have eucalypts, the company's activities will raise, to some extent, the area of land in people's villages planted by eucalypts and decrease that planted by pine and, to a lesser extent, sugarcane.

The land tenure situation for forest suitable land varies from region to region in China and even from village to village in project areas. In some villages, a significant proportion of such land has been "contracted out" to households and has thus become private use land. In others, most or all of this land has not been "contracted out" to households and remains under the control of the collective as a group either through "contracting out" from a higher level collective or through direct ownership. Whether the land rented is under private or collective use rights have important implications for how rental benefits are enjoyed, as discussed later in this chapter. Survey results indicate that, overall, about 42 percent of forest suitable land in project villages is under collective use rights, while the other 58 percent is under private use rights (Annex VII, Table 28). Based on survey of 15 small groups in project villages and on input of Stora Enso staff, survey results indicate that, estimate for the ratio of Stora Enso village land that is private versus collective is 40:60, or approximately the reverse of the overall use rights ratio (Table 12-3). Thus, it might be concluded that the company's rental in villages affects a slightly higher proportion of collective forest suitable land than of private forest suitable land, though the affected proportions estimated based on survey results, as given in Table 12-2, do not support this.

Table 12-3
Land Use Rights of Forest Suitable Land in Project Villages

Land Use Rights	Collective	Private
Proportion of Forest Suitable Land in Project Villages	42 %	58 %
Proportion of Use Rights Type in Stora Enso's Overall Village Land Holdings	60 %	40 %

Response rate = 100%

¹⁶ Percentages presented in this table are calculated based on survey data presented in Annex VII, Tables 20 to 27.

12.2 Decision to Rent Land

Decision to Rent Private Land

Field research indicates that rental of private village land to Stora Enso has been voluntary and in congruence with the individual land use rights of farmers to whom such land has been allocated. The team did not discover any egregious examples of farmers having been "forced" to rent their land or of their land having been rented without their agreement. Yet, while satisfaction appears to be the norm, some private renters expressed a feeling of either not having been given full information or not having been given full choice in the matter. These expressions of dissatisfaction were identified in expert field work and are not a result of the large survey. While it is possible, then, that they are isolated cases, the extent of dissatisfaction is not fully understood. Also, it has been suggested that the strong concerns voiced regarding the environmental and toxic impacts of eucalypts (findings discussed in Chapter 16 and applying to both private and collective rental) may in some cases have been an indirect means of expressing more general dissatisfaction with rental. Thus, we recommend that Stora Enso continue to monitor the private land rental process and that both the company and the government make greater efforts to ensure that private land rental is in all cases fully voluntary and transparent. (In many regards, the local government will need to play the more direct role, but Stora Enso can offer encouragement by making clear its standards and preferences for a fully voluntary and transparent process.)

As background, Stora Enso has found it easier to secure rental of collective land than of private land. Collective land is harder for villagers to develop, because cooperation among many households is required. Thus, villagers may find more to be at stake in renting their private land, which they can develop as they please.¹⁷ In open-ended questions, township governments indicated "increased income, as land is not cultivable" as a reason that villagers are willing to rent private land and "more profitable to plant sugarcane," "rental is modest and it's difficult to get cash soon," and "too many people, too little land" as reasons they are unwilling. On average, the township governments estimated that 34 percent of villagers are willing to rent out their private land (Annex VII, Table 33).

Table 12-4
Initially, did you agree when you were asked to lease out your private land for Stora Enso plantations? (Households in Project Area Villages)
Survey Type A

Response	Number of respondents	Percent of those responding to question (%)
Yes	149	63.1
No	86	36.4
Other (No one asked for my opinion)	1	0.4
Total	236	100.00

N(A)=244, response rate (A) = 96.72%

Note: All or almost all of Type A households sooner or later rented private land to Stora Enso.

Turning to those that have agreed to rent private land to Stora Enso, a majority (63 percent) of surveyed households indicated that they were willing to rent their land when initially asked. The significant proportion that were initially not willing (36 percent), however, suggests examination of the process through which they eventually agreed (Table 12-4). For those that were not initially willing, 43 percent gave "desire to continue current land use" (the top response given) as their reason (Annex VII, Table 34). When asked what finally made them change their minds, the initially unwilling most often responded "other households did so before us" (43 percent) or "local authorities encouraged me to see the benefits" (41 percent), rather than "I decided it would be best" (2 percent)

¹⁷ Restrictions, however, do exist. Farmers cannot convert private land classified as "forestland" to agricultural land. Also, they cannot cut trees on their land without obtaining the necessary "quota" from local forestry departments.

(Table 12-5). Both local authorities and peer pressure, then, play a significant role in household decision-making.

Table 12-5
If at first you were not willing initially, what was the reason for which you finally agreed to lease out your private land in the end? (Households Renting Private Land in Project Villages)

Survey Type A		
Response	Number respondents	Percent of those responding to question (%)
Local authorities encouraged me to see benefits	41	41.4
Considered the benefits of the group as a whole	2	2.0
I decided it would be best	2	2.0
Other households did so before us	43	43.4
Other reason	11	11.1
Total	99	100.00

N(A)=244, response rate (A) = 40.57%

While Stora Enso cannot control such factors at the village level, we recommend that the company do what it can to influence the private rental process. The company might consider distributing simple, one-page brochures explaining the rental process to all households that are targets of private rental and do so sufficiently in advance of contract signing. This could alleviate certain dissatisfactions, such as that expressed by one young man who told the team that his father, who is illiterate, had been asked to sign (and had signed) a contract for rental of the family's forestland. The young man had been upset to learn later that the contract period is 30 years, a length of time he finds unacceptably long and had not known about at the time of signing. We understand that, usually, households do not have an individual contract for the private land they rent, but, rather, sign a multiple-household contract. While individual contracts for each household may be impractical, we believe that transparency would be increased if, in addition to the information sheet mentioned above, a brief summary page of the contract (including area rented by the household) is provided to each family for their records. Finally, Stora Enso can also influence township, village, and collective small team leaders by conveying to them a set of guidelines and standards for private rental. Field managers should convey these guidelines verbally, but might supply a simple printed list of them as well. Examples of possible guidelines are: (1) Households should be fully informed of the process and terms of rental; (2) Rental should be fully voluntary; and (3) A printed summary page of the contract should be provided to each family renting private land.

Decision to Rent Collective Land and Decision of How to Spend Collective Rental Income

In contrast to findings on private land rental, in which households are indeed the final decision-makers, the analysis found participation in the decision to rent collective land to be weak. Participation in the decision of how to spend collective rental income is also weak. Not surprisingly, satisfaction with rental is mixed. These results are likely linked much more closely to the traditional practices of public decision-making in the areas involved than to any special characteristics of Stora Enso's project. It would be difficult and inappropriate for Stora Enso to attempt to directly influence the collective decision-making process. It is recommended, however, that local governments improve participation to the extent possible and that Stora Enso encourage them in this direction. To this end, Stora Enso may also wish to include action items targeting local governments' handling of participation issues in the overall communications plan recommended elsewhere in this report.

Generally, survey results indicate collectives are split in willingness to rent their land but are more supportive of rental than private landholders. Township governments interviewed estimated, on average, that about 50 percent of collectives are willing to rent out collective land to the company. Reasons (common responses to open-ended question) these officials gave for willingness include: "income of both the collective and individuals will increase," "certain individuals use the collective land as their own," and "rental will increase the collective's economic strength." Reasons given for unwillingness to rent collective land varied, with some being: "rental rate is too low" and "rental

period is too long" (Annex VII, Table 35). Results from the village small group survey also suggest a similar split of support, with 8 groups supporting rental of village forest land to Stora Enso and 6 groups not supporting such rental (Annex VII, Table 36).

Table 12-6
How was it decided to rent out the collective land to "the company" and how will it be decided what to do with the collective rental money? Are you satisfied with the transparency and fairness of the process for deciding to rent collective land? (Village Households in Project Areas)
Survey Type A

How the Decision Was Made	Decision-making for collective land rental		Decision-making for how to use the income from collective land rental	
	Respondents	%	respondents	%
Village leaders acted on behalf of collective interest	16	8.7	14	7.5
A small group represented the collective in making the decision	105	57.1	99	53.2
The collective voted and 2/3 or more agreed	54	29.4	56	30.1
Other	1	0.5	0	0
Don't know	8	4.4	17	9.1
Total	184	100	186	100
Satisfaction with decision-making process for collective rental		Respondents	%	
Households satisfied with the transparency and fairness of the process		154	83.2	

N(A)=244, response rate (A_decision to rent) = 75.41%, response rate (A_how to use income) = 76.23%, response rate (A_satisfaction) = 75.82 %

Asked how the decision was made to rent collective land, 57 percent of households in project villages selected "a small group represented the collective in making the decision." Only 29 percent selected "the collective voted and 2/3 or more agreed," although it is our understanding that this is the legal procedure and that which Stora Enso had thought to be generally followed. Seventeen percent (of 185) respondents indicated that they were not satisfied with the transparency and fairness of the decision-making process to rent collective land. Patterns for decision-making on how to spend collective rental monies are similar to those on the initial decision to rent. Fifty-three percent of households in project villages indicated the decision of how to spend rental money was made by a small group on behalf of the collective, while only 30 percent indicated a 2/3 vote was held (Table 12-6).

In light of the above findings, it is recommended that township officials work with village collectives to ensure that the procedure of 2/3 vote is adhered to in decisions of whether to rent collective land and how to use collective rental income. While Stora Enso cannot have a direct influence on this process, the company can improve satisfaction among collective members by making sure all households that are members of collectives potentially renting to the company understand the rental process and rental terms (for example, by providing a simple brochure to each household involved). In providing rental guidelines (both verbal and written) to local officials and leaders, field managers should emphasize that Stora Enso wishes to rent land only from those collectives that have made their decisions by a 2/3 vote. Stora Enso may also wish to consider including on the collective contract a section in which the collective small team leader verifies, with his signature, that a 2/3 vote has indeed been undertaken.

Decision to Rent State Land

Results from the survey suggest that state forest farm worker/labourers in project areas, as a group, do not strongly support rental of land to Stora Enso, are not involved in the decision to rent state forest farmland to the company, and are not very aware of rental terms. Yet, in contrast to households involved in the rental of collective and private land, state forest farm workers do not have usage rights of the land being rented. There are mixed views on the importance of participation of state farm

workers in the decision to rent their state farm's land. While some would say that the decision to rent is a business decision and does not necessarily require the participation of workers, others, particularly in China, where state-owned work units ("danwei") have traditionally acted as providers of social services and life-time employers, believe that workers should have the right to participate. At the very least, the government and forest farm management may want to ensure that workers are kept fully informed of the rental process and that rental revenues benefit not only management, but also line staff.

Table 12-7 below shows that over half of the 20 small groups surveyed on project area state forest farms did not support rental to Stora Enso. In fact, of these, seven "strongly objected" to the rental. The social team notes, however, that these results may partially be a reflection of a more general level of dissatisfaction with the poor profitability of the forest farms, many of which stopped paying salaries to regular staff several years ago. It is likely that there remains some dissatisfaction following the reforms within the state forest farms. The survey of forest farm management also indicates a majority of forest farm staff do not support rental, with reasons such as "employees lose work opportunities" and "we have the ability to do the business ourselves" offered in an open-ended question (Table 12-8). Asked how the forest farm decided to rent land to Stora Enso (multiple responses possible), half of the 20 small groups indicated a government decision was involved. Interestingly and possibly indicating a certain level of participation, however, four small groups indicated a decision was made at a meeting of workers' representatives (Table 12-9). The small groups overwhelmingly expressed dissatisfaction with the rental terms and process and showed lack of awareness of the rental rates (Table 12-10). Forest farm management also suggested relatively low levels of awareness of the rental and its terms among regular staff (Annex VII, Table 37).

Table 12-7
When Stora Enso rented forestland
on your forest farm to develop plantations, what was the attitude of staff?
Survey of 20 Small Groups on Project Area Forest Farms

	Strongly support	Support	Do not support	Strongly object	Don't know
Total	2	5	5	7	1
%	10	25	25	35	5

N=20, response rate = 100%

Table 12-8
Willingness of Staff for Forest Farm to Rent Land
Survey of 23 Management Teams on Project Area Forest Farms

Generally speaking, are forest farm staff willing for the farm to rent out forestland?	Respondents	Percent (%)
Yes	5	21.7
If yes, why?	Increase income and job opportunities; develop forestry sector production; improve natural environment; resolve forest farm financial problems	
No	15	65.2
If no, why not?	After rental, employees will lose jobs; the rental rate is too low; income of the forest farm will go down; we have the ability to do this business ourselves.	
Not sure	3	13.0
Proportion of employees willing for farm to rent out forestland	Respondents	Proportion willing for farm to rent out forestland (%) (average of respondents' estimates)
Respondents making estimate	11	43
Unable to make estimate	12	---

N = 23, response rate = 100%

Table 12-9
How did your forest farm decide to rent to Stora Enso its state owned or private individuals' land? (Check all that apply)

Survey of 20 Small Groups on Project Area State Farms

Response	Respondents	Percent of Respondents (%)
Two thirds majority of workers' votes	1	5
Decided at workers' representatives meeting	4	20
Forest farm head decided	1	5
Individual household decided	1	5
Government decided	10	50
Others	6	30

N = 20, response rate = 100%

Table 12-10
Workers Knowledge of and Satisfaction with Rental Arrangement
Survey of 20 Small Groups on Project Area State Farms

Do you know the rental rate?	Respondents	Percent of those responding (%)
Yes	2	11
No	17	89
Are you satisfied with the rental arrangement and process?	Respondents	% of those responding
Satisfied	1	6
Not satisfied	16	94

N=20, response rate (rental rate) = 95% (19 respondents); response rate (satisfaction) = 85% (17 respondents)

12.3 Benefits from Rental

The main benefits from rental are: (1) direct increases in income through rental payments (private and collective rental), (2) improved public goods (in the case of collective and state rental, as rental monies may be spent on improved infrastructure, etc.), (3) improved employment benefits (for state farm workers), and (4) employment opportunities (for those living in the neighborhood of rental or migrating there for work). An annual increase in income was the positive impact of the project most often cited by villagers in project areas (indicated by 130 of 244 respondents). Less than half as many village respondents (63) indicated employment as a positive impact, fitting with results given earlier on the low numbers of this group actually having worked on project land. Less than half again (31) indicated infrastructure improvements as a benefit of the project (Table 12-11). While rental income is probably the most significant positive impact for village respondents overall, employment clearly plays a more significant role as a benefit for state farm staff and was rated overall as the top positive impact by the two groups of project area state farm households surveyed (Table 12-12). This section focuses on the benefits derived directly from rental income (direct income increase, improved public goods, and improved state farm employment benefits). Employment is treated more fully in the next chapter.

Table 12-11
Main Positive Impacts of land rental to "the company" for plantation development (check all that apply) (Households in Project Villages)

Survey Type A

Positive Impact	Respondents	Percent of those responding to question	Percent of total survey group

Increase in annual income	130	82.3	53.3
Increase in employment opportunities	63	39.9	25.8
Improve infrastructure conditions	31	19.6	12.7
Improvement in the natural environment	54	34.2	22.1
Promote development of related industries	66	41.8	27.1
Increase in government tax revenues	69	43.7	28.3
Other	1	0.6	0.4

(A)=244, response rate (A_positive) = 64.92%

Table 12-12
Main Positive Impacts of land rental to "the company" for plantation development (check all that apply) (Project Area State Farm Staff Households)
Survey Types C (have worked on Stora Enso land) and E (have not worked on Stora Enso land)

Positive Impact	C			E		
	Respondents	% of those responding	% of full C group	Respondents	% of those responding	% of full E group
Increase in annual income	83	95.4	45.9	42	61.8	29.4
Increase in employment opportunities	84	96.6	46.4	57	83.8	39.9
Improve infrastructure conditions	36	41.4	19.9	26	38.2	18.2
Improvement in the natural environment	21	24.1	11.6	25	36.8	17.5
Promote development of related industries	55	63.2	30.4	52	76.5	36.4
Increase in government tax revenues	61	70.1	33.7	33	32.4	23.1
Other	0	0	0	3	4.4	2.1

N(C)=181, response rate (C)=48% (87 respondents)

N(E)=143, response rate (E)=47.5% (68 respondents)

Direct Benefit of Rental to Village Household Income

The annual added increment to income from private land rental varies largely from household to household, depending on area rented and the rental rate. Some households have found the added income to be very small and of minimal impact. For example, one villager renting less than 10 mu at 12 yuan per mu per year said that, at less than 100 yuan per year, the rental money was not of much consequence to his household. He added, however, that, to a rural household, "one yuan is one yuan," so they agree to rent, even if the incremental income is very small.

Based on our estimates, however, the added annual increment in terms of rural per capita net income in the project areas, while small, is somewhat more consequential. Taking an average rental area of 20 mu of private land rented per household and an average annual rental rate of 25 yuan per mu, the average annual increment to household income is 500 yuan, or (at 4.88 members per household), 102 yuan/capita.¹⁸ This is about 4 percent of the average net per capita income (2,484 yuan) in project villages. If the household is also a member of a collective renting land and the collective decides to distribute rental income fully among households, an estimated average increment of (100 mu/collective x 25 yuan/mu ÷ 30 households/collective =) 83 yuan per household, or 17 yuan per capita, is added. If a household participates only in collective rental, the added increment to per capita income is very small (less than 1 percent).

¹⁸ The average rental area is based on a combination of survey and field results. The average rental rate was provided by Stora Enso. The average number of members per household and average per capita income are a results for survey group A (village households renting private land in project areas).

In some special cases, individual households are able to gain a much higher income benefit per mu by participating with their rented land in the nation's "Sloping Cropland Conversion Program." Under this program, which is targeted at reducing soil erosion and other environmental problems, localities are given a certain "quota" of land for which subsidies will be provided to households in return for conversion of sloping cropland to trees or grasses. According to local officials interviewed in one township, the annual subsidy rate is 230 yuan per mu to be provided for eight years. Thus, the combined household income increment for rental and cropland conversion is (230+25=) 255 yuan per mu per household for the first eight years. The per capita income increment for a family renting out 20 mu would represent an increase in the household's average per capita income of 42 percent. Yet, this calculation does not take into account the losses from discontinuing sugarcane production (see section on opportunity cost later in this chapter).

Benefits of Collective Rental Income

While collective rental income, if distributed fully among collective members, is estimated above to add an average annual increment of 83 yuan per household, the survey indicates that this money is frequently spent in other ways and, thus, that the nature of benefits may be different. Field results indicate that use of rental income varies by collective: some split all money among households, some use all on collective purposes (e.g. infrastructure), and some use the money in both of these two ways. Survey results suggest that each of these two uses is common in project villages, with distribution to households (114 respondents) slightly more common than investment in local infrastructure (94 respondents). Interestingly, in terms of preference, many households recognize the importance of collective goods. While 33 percent of those responding prefer that all collective rental income be split among households, 47 percent prefer that part is spent for collective purposes (the other part split among households); and 20 percent prefer that all the money be spent on collective purposes (Table 12-13). Very roughly speaking, then, current practice in spending these moneys is congruent with preferences. Lack of participation in decisions of how to spend rental money (as discussed above), however, is a problem that may need to be addressed.

Table 12-13

How has the collective rental income been spent to date (check all that apply) and what do you think is the best way to spend collective rental monies (check only one)? (Households in Project Villages)

Survey Type A

Current Spending		
Response	Respondents	Percent of those responding to question (%)
Local infrastructure for the collective	94	42.0
Distribute directly to all households in the collective	114	50.9
Other	0	0
Don't know	16	7.1
Desired spending		
Response	Respondents	Percent of those responding to question (%)
All the rental income among individual households of collective	61	32.8
Use all rental money for collective purposes	37	19.9
Divide part of rental among households, use other part for collective purposes	88	47.3

N(A)=244, response rate (A_current spending) = 91.80% (224 respondents), response rate (A_desired spending) = 76.23% (186 respondents)

Seeking a better understanding of the nature of benefits villagers in project areas prefer, the survey asked respondents their preferred areas of spending for collective rental monies if spent on collective goods. In the small group village survey, the most frequently identified need was road improvements, followed by clean drinking water (see Table 12-14). Road improvement was also the most common

option (though among fewer choices) chosen by households surveyed in project villages (Annex VII, Table 38). The next chapter examines in greater detail development needs of project areas and affected groups' preferences for public goods.

Table 12-14
Suggestions for Spending Rental Income from Collective Forestland (Check all that apply and rank, with the most important ranked as "1")

Survey of 15 Small Groups in Project Area Villages			
Suggested Spending	Respondents	%	Average importance (1 to 8)
Improve road conditions	12	80	1
Improve access to clean drinking water	9	60	2
Improve local communications and internet access	3	20	6
Improve local land irrigation and water/conservancy	7	46.7	3
Improve local education conditions	4	26.7	5
Improve local health services	4	26.7	7
Improve local living environment	7	46.7	4
Improve local agricultural trade market	3	20	8

N=15, response rate = 100%

Benefits of Rental Income to Middle Persons

Findings indicate that the benefits derived by middle persons of both types (i.e. both land-securing and re-renting middle persons) from village land rental are not egregious. While the respondent number is very limited, all of those small groups surveyed in project villages that had been contacted by middle-persons during the land rental negotiation process believed that the middle person's role was beneficial to both sides (Table 12-15). Making a rough estimate, if assuming the average land rental rate to be 25 yuan per mu per year for 30 years (ignoring for the moment increases in rental rates) and the "land-securing" middle person's payment to be 10 yuan per mu, the middle person's revenue is equivalent to 1.3 percent of total contract value. Thus, the response of the surveyed small groups seems rational.

Table 12-15
Did you have contact with a middle person in the rental process?
If so, what is your opinion of the middle person's role?
Survey of 15 Small Groups in Project Villages

Contact with a middle-person in the rental process?	Respondents	Percent of those responding to question (%)
No	5	45.5
Yes	6	54.5
If yes, what is your opinion on the middle person's role?	Respondents	Percent of those responding to question (%)
Middle person makes good money	0	0
It's beneficial to both sides	5	100
I/we was/were taken advantage of	0	0

N= 12, response rate (contact) = 92% (11 respondents); response rate (opinion) = 42% (5 respondents)

As mentioned, re-rental middle persons play a role in only a small proportion of land rental in "village" project areas, though more information is needed on what proportion of rented state farm land is actually re-rented village land. The margins of re-rental middle persons are clearly higher than those of land-securing middle persons. For example, an interviewed township official renting (as an individual) from villagers at 30 yuan per mu for the express purpose of re-rental (because villagers were not willing to rent directly to Stora Enso), re-rents to Stora Enso at 35 yuan per mu. The township official thus derives 14 percent of the rental income benefit. Those re-rental middle persons

who rented land some time back for another purpose before re-renting to Stora Enso may make even higher margins. They are benefiting, however, from an unanticipated change in situation rather than speculation. While egregious margins of re-rental middle persons are not currently a problem, we recommend that Stora Enso, to the extent possible, monitor the margins of middle persons that are renting land with the express purpose of re-renting to Stora Enso.¹⁹ If high profit-taking and land speculation is discovered, Stora Enso can report these to the government so that the latter can adopt measures to prevent further problems.

In general, given rising income disparities in rural China, it is recommended that Stora Enso remain vigilant regarding the role and benefits of both types of middle persons. Stora Enso may wish to attempt, to the extent possible, to work directly with those renting out their land, so as to avoid contributing in any way to growing disparities in rural society.

Benefits of State Rental Income

Comprehensive information on how state farm rental income will be spent is not available. Based on anecdotal information from interviews, state farm rental income will be used to pay salaries of those staff still receiving salaries (i.e., in many cases management staff only) and to develop new business projects. It may also be used to support pensions of all retired staff (both management and line staff) and public goods on the forest farm. Table 12-16 below presents rough estimates on the rental income per forest farm, per branch farm, and per forest farm staff. Average rental income per state farm employee is substantial in comparison to per capita income. Yet, under present circumstances, it is unlikely that much of rental income will go towards benefiting line staff. It is recommended that, as government officials and state farm management plan how to spend rental income, they give special attention to issues of employee benefit sharing. It would be helpful for forest farms to spell out the broader employee benefits derived from the affiliation with Stora Enso and this is something that Stora Enso should encourage. On some forest farms, the amount of land rented by Stora Enso constitutes a majority of forestland resources. For example, Qinlian Forest Farm is planning to rent a total of 400,000 mu to Stora Enso, about 70 percent of its forest suitable land. While it is true staff that are no longer receiving salaries may have been allotted land to grow cash crops, when such a major transfer of a state farm's main productive assets is involved, the impacts and potential benefits for line staff should be fully considered.

Table 12-16
Rough Estimates on Annual State Farm Rental Income²⁰

Time	Annual Rental Income per State Farm	Annual Rental Income per Branch Farm	Annual Rental Income per State Farm Employee
At present (20,000 ha)	1,400,000 yuan	280,000 yuan	2,800 yuan
At targeted scale (120,000 ha)	7,560,000 yuan	1,512,000 yuan	15,120 yuan

¹⁹ As part of the process of renting from such middle persons, Stora Enso may request to see their original rental contract to verify land use rights and, thus, in the process, determine the original rental rate. From the original contract, Stora Enso may also determine the date of original rental and thus get an idea of whether rental was recent and for the express purpose of re-rental. For monitoring, then, Stora Enso may wish to keep a record of such re-rental middle persons and their margins and original rental dates in its rental database.

²⁰ Assumed average rental rate of 35 yuan per mu. Assumed 2/3 of Stora Enso land at present and 60 percent at targeted scale to be state farm land. Extra payment for existing trees is not included in calculations. At both present and future full-scale, total number of state farms is assumed to be five. Three farms have a total of 23 branches; and the other two farms with no branches are taken together with these to provide a total of 25 "branch farms."

12.4 Opportunity Cost of Rental and Alternative Uses of Land

An important aspect in evaluating the positive or negative impact of rental on affected groups is that of alternative uses of the rental land and the opportunity cost of choosing to rent. The basic question to be answered is whether farmers would benefit more by choosing an alternative to rental, considering both benefits that would be generated soon and those that would come some time later during the relatively long (e.g. 30 year) rental period. This section examines what farmers and state farms were doing with their rented land prior to rental and also what they might choose to do with it had they not rented. Fieldwork results generally show that, in economic terms, most of the land rented in village areas was not being put to highly productive uses, so that rental probably generates more income per mu than continuation of past use. The land, however, might have been a source of non-market fuel wood (for self-use), which raises the questions of how household fuel wood needs will be met after rental. In terms of alternative future uses, opportunity cost is more difficult to evaluate, particularly for the long-term (e.g. 30 years) and particularly if we consider the unpredictability of future markets for fruit, sugarcane, eucalypt, and other products. The social team presents, however, information gathered on the options and also some practicalities (regulations against converting forestland to agricultural uses and lack of investment funding) that may make some alternatives impractical.

Land Use Prior to Rental

Fieldwork results suggest that most of the private and collective village land rented to Stora Enso had pine forest (usually sparse) prior to rental and generated minimal if any income. The land may have been used for fuel wood; and the pine was generally said to be of low value relative to other options, such as eucalypts. Once the contract was signed, the household or collective involved was able to harvest the pine and sell it on the market. The exception to the low economic productivity of land prior to rental is the 10,000 mu (representing about 1/10 of Stora Enso's current village holdings) of land planted with sugarcane that was rented to the company. We believe that rental of this land became attractive to households only after the substantial subsidies (230 yuan per mu for eight years) associated with the nation's Sloping Cropland Conversion Program were added to the deal. Data from the survey confirms that pine is the top use of land destined for rental in project villages (Table 12-17).²¹ Pine is much less common on private forestland and bare land that is not rented, for which sugarcane is the primary use (Table 12-18). These results suggest, as would be expected, that it is the lower productivity pineland that is chosen for rental.

Table 12-17
What was this private land used for before you leased it out for eucalypt plantation development?
(Check all that apply, for Households in Project Villages)

Survey Type A		
Response	Number of respondents	%
Bareland	46	18.9
Eucalypt	41	16.8
Pine	114	46.7
Sugarcane	102	41.8
Fruit trees	20	8.2
Other economic tree crop	1	0.4
Grazing	43	17.6
Other uses	0	0

N=244, response rate = 100%

²¹ We are not certain why such a large percentage of respondents (42%) indicate sugarcane was planted on their land prior to rental. Our understanding is that the proportion of Stora Enso's village land that had been planted with sugarcane prior to rental is closer to 10%.

Table 12-18

**What do you currently use the private forestland and bare land that you have not yet rented out for?
(Households in Project Villages)**

Survey Type A

Response	Number of respondents	% of respondents
Barren land	9	5.8
Eucalypt plantations	30	19.2
Pine plantation	29	18.6
Sugarcane	65	41.7
Fruit trees	11	7.1
Other economic tree species	0	0
Grazing land	11	7.1
Other	1	0.6

N(A)=244, response rate(A) = 63.9%

For collective land, pine comes out even more clearly in front as the top use prior to rental (Table 12-19). This is not surprising, as it is difficult for collectives to carry out development of collective land, given the number of households involved. Again, pine is less prevalent on the land (in this case collective) that is not being rented out, though in this case the land not rented out does not have any sugarcane, suggesting this crop is more popular on private land, where it can be developed individually.

Table 12-19

**Use of the collective land that was rented to "the company" prior to rental (check all that apply)
(Households in Project Villages)**

Survey Type A

Response	Respondents	%
Bareland	55	22.5
Eucalypt	32	13.1
Pine	130	53.3
Acacia	0	0
Fruit trees	30	13.3
Sugarcane	41	16.8
Grazing	55	22.5
Other	0	0

N(A)=244, response rate(A) = 100%

Given the lower economic productivity of most land (e.g. sparse pine forest) prior to rental, it is concluded the farmers make a rational economic choice as far as short-term annual cash earnings are concerned. It is more difficult for them, of course, to predict opportunity costs in the long term. Also, fuel wood issues are an important concern and are examined in the next subsection. Sugarcane land rented also presents a special case. High government subsidies make rental an attractive option, though the eight year duration of such subsidies compared to the 30 year contract term make the longer term opportunity cost less clear.

Fuel Wood Issues

Survey and field results suggest that the potential of lost access to fuel wood through land rental is a significant issue that should be examined. Many farmers in project villages told the team that, prior to rental, they had gathered fuel wood on the land that they had rented to the company. Also, seventy-five percent of respondents in project villages indicate they use fuel wood as a main source of fuel. Only agricultural residues (84 percent) were selected by more households as a main source of fuel (Annex VII, Table 40). Asked where they obtained fuel wood prior to rental, household private plots (77 percent), followed by collective land (68 percent) were the most popular responses for village households. Much fewer (13 percent) indicated they currently purchase fuel wood on the market (Table 12-20).

Table 12-20
If you use fuel wood, where did you get it before renting land to "the Company" (or at present)?
(select all that apply, for Households in Project Villages)

Survey Type A

Response	Respondents	%
My household's private plots	187	76.6
Collective land	167	68.4
Purchase on market	31	12.7
Other	37	15.2

N(A)=244, response rate (A) = 100%

Asked where they would obtain fuel wood in the future after land had been rented, private plots was again the top answer (43 percent), followed by market purchase (29 percent) and collective land (21 percent). Asked about fuels to replace fuel wood, the top response was agricultural residents (indicated by 81 percent of respondents), followed by natural gas (45 percent of respondents) (Table 12-21). Thus, while the top sources of fuel wood (private and collective land) are the same as before, the shift in percentages of households citing each source suggests a shift to less supply from private and collective land and somewhat more supply from the market and alternative sources, such as agricultural residues. Field work yielded varied responses on fuel wood issues. Most interviewees did not seem overly concerned. One woman explained that her family was renting out one forestland plot, but keeping a second one especially for fuel wood. One young man in another village, however, did express strong concern about future sources of fuel wood. He explained that natural gas is too expensive to be a real alternative for people in his village and asked that Stora Enso leave the scraps from harvesting on the land for the village people to collect.

Table 12-21
If the land is/has been rented, where will you get fuel wood in the future? (check all that apply)
(Households in Project Villages)

Survey Type A

Response	Respondents	%
My household's private plots	99	42.9
Collective land	49	21.2
Purchase on market	67	29.0
Will use the following alternative source of fuel:	---	---
Coal	1	0.4
Gas	104	45.0
Agricultural residues	188	81.4
Other	28	12.1

N(A)=244, response rate (A) = 94.67 %

In light of the dependence of local villagers on private and collective land for fuel wood and the likely reduction in access with rental to Stora Enso, we suggest the company clearly articulate its policies related to fuel wood and do whatever it can to increase availability. For example, in the chapter on soils in this study, it has been recommended that bark and leaves be left on the ground to increase nutrients in the soil. Stora Enso might articulate its policy in which people may take the fallen woody branches for fuel wood, but leave the bark and leaves. Stora Enso also plans to make woody residues from harvesting available to local people. Stora Enso's rental-related information campaign, in addition to outlining the rental process and conditions, should clearly state its plans and policies with regard to access to fallen woody branches and woody harvesting residues. In this way local people can have a greater understanding of their future options and opportunity costs.

Alternatives and Practicalities

Research on alternatives to rental and associated opportunity costs yields a complex picture. The agricultural and forest plantings that are the most suitable to and widely seen on the land suitable for eucalypts in the region are pine trees, sugarcane, cassava, and fruit trees (mainly litchi, longan, and orange). Asked what they would most want to plant on the land rented out to the company, project area village households expressed interest in several options, foremost of which were sugarcane (96 percent) and fruit trees (95 percent) (Table 12-22).

Table 12-22
Regarding the private land you have rented (or might rent in the future) to "the company", if it wasn't planted with eucalypts, what would you most like to do with it? (Please rank based on your own preference, indicating your favorite as "1", etc.) (Households in Project Villages)
Survey Type A

Option	Number of households	%	Average preference (1-8)
Sugarcane	234	95.9	2
Fruit trees	231	94.7	1
Hemp	195	79.9	5
Pasture	196	80.3	6
Fuel wood	200	82.0	3
Grazing	216	88.5	4
Other	14	5.7	7

When respondents did not indicate preference level for a particular item chosen, that item was ranked as "8".

N(A)=244, response rate (A) = 100%

The assessment carried out a rough case-study assessment on the profitability of various options (Table 12-23). While in this work sugarcane, followed by cassava, were the most profitable options and almost all options yielded higher profits than rental, a few caveats must be noted. First, China has strict regulations about the conversion of forestland to agricultural land. Namely, at present, such conversion is not allowed, so that sugarcane and cassava are generally not options for land classified as forestland. Second, profitability varies widely from case to case and is particularly sensitive to widely fluctuating market prices. For example, the team learned that the popularity of sugarcane with farmers has risen and fallen with market price and fluctuations in the sugar industry and that China's entry into the World Trade Organization may put downward pressures on the commodity's price. It was also found that those who established their fruit tree orchards several years ago, before prices fell, were better able to recover high up-front costs and maintain profitability, while those planting fruit trees more recently were not doing as well and sometimes even suffering losses. Last and perhaps most important, are the issues of having the funds and labor to invest in these various alternatives and the financial strength to bear the associated risk. In the case of eucalyptus, economy of scale for intensive management is also something that most farmers will not have.

Table 12-23
Three Year Averages (2001 to 2004) of Net Income per mu for Eucalypts and Alternatives to Eucalypts (Based on Case Studies)

Species	Organization or Individual	Net Income in yuan per mu (Averaged Over Three Years)	Rank in Terms of Profit per mu
Eucalypt	10 forest farms in Guangxi (average result) ²²	172	6

²²Social assessment for the World Bank Loan "Guangxi Integrated Forestry Project" took place from December 2004 to January 2005. In the process, 10 forest farms were investigated. Results are now in the Guangxi Management Office for the Utilization of Foreign Funding in Forestry.

	10 Guangxi villagers with plantations (average results) ²³	96	
	Household #1	270	
	Average	179	
Sugarcane	Household #2	558	1
	Household #3	486	
	Household #4	520	
	Average	521	
Cassava	Household #5	450	3
	Household #6	315	
	Household #7	423	
	Average	396	
Lychee	Household #8	630	2
	Household #9	- 278	
	Average	176	5
Longan	Household #6	190	7
Orange	Household #5	376	4

Source: Team's computations based on data gathered in field interviews

It is concluded that farmers have chosen to rent out their land, despite the lower income per mu relative to other options, because of the aforementioned constraints. They lack the financial strength, know-how, and economies of scale needed to develop the alternatives. Also, most of the land they are renting is classified as forestland and therefore they do not have the option of planting cassava or sugarcane on it, leaving fruit trees as the main option. Yet, several years ago, when fruit prices were higher, many farmers rushed to develop orchards, so that now the price of fruit is low and returns much less attractive than in the past. It can be concluded from this that any substantial expansion in fruit orchards is likely to contribute to further depressed prices.

It is also concluded, however, that farmers lack an advocate in the rental process to help them make decisions and consider the longer term implications. For example, for those farmers that have agreed to have their sugarcane land converted to plantations, it is unclear whether they have been able to think through the opportunity costs clearly and consider the implications once the eight-year government subsidy is over. Also, for rental in general, the top-down system is such that local governments have incentive to promote the benefits of rental to farmers rather than help them carefully consider the alternatives and opportunity costs. Thus, there would be benefit in promoting the development of impartial local farmer organizations to support farmers in their decisions on use of forest suitable land and to help them obtain pertinent information. These organizations could take the form of the many growers associations that are being established in rural China nowadays. The problem of farmers lacking an advocate, of course, is not one that Stora Enso needs to address. Instead, relevant actions would like in the domain of the government and/or local civil society organizations.

12.5 Rental Terms and Payment

During fieldwork in villages, the team frequently heard expression of discontent from farmers that the company's rental term (30 years) is too long and that the rental rate is too low.²⁴ Although Stora Enso has a policy stated in the contract of adjusting the rental rate once every seven years according to national price indices, farmers appeared to be generally unaware of this policy. When farmers were

²³ Social assessment for the World Bank Loan "Guangxi Integrated Forestry Project" took place from December 2004 to January 2005. In the process, 10 village-level participatory assessments were carried out. Results are now in the Guangxi Management Office for the Utilization of Foreign Funding in Forestry.

²⁴ Survey results also indicate a certain level of dissatisfaction from state farm management with regard to the land rental contract (see Annex VII, Table 41).

told about this policy during fieldwork, they had a positive reaction; and it appeared some of their concerns for the long rental period were alleviated. Given the situation, it is recommended that Stora Enso, in its information campaign, ensure that current and potential renters are made aware of the policy to adjust rental rates every seven years. This policy should be made a bullet in any rental brochures distributed and should also be a point of discussion of any in-person presentations in villages.

The team also learned in the field that there were some concerns about Stora Enso being "slow" to develop the land and that rental payments were delayed because of slowness in determining exact land area and borders. Farmers are generally concerned about not receiving rental payments and, when Stora Enso does not develop the land for some time after rental, their concerns tend to grow. It is recommended that Stora Enso attempt to move things forward as quickly as possible once rental agreements have been signed. In cases where delays are inevitable, the company should step up communications with affected villages and keep them informed.

Finally, aside from delays, the team did not discover any problems in households receiving the rental payments due to them. Receipt of rental monies disbursed, however, is a potential problem area and therefore one that should be closely monitored. It is recommended that, to the extent possible, Stora Enso pursue a policy of distributing payments for private land rental directly to the families involved.

12.6 Preferred Forms of Cooperation

In discussions with the Guangxi Forestry Bureau, the team learned that the Bureau hopes to promote what it called the "shareholding model" of company-community cooperation. In the shareholding model, the company and community together develop plantations and split profits. The shareholding model, currently used by some other companies in Guangxi, might potentially bring the grower a greater return than the land rental model and also provide the grower with employment through labour opportunity, but measuring and ensuring the farmer's assigned proportion of profits is problematic because of uncertainties in cost and price standards. In addition, farmers are at a disadvantage in terms of information and in terms of skills to measure the harvested wood. The current rental model used by Stora Enso can bring farmers renting out land reliable and unambiguous benefits, and also provide them with employment through labor opportunities generated. The rental model, however, has no room for the "upside" associated with profits; and farmers might also lose out if market rental rates increase ahead of scheduled review and adjustment.

Several of the surveys addressed the question of preferred models of company-community cooperation and results are summarized in Table 12-24 below. Interestingly, the share-holding model was not any more popular overall than the rental model. Instead, village, township, and state farm respondent groups all overwhelmingly suggested that farmers and forest farm staff prefer to plant trees themselves and sell these to the company. While this approach does not fit with Stora Enso's main business model, the company may want to keep this preference in mind for special initiatives. It is believed that Stora Enso will be buying a small portion of pulpwood for its mill on the market. Perhaps, then, the company could build its relationship with the communities in which it rents by providing technical assistance for a certain portion of eucalypts to be developed by an "out-grower" model that could then supply the company with the market pulpwood desired. More generally, it is suggested that Stora Enso remain flexible and open to forms of cooperation other than rental, with an eye for adapting to the local situation.

Table 12-24
Preferred Models of Cooperation with Companies in Plantation Development: What do local
farmers (or forest farm staff) prefer?
units are number of respondents in each survey selecting cooperation model

Preferred Model	Village Small Group	Township Government Survey	Forest Farm Small Group Survey	Forest Farm Management Survey
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	Survey			
Farmers (or staff) plant trees themselves, sell to company	12	7	17	10
Rent land to company	1	4	1	5
Hold shares jointly and run business with company	1	1	1	7
Other	1	0	1	1

N(village small group)=15, N(township government)=12, N(forest farm small group)=20; N(forest farm management)=23. Response rates for all four groups were 100 percent.

Summary of Chapter's Key Points on Land Rental:

- Survey results suggest Stora Enso rental encompasses a majority of the forest suitable land held by households and collectives renting to the company, but over 30 percent of such land in both cases is retained for other purposes (such as fuel wood collection).
- Satisfaction with the process of private village land rental appears to be the norm, though local authorities influence decision-making. In at least a few cases, farmers feel either uninformed or not fully in control of the decision. Local governments should work to ensure private land rental is in all cases fully voluntary and transparent. Stora Enso should monitor the private rental process and provide input (e.g. information sheets on rental process for households, separate contracts or contract summary sheets for each household, guidelines for local officials, etc.) to improve the situation.
- Participation in the decision to rent collective land is weak, with votes not held in the majority of cases. Local governments should improve participation. Stora Enso may encourage local governments to adhere to the policy of two-thirds vote, ask small team leaders to verify such vote by signature, and improve transparency by provision of information sheets to involved families.
- State farm staff in project areas do not strongly support rental of state farm land to Stora Enso, are not involved in the decision to rent, and are not very aware of rental terms. Government and forest farm management may want to ensure workers are kept informed of the rental process and rental revenues benefit all staff.
- Some households find rental income to be very small and of minimal impact. Rough estimates suggest a per capita income increment of 4% for private rental and 1% for collective rental.
- Most of the land rented in village areas was not being put to highly productive uses prior to rental, so that rental probably generates more income per mu than past use. The land, however, might have been a source of fuel wood (the main source of fuel for most households in the area), suggesting that Stora Enso clearly enunciate its policy for use of litter and harvesting scraps prior to rental.
- Farmers choose to rent out land, despite lower income per mu relative to other options, because they lack the financial strength, know-how, labor, and/or economies of scale to develop the alternatives. They also lack an advocate in promoting their interests in the decision-making process. The Guangxi Government might promote the development of local farmer organizations to support farmers in their decisions on use of forest suitable land and to help them obtain pertinent information.
- Some farmers complain the rental period is too long and the rental rate, too low. Stora Enso should ensure renters are made aware of its policy to adjust rental rates every seven years.
- Some villagers are concerned about Stora Enso being "slow" to develop the land. They worry they will not receive rental payments. Once rental contracts are signed, Stora Enso should move forward quickly and keep villagers informed when delays are inevitable.
- Respondents indicate farmers and forest farm staff prefer to plant trees themselves over other forms of cooperation. For its market pulp requirements, Stora Enso might consider providing "out-grower" technical assistance to the communities in which it rents land.

Chapter 13. Employment

This chapter reviews impacts and issues associated with employment in plantation work on Stora Enso land. Plantation workers are not formal employees of Stora Enso, but, rather, are hired by contractors (businesspersons that have contracts with Stora Enso to fulfill tasks related to plantation development). Yet, Stora Enso has expressed a strong interest in ensuring, to the extent possible, the socially responsible employment of plantation workers. This chapter begins with background information covering the types of groups involved in Stora Enso plantation work, local perceptions of the project's employment generation, length of involvement to date of various types of workers, desirability of the work, and the types of work done and anticipated by workers. The benefits of employment, with an emphasis on income generation, are then examined. Next, the chapter presents results on alternatives to or the "opportunity cost" of work on Stora Enso plantations for those participating. It then moves to address key employment issues, including contracts, labor disputes, and health and safety. The chapter also addresses special issues unique to migrant labor. It closes with an assessment of the scale of employment generation by the plantation project.

13.1 Background: Groups Involved and Types of Work

Types of Households Involved

Currently, there are four types of households that benefit from work on Stora Enso's Guangxi plantations:

- Households in villages currently renting land to Stora Enso, with at least one member having worked on Stora Enso's land. (Such households are represented, in part, by Household Survey Type A, households that have rented private village land to Stora Enso. Survey results indicate, however, that most such households have not had or have not taken advantage of the opportunity to work on Stora Enso land. Less than four percent of respondents reported involvement in such work.)
- Households of project area state forest farm line staff ("workers"), with the state employee (and possibly other household members) having worked on Stora Enso land. (Such households are represented by Household Survey Type C.)
- Households in villages not renting land to Stora Enso, but located on or near a state-owned forest farm renting land to Stora Enso, with a household member having worked on Stora Enso land on the forest farm. (Such households are represented by Household Survey Type D).
- Migrant workers that work on Stora Enso land in Guangxi (both in villages and on forest farms). They come from other provinces or from Northwest Guangxi. (Such households are represented by Household Survey Type H).

While the exact proportion of involvement of these various groups of workers is unknown, rough estimates by Stora Enso suggest that (1) those working Stora Enso land on state forest farms are: 11 percent state farm staff, 30 percent local villagers living near the farm, and 59 percent migrant laborers; and (2) those working Stora Enso land in villages are: 41 percent villagers living in or near to project villages and 59 percent migrant laborers (see Chapter 10 of Part IV for estimates of actual numbers). These results, along with information gathered in field interviews, suggest there is a "pecking order" inversely related to household income in terms of who is willing to take part in the relatively low paying and physically demanding labor associated with plantation work. Local villagers are more willing than state farm workers (who have the highest net per capita income of the three groups), but migrant workers (with the lowest net per capita income of the three groups) appear more willing than local villagers to do such work. Two young men from a project area village, for example, expressed strong pessimism that plantation development would bring them work opportunities. One guessed that, given the labor market, contractors would be able to find people

("probably from northern Guangxi") to work quite cheaply at perhaps 15 yuan per day. He and his friend did not believe that 30 or 40 yuan per day would be offered, though the team had heard these rates mentioned in other localities.

Fieldwork suggests that, generally, local workers participating in the project tend to be from among the poorer, or at most middle-income, households of respective household types (e.g. villagers or state farm workers) based in project areas. Participating migrants, though not necessarily the poorest from their hometowns, tend to be poor by national standards and by the standards in project areas. The project, then, appears to bring work opportunities and income benefits to poor households in particular, so that employment impacts are greatest on this segment of the population. Poverty in the region and impacts of the project on the poor will be covered in greater detail in the next chapter.

Local Perceptions on Job Creation

Local perceptions on whether job creation from the project will be significant are mixed, according to the survey of 12 Township Governments, 15 Small Groups in Villages, 23 State Farm Management Teams, and 20 Small Groups of State Forest Farm Workers – all in Project Areas. In line with the "pecking order" mentioned above, township officials and village small group respondents were more optimistic about job creation than were state farm management and small groups of state farm staff. Respondents that expected job creation generally expected opportunities across the range of plantation development functions, though harvesting is one area in which respondents consistently expected less opportunity (Table 13-1).

Table 13-1

Will job creation from the plantation project be significant in your township/village or on your state forest farm? If so, what will be the main types of work created by the project (check all that apply)?

Response	Township Governments	Village Small Groups	State Farm Management	Small Groups of State Farm Staff
Yes	7	10	11	10
Site preparation	4	9	9	8
Nursery and seedlings	5	9	9	7
Digging holes	4	9	11	9
Planting	6	10	10	9
Fertilizer application	7	10	11	10
Weeding and other maintenance	5	9	9	10
Harvesting	2	4	1	6
Other	0	1	0	0
No	5	5	11	10

Response rates all 100%, except for state farm management, for which 22 out of 23 responded.

Experience to Date: Length of Time Involved in Project and Types of Work done

As additional background about the groups working Stora Enso plantation land, the analysis presents below results, by group, on when respondents first became involved in work for Stora Enso's plantation project (Table 13-2). State farm workers, corresponding to their closer institutional links with the project (as employees of organizations renting large areas of land to Stora Enso), show the longest involvement, with over 89 percent indicating they first worked on the project at least one year ago. Many local villagers working on Stora Enso state farm land (59 percent) also first worked for the project a year ago or more. (It is noted, however, that these two groups may have misinterpreted the question and thus may have been responding more generally about their work on their respective state forest farm, rather than work specifically on Stora Enso land.) Surveyed migrant workers, perhaps with the weakest initial links to the project, have gotten involved the most recently, with 98 percent having first worked for the project a maximum of six months ago. This data may also reflect migrant labor's tendency to move from one job and place to another frequently.

Table 13-2
When did you begin to work on "the company's" plantation project?

Timing	C: State Farm Workers Working on Stora Enso Land		D: Local Villagers Working on Stora Enso State Farm Land		H: Migrant Workers Working on Stora Enso Land in Villages or on State Farms	
	Number of Workers	Percent	Number of Workers	Percent	Number of workers	Percent
One year ago	117	89.3	73	58.9	1	2.0
Nine months ago	10	7.6	12	9.7	0	0.0
Half a year ago	2	1.5	23	18.5	21	42.0
Three months ago	2	1.5	9	7.3	14	28.0
Within the last three months	0	0	7	5.6	14	28.0
Total	131	100.0	124	100.0	50	100.0

N(C) = 181, response rate (C)= 72.4%, N(D) =136, response rate (D) = 91.2%, N(H) = 50, response rate (H) = 100%

Data on the types of work in which those working on Stora Enso's land have been involved shows that significant proportions of state farm workers, local villagers, and migrant workers (both men and women across these groups) have been involved in most categories of work, with site preparation, planting, fertilizer application, and weeding and maintenance being the most common work. Expectedly, given the newness of Stora Enso's project, harvesting is the category in which the least number of respondents in each group have been involved. Seedling production, normally undertaken by Stora Enso itself or Stora Enso-commissioned companies, is the second least common work category, though significant numbers of respondents indicate having been involved in this area (Annex VII, Table 42). Stora Enso has established a joint venture nursery on Shankou Forest Farm, which provides most of the seedlings and currently has about 80 workers, over 40 of which are permanent staff and 30 temporary, and almost all of whom are female.

Plans: Future Involvement in Project and its Various Types of Work

Plans of workers regarding future involvement in Stora Enso plantation work offer insights on the perceived desirability of the work as well as possible trends in the future. Results indicate those already working on Stora Enso land are fairly interested in working on the company's land in the coming year. Fifty-seven percent of such state farm workers, 73 percent of such villagers living near state farms, and 58 percent of such migrant workers indicated that, "yes," they anticipate accepting work on the company's plantations in the coming year. There were very few categorical "no" responses to this question among these three groups, with most of the remaining respondents answering "maybe" or "don't know." Apparently, these three types of workers have found working on Stora Enso land to be a relatively desirable option, with the local farmers living near state farms being the most enthusiastic. Farmers in project villages, most of whom have not yet worked Stora Enso land, had a much lower proportion (16 percent) with affirmative plans to work Stora Enso land in the coming year. If "maybes" and "don't knows", however, are added to the "yes", the proportion rises to 80 percent, suggesting that these farmers either would like to keep their options open or are unclear about whether they will actually have such an opportunity (Table 13-3). Aside from work on Stora Enso land, the team also investigated work in its joint venture nursery. Interviewees working at the nursery (both state farm staff and local villagers) indicated that they found their jobs highly desirable and hoped to continue on with them in the future.

Table 13-3

Do you anticipate accepting work on "the company's" eucalypt plantations over the coming 12 months? Survey Types A, C, D, and H (Note: C, D, and H have all worked on Stora Enso land in the past; A has rented private land to Stora Enso.)

Response	A: project villager		C: state farm worker		D: villager living near state farm		H: migrant worker	
	Number	%	Number	%	Number	%	Number	%
Yes	38	15.6	103	67.3	90	72.5	29	58.0
No	49	20.1	10	6.5	1	0.8	2	4.0
Maybe	52	21.3	30	19.6	26	21.0	9	18.0
Don't Know	105	43.0	10	6.5	7	5.6	10	20.0
Total	244	100.0	153	100.0	124	100.0	50	100.0

N(A)=244, response rate (A) = 100%; N(C)=181, response rate (C) = 84.5%; N(D) = response rate (D) = 91.2%, N(H) = 50, response rate (H) = 100%

Across all groups surveyed, the type of work respondents are willing to do in the future for Stora Enso's project spans the full range of steps in the plantation development process. The most and least popular options (in the case of survey types C, D, and H, all respondents of which have experience working Stora Enso plantations) appear to correlate roughly with those areas in which workers have the most and least experience, respectively (Annex VII, Tables 42 and 43). For example, harvesting was the least popular option, followed by seedling production, across all groups. The workers, it appears, are most willing to do work with which they are familiar.

13.2 Benefits of Employment: Income Benefits and Skills

Worker Wages, Days Worked, and Project-Related Income as Proportion of Net Per Capita Income

Data from the survey indicates average daily wages when working on Stora Enso land of 25.2 yuan for state farm workers, 23.3 yuan for local villagers working on state farm land, and 18.3 yuan for villagers working on village land. In the field, the expert team learned that workers are more often paid by task completed (e.g. 0.6 yuan per hole dug, 1 yuan per tree planted) than by time worked. The range of daily earnings quoted to the team for local villagers and state farm workers ranged for 16 yuan per day to 40-plus yuan per day. The range of wages quoted for migrants (500 to 1,200 yuan per month when paid according to tasks completed and 600 to 800 yuan per month when paid according to number of days worked) was similar.²⁵ Fieldwork indicates that employment benefits other than wages are uncommon. (Contractors may provide money for meals, but this is later deducted from salaries.) The migrant worker survey also indicates non-salary benefits are rare. Among 50 migrants, none received food or housing benefits and only three received minor medical subsidies (less than 10 yuan per illness) from their manager (Annex VII, Table 44). While absence of such benefits is the norm for this type of work in China, Stora Enso may want to considering "raising the bar" in this area by encouraging contractors to provide some degree of support for worker medical needs, as well as, in the case of migrants, improved housing (see "Migrant Labor Issues" section below).

Data from the survey on days worked on Stora Enso land in 2004 indicates an average of 158 days for state farm workers and 165 days for local villagers working on state forest farms, though these figures may be questionable. In the field, plantation workers more often quoted figures of 10 to 30-plus days for the time they had worked on Stora Enso land so far. It thus may be possible that the question was

²⁵ One group of migrants paid according to task completed told the team that they are paid at the rate of 0.30 yuan per hole dug. They explained that women can generally complete 100 holes in a 12-hour day (making 30 yuan per day) and men, 120 to 130 holes. Migrants and contractors alike indicated to the team that contractors often provide an advance payment to workers for food and then deduct this from the final salary. In one case, this advance was paid every ten days and was about 150 to 200 yuan each time.

misinterpreted; and respondents gave total days worked on the state farm, rather than, specifically, on Stora Enso land on that farm. The small number of villager respondents working on Stora Enso land in project villages worked an average of 18 days on that land in 2004. One villager with whom the team spoke estimated that he would have the opportunity to work 30-plus days on Stora Enso land in the coming year – ten days for each of three fertilizer application periods during the year. It should be noted, however, that the extent of work opportunities will fluctuate with various stages in the plantation cycle from early days when land is idle, to clearing, to planting, to monitoring during years of growth, and, finally, to the frenzy of activity at harvesting.

Table 13-4 presents average daily wages, days worked in 2004, persons per household working, and annual amount earned per person, all for work on Stora Enso land. This data is then used to calculate (with results given in the same table) the average percent increment to annual net per capita income. Results, with a 25 percent increment to income for state farm workers and a 50 percent increment for villagers working on state farm land, are quite substantial. As above, however, based on fieldwork results, the "annual amount earned per person" may be for *all* work on the nearby state farm and not just that work on Stora Enso land. Thus, this provides a second income increment estimate (given in the last line of the table) based on each group having worked only 30 days in 2004 on Stora Enso land. Results range from an income increase of 4.5 percent and 4.8 percent for villagers in project villages and state farm workers, respectively, to 9.0 percent for local villagers working on state farm land. It can be concluded, then, that work on plantations on state farms is a very significant source of income for some state farm workers and some villagers living near state farms. Also, income from working on Stora Enso land is significant in terms of total income. In 2005, the work opportunities on the large pieces of Stora Enso land on some state farms will be substantial, so that it is realistic to assume six months or more of work per year for a worker and the (very large) types of annual net per capita income increments (i.e. 25 to 50 percent) indicated above.

Table 13-4
Average Wages and Average Days Worked on "the Company's" Plantations in 2004: Computing the Increment to Net Per Capita Income. Survey Types A, C, and D (note: C and D consist specifically of households that have worked on Stora Enso land on a state farm)

	A: project villager	C: state farm worker	D: villager near state farm
Average daily wages (yuan/day/person)	18.3	25.2	23.3
Average days worked in 2004 (days)	13.2	157.8	165.0
Persons working per household in 2004 (persons)	1	0.9	1.4
Annual amount earned per person (yuan/year/person)	NA	4,325.5	4,126.0
Persons per household (persons)	4.9	3.6	3.9
Annual increment per person in household	241	1,066.4	1,481.1
Overall per capita net income (yuan/year/person)	2,484	4,236	2,988
Percent increment to per capita net income (%)	2.0%	25.2%	49.6%
Increment if only 30 days on Stora Enso land (%)	4.5%	4.8%	9.0%

N(A)= 244, but only 9 worked on the company's forestland in 2004, assume response rate(A) =3.7%, N(C) = 181, response rate (C) = 100%, N(D)=136, response rate (D)=100%, N(H)=50, response rate (H)=100%. Note: calculations of increments for C and D are based on annual amount earned by each person, while that for A is based on wages and work days given.

Overall Impact on Worker Income

Results from the survey suggest that workers have seen a positive and significant impact from the project on household income. Eighty-four percent of Type C (state farm workers working on Stora Enso land) respondents answering the question indicated their overall household cash income had risen and gave an average increase amount of 2,827 yuan per household (Table 13-5). At the same time, however, asked about the impact if they "no longer had the opportunity to work on the forest

land," the majority of state farm staff, local villagers living near state farms, and migrant workers (all having worked on Stora Enso land), responded that there would be "no tangible effects" (Annex VII, Table 45). A discussion of alternatives to working on Stora Enso land will be discussed later in this chapter. Here it is mentioned that, in field interviews, the team learned that Stora Enso plantation work presents an opportunity near to home (the equivalent of which might not otherwise exist) for those locals that do not wish to out-migrate.²⁶ In contrast, migrant workers involved in the project may believe that they would make similar amounts of money elsewhere if the Stora Enso opportunity did not exist.

Table 13-5
How has your household annual cash income changed since working for "the company"?
Survey Type C (Household of Forest Farm Staff working on Stora Enso land)

Change in income	Respondents	%	Average increase or decrease per household (+/- yuan)
Increased	81	83.5	+2,827.2
Decreased	0	0.0	0
No change	16	16.5	--
Total	97	100.0	--

N(C) = 181, response rate (C) = 53.59%

Benefits to Worker Skill Base

During in-depth field interviews, workers did not indicate that the plantation work was adding substantially to their skill bases, though a large proportion of state farm workers working on Stora Enso land did indicate skill enhancement in the large-scale household survey. One state farm worker told the team that while he has noticed some difference in the techniques used by Stora Enso (as compared to his farm), he has really not learned much that is new to him. A migrant couple interviewed also indicated that they had not acquired new skills through the work. It is likely that most state farm workers working Stora Enso land have done plantation work before for their respective farms. Interestingly, survey results indicate that a large proportion (56 percent of respondents) of migrant workers also have had previous plantation experience (Table 13-6). About 74 percent of responding state farm workers working on Stora Enso land indicated they had acquired new skills through the Stora Enso-related work; and about 75 percent of these were optimistic that these skills could be used elsewhere. The migrant survey yielded less positive results, with only 38 percent indicating the acquisition of new skills, though almost all of these said they would be able to apply these skills elsewhere. Given these mixed results, an overall conclusion is that perception of worker skill enhancement through work on Stora Enso plantations is not strong. Perhaps this is inevitable given the nature of the work. If, however, a space for skill enhancement exists, Stora Enso may wish to work more closely with contractors to ensure they pass the necessary knowledge down to their workers.

²⁶ In addition, we note that female nursery workers (both regular state farm staff and nearby local villagers) are particularly enthusiastic by the income generation opportunity presented by their jobs and generally see it as providing a unique increment to their income that they would not otherwise have.

Table 13-6
Do you have previous experience working on plantations?
Survey Type H (Migrants Working on Stora Enso Land)

Plantation Experience	Respondents	Percent
Have plantation experience	28	56.0
Do not have plantation experience	22	44.0

N (H) = 50, response rate (H) = 100%

Table 13-7
Have you acquired new skills through your work for "the company's" project? (State Farm Workers and Migrants Working on Stora Enso Land)
Survey Types C and H

Acquired New Skills?	C: State Farm Workers		H: Migrant Workers	
	Respondents	Percent	Respondents	Percent
Yes	105	73.6	19	38.0
Skills applied elsewhere?	77	74.8	16	84.2
Skills not applied elsewhere?	13	12.6	1	5.3
Do not know	15	14.6	2	10.6
No	37	21.4	31	62.0
Total	140	100.0	50	100.0

N(C)=181, response rate (C)=77%, N(H)=50, response rate (H)=100%

Benefits for Contractors

Those contracted by Stora Enso to develop plantation land conduct this work mostly as self-employed businesspersons, though (for the minority of cases in which a state farm itself is the contractor), less often, some forest farm staff may supervise workers as a part of their formal jobs on the farm. While profits are difficult to calculate, there is a general feeling among those familiar with contractors that they would not become involved in this work and take on the necessary risk of initial outlays were the payback not good. One source indicated a contract rate of 100 yuan per mu (for carrying out all five of the main steps in plantation establishment), with labor costs of 80 yuan per mu, for a contractor carrying out work over an area of 600 mu in project villages. Profits before other expenses are accounted for, then, would be 12,000 yuan. As the five stages of plantation development require about two months time, then, net income for the contractor before non-labor expenses would be about 200 yuan per day. This is about five times the amount plantation workers at the top end of the pay scale are earning (40 yuan per day) and considered a high income in the area. While Stora Enso provides and delivers seedlings, equipment, and fertilizer as close to the site as possible, however, the contractor may face additional expenses (not accounted for in this calculation) in transporting materials up the hills. In addition to income benefits, contractors can gain experience and skills in management and labor coordination. They also gain knowledge of intensive management practices by working with Stora Enso field staff to achieve quality standards.

For the benefits they receive, contractors must face some risks associated with the unpredictability of plantation contracting. First, they face a certain degree of unpredictability in labor costs for certain stages in plantation development. For example, one contractor working in villages contracted an are including several hills, of which more than 200 mu are made up of steep slopes and stony and hard ground that is difficult to work. The contractor pays her workers more for working on this difficult land, but Stora Enso pays her the same rate as for other land. Thus, the contractor has operated at a loss during the site preparation segment of work on the difficult terrain. Second, some contractors face cash flow problems. Some indicate their problem is a result of Stora Enso's policy for paying them. One contractor on a state forest farm explained that Stora Enso pays him 30 percent of the contract value early on, but does not pay the other 70 percent until work has been completed. The contractor thus had to borrow about 150,000 yuan to pay for inputs and workers' wages. He was employing 180 laborers (both migrant and local) and retained an additional ten persons (all relatives and friends) to undertake supervisory work.

13.3 Alternatives to and Opportunity Cost of Work on Stora Enso Plantations

This section explores the alternative uses of worker time spent working on Stora Enso land and covers: (1) the need of workers to do agricultural work on their own land, (2) comparison to other work that the workers or their family members have already done, and (3) comparison to other work the workers believe they might be able to do instead. Results suggest that the working conditions and income afforded by the Stora Enso-related opportunity are similar to those workers have already found and believe they would find elsewhere. For those workers that are locals, Stora Enso work has the advantage (compared to alternatives) of allowing them to stay near home, but, in some cases, may not offer as many months per year of work time as out-migrant work would.

Farming as an Alternative

Survey results suggest that the majority of workers on Stora Enso land find that work to be preferable to agricultural work in their own fields. Most, when asked about a conflict between agricultural needs and their Stora Enso plantation work, said that they would choose to work on the plantation. The exception to this is the survey group of villagers living near state farms and working Stora Enso land on the farms. Seventy-five percent of those in this group responding to the question indicated they would not be willing to work on the plantation were there to be a conflict with their needs to work their land (Table 13-8). Asked how they would deal with conflicts between the two types of work, the most popular response among the three local survey groups was "work harder," while that of the migrant workers was "hire laborers" (Annex VII, Table 46). Thus, it is concluded that, for most groups, benefits from work on Stora Enso land are higher than that from agricultural work, so that workers generally find alternatives to get their agricultural work done.

Table 13-8

If there is an overlap in the timing of plantation work and the need to work your agricultural land, are you willing to work on the company's plantation?

Survey Types A, C, D, and H (Note: C, D, and H have all worked on Stora Enso land in the past; A has rented private land to Stora Enso.)

Willing to work if conflict with your agriculture?	A: project villager		C: state farm worker		D: villager living near state farm		H: migrant worker	
	Number	%	Number	%	Number	%	Number	%
Yes	174	71.3	107	74.8	23	18.5	35	70.0
No	70	28.7	36	25.2	101	81.5	10	20.0
It depends							5	5.0

Note: Only Survey Type H included the "it depends" option. N(A)=244, response rate (A)=100%, N(C) = 181, response rate (C)= 79.0%, N(D) =136, response rate (D) = 91.2%, N(H) = 50, response rate (H) = 100%

Other Work in which Workers Have Been Involved (Current Alternatives)

Survey results suggest that involvement in other work opportunities (other than the Stora Enso project) is common across all groups, to varying levels, and that out-migration to other provinces is also significant for all groups. Fifty-four percent of village households renting their land to Stora Enso reported involvement in other work by one or more family members (Annex VII, Table 4). This proportion was somewhat lower for state farm workers working Stora Enso land (27 percent, Annex VII, Table 10) and for local villagers working Stora Enso land on state farms (39 percent, Annex VII, Table 13). The proportion was highest for migrant laborers working Stora Enso land (66 percent, Chapter 11, Table 11-13). Out-migration to other provinces for (other) work was 21 percent among households surveyed in project villages, 10 percent among state farm households working Stora Enso land, 11 percent among village households working Stora Enso land on state farms, and 26 percent among the households of migrant workers working Stora Enso land. Overall, migrants tended to have found a higher proportion of their "other" work opportunities outside their home counties than within their home counties and farmers living near and working Stora Enso land on forest farms also found

more of their other opportunities outside their home counties than within. In contrast, households in project villages found more opportunities within their own counties than without and state farm workers working Stora Enso land had about the same number of households finding opportunities within and without of their home counties. For each of the three local groups, however, given that migration out of the county (and province) is significant, the Stora Enso work opportunity provides a benefit for those who prefer to stay close to home.

For those that do leave their counties for other (non-Stora Enso-related) work, wages are roughly comparable to what might be earned working on Stora Enso land. In some cases, however, the potential duration of work (i.e. number of months for which a person might be able to do the work) may be longer for these other work opportunities, thus making them attractive to those who would like to work longer and earn more. Among households with members migrating out of their home counties for "other" work, the average number of months of work in 2004 per out-migrant was 9.5 for project area village households (Type A), 8.2 for forest farm staff working on Stora Enso land (Type C), and 7.1 for village households living near a forest farm and having a member working on Stora Enso land on the farm (Type D). While this length of annual employment may be possible for those working Stora Enso land on forest farms that have rented out large areas to the company, it is unlikely that those working Stora Enso land in their home village would garner this length of continuous employment from the opportunity. Average monthly wages for out-migrants in each of the three aforementioned groups were 593 yuan, 710 yuan, and 656 yuan, similar to a typical wage on Stora Enso land of 25 yuan per day, assuming one day per week off (Annex VII, Table 47). For families of migrants working on Stora Enso land, average duration of work for family members migrating out of the home county for other work was similar to that of the aforementioned groups. Average wages for such "other" work was somewhat higher than averages for the two local village household types and similar to the average wages for state farm staff household members working outside of their home county (Table 13-9).

Table 13-9
Other Work (Aside from Work on Stora Enso Land) by Migrant or Migrant's Family Members outside Home County. Survey Type H (Migrants Working on Stora Enso Land)

Number of family members migrating for work outside home counties, 2004	Number	Percent	Total average months of this work per household	Average monthly wage per person in this work
0 family members	17	34	0	0.0
1 family member	16	32	8	658.6
2 family members	15	30	14.3	856.7
3 or more family members	2	4	40.5	725.0

N(H) = 50, response rate (H)=100%

Perceptions of other Opportunities Workers Might Pursue

In order to compare the alternatives and assess the opportunity cost of work on Stora Enso land, the survey asked workers what they would be doing with their time if they did not work Stora Enso land (Table 13-10). Responses were mixed across the choices of working on their own agricultural land, working nearby, and out-migrating for work. Within groups, however, some trends can be seen. The top-ranked and most popular response (by a significant margin) among state farm workers working on Stora Enso land was "agricultural work on my own land." Respondent numbers for local villagers working on Stora Enso land was similar for "agricultural work on my own land," "work at more pay near my home," (top ranked choice) and "work at more pay away from home." The migrant workers, as a group, saw working in their own fields as a less important alternative, with the most respondents expecting they would out-migrate elsewhere for similar wages and with the second most respondents expecting they would work near home for similar wages. The migrants, as might be expected, are the group most willing to work away from home, with wage level likely being their primary concern. In contrast to the migrant workers, female nursery workers interviewed during fieldwork indicated that they would not have other work options should they not work at the nursery. Many have children; and leaving home for work is not an option.

Table 13-10

**If you did not work on the land rented by "the company," what would you do with the time you now spend doing that work? (Check all that apply and rank, with the most important as "1".)
Survey Types C, D, and H (Note: All respondents have worked on Stora Enso land.)**

Alternative	C: Forest Farm Staff			D: Villager Near Forest Farm			H: Migrant Worker		
	Count	%	Average rank	Count	%	Average rank	Count	%	Average rank
Agricultural work on own land	131	72	1	111	83	2	11	22	3
Work at same pay near home	75	41	4	89	65	6	28	56	5
Work at less pay near home	49	27	6	77	57	5	2	4	7
Work at more pay near home	85	47	3	106	78	1	11	22	1
Work at same pay as migrant	52	29	7	80	59	4	33	66	4
Work at less pay as migrant	41	23	8	78	57	7	8	16	6
Work at more pay as migrant	97	54	2	109	80	3	22	44	2
Nothing to do	68	38	5	79	58	8	0	0	---
Other							5	10	---

N(C)=181, response rate(C)= 100%; N(D)=136, response rate (D)=100%; N(H)=50, response rate (H)=100%

Table 13-11 below summarizes worker respondents' opinions about how alternative work would compare to their work on Stora Enso land. The comparison was made across four categories: (1) safety, (2) work intensity, (3) treatment by boss, and (4) skill acquisition. Impressively, in each category, a majority of respondents in each of the three groups indicated that the alternative work would be the same as their current work. Roughly speaking, then, these results indicate that respondents are not dissatisfied with their working conditions as compared to the alternatives, but nor do they believe their working conditions are particularly good compared to other options. Looking across groups, the state farm workers had, in each category, the weakest majority indicating "sameness" of conditions of alternative work with their present situation. This may indicate they are the least satisfied with the work and are the group that has the largest proportion believing better alternatives exist. In particular, the group had almost as many respondents indicating alternative work would better help them build skills as indicated skill acquisition would be the same. The last chapter discussed how state farm workers appeared to be the least satisfied group in terms of land rental. While no obvious solution exists, these results suggest careful consideration of whether there is a way to bring a higher level of satisfaction to these stakeholders, perhaps through a slightly higher level or more technical type of work. Finally, migrants as a group appear, in this table, to be the group believing most (having the top respondents for "sameness" in three out of four categories) that their current work on Stora Enso land has the same working conditions as any alternative work they would find.

Table 13-11

If you and your family members did not work on the forestland, what would your alternative work be like in comparison (choose one in each group)?

Survey Types C, D, and H

Comparison Category/ Response	C: State Farm Workers Working on Stora Enso Land		D: Local Villagers Working on Stora Enso State Farm Land		H: Migrant Workers Working on Stora Enso Land in Villages or on State Farms	
	No. of Workers	Percent	No. of Workers	Percent	No. of workers	Percent
1. Comparison of safety						
Safer	40	22.1	18	13.2	7	14.0

More dangerous	20	11.1	8	5.9	1	2.0
The same	121	66.9	110	80.9	42	84.0
2. Comparison of work intensity						
Harder labor	34	18.8	17	12.5	2	4.0
Lighter labor	34	18.8	11	8.1	10	20.0
The same	113	62.4	108	79.4	38	76.0
3. Comparison of treatment						
Better treatment by boss	54	29.8	24	17.7	3	6.0
Worse treatment by boss	26	14.4	15	11.3	1	2.0
Almost the same	101	55.8	97	71.3	46	92.0
4. Comparison of skill development opportunity						
Increases skills more	81	44.8	37	27.2	2	4.0
Increases skills less	13	7.2	5	3.7	1	2.0
No significant difference	87	48.1	94	69.1	47	94.0

N(C)=181, response rate (C)=100%, N(D)=136, response rate (D)=100%; N(H)=50, response rate (H)=100%

13.4 Key Employment Issues: Contracts, Minimum Wage, Labor Disputes, and Health and Safety

In order to remain cognizant of the status of labor issues on its plantations and ensure that activities meet criteria of social responsibility, we recommend that Stora Enso institute a labor standards and periodic contractor monitoring system. Training for contractors on Stora Enso standards might also be a part of this system. The system should cover the key areas examined below, namely, the use of contracts when legally required, the meeting of minimum wage requirements, and compliance with health and safety standards as outlined by Stora Enso. While no use of child labor among contractors was discovered, the importance of not using child labor should be emphasized in contractor guidelines. Special considerations for migrant labor, such as improved housing and drinking water access, might also be included. Finally, in order to monitor for the presence of unresolved labor disputes, site visits to audit contractors should also include a mechanism for gathering feedback from plantations workers.

Contracts

Fieldwork suggests that Stora Enso contractors rarely have formal written contracts with the workers that they employ and have verbal agreements instead. Survey responses (obtained for both state farm workers and migrants working on Stora Enso land) indicate that only a minority of workers have contracts (Annex VII, Table 48). Fieldwork suggests that migrants working on Stora Enso land often work under a relative or other person from their hometown. The individual may pay the migrant's wages, but does not have a formal contract with them. He may, however, have a "sub-contract" with the contractor.

According to officials at the Guangxi Labor Bureau, verbal agreements are permissible if either: (1) work is less than 30 hours per week or (2) the duration of the work engagement is less than three months. If work is both for over three months and for 30 or more hours per week, then, contractors should be providing workers with contracts. It is recommended that Stora Enso provide simple written guidelines to all of its contractors for the labor, health, and safety practices to which it would like them to adhere. Compliance with these guidelines might even be included as a clause in Stora Enso's contract with the contractors. Among these guidelines should be the relevant government regulations on when a contract is required. If contractors do at times employ workers full-time for periods of over three months, it is recommended that Stora Enso also provide contractors with a simple sample contract, since many of them will not have experience preparing such contracts for their workers. In this regard, Stora Enso may wish to liaise with the Guangxi Labor Bureau for standard, sample contracts used in the province.

Minimum Wage

The Guangxi Labor Bureau requires that the pay of people working within the province meet minimum wage requirements. These requirements include both monthly and hourly standards and are divided into four different levels based on geographic location. The Bureau told the team that the lowest of the four levels applies to Hepu County; and we here assume that it also applies to the other rural areas in which the project is located. The level four standard of minimum wage was, in 2004, 320 yuan per month and 2.4 yuan per hour. Based on wage rates quoted in fieldwork, it is believed that this wage level is in most cases being met by Stora Enso contractors. At the low end of the pay scale, however, exceptions may be occurring. For example, one farmer working for a Stora Enso contractor in his home village reported being paid 16 or 17 yuan per day for seven to ten hour workdays, suggesting an hourly wage of less than the minimum 2.4 yuan per hour. It is recommended that in providing labor, health, and safety guidelines to its contractors, Stora Enso include the relevant minimum wage regulations and rates (by region) and request that contractors comply.

Treatment of Labor and Labor Disputes

In fieldwork, the team often found a congenial relationship between contractors and their workers. One contractor, for example, indicated going to the work site almost daily to check on migrant workers and deliver food supplies she had purchased for them. The contractor indicated that she felt she had a social obligation to her workers and would pay for medicine (generally, ten-plus yuan) if they got sick.

In general, fieldwork indicates that labor disputes have not become an important issue for workers involved in Stora Enso plantation development. Stora Enso, however, should be aware that such disputes do occur in the plantation contracting business (see Box 13-1 for example). As such, Stora Enso may wish to adopt measures to lessen or prevent such disputes. One such measure would be to encourage written contracts between contractors and their workers (or at least between contractors and each group of migrants that come together from one hometown). In addition, Stora Enso may wish to enhance its grievance hotline (such a hotline has been established for rental issues) or establish a separate hotline for those working for Stora Enso contractors. Getting information about such a hotline to workers will be more difficult than promoting it to those renting out land. If (as recommended above), Stora Enso establishes a monitoring system with regular visits to worker sites, such visits could also be used to distribute information on the hotline.

Box 13-1

Example of Labor Dispute in the Local Plantation Industry

A group of Miao migrants from Yunnan now working on Stora Enso land told the team that they were once cheated in previous plantation work on a forest farm in the region. According to the migrants, "The main problem was that we believed him [the contractor] too much. We didn't sign a contract." The group had only a verbal agreement for work on several hundred mu of land. The contractor failed to pay them 6,000 yuan of the total owed, suggesting that this count towards an "introduction fee" of subsequent work he found for the migrants. The migrants did not pursue the matter further, because the dispute was with local people and, they believe, as migrants they were at a disadvantage.

Table 13-12 shows survey responses regarding channels workers would use to resolve labor disputes. Perhaps reflecting positive relationships with contractors, but also possibly because of lack of integration into the local community, the majority of migrants surveyed (66 percent) indicated labor disputes were not a problem. "Letting the company know," however, was the second most popular response (20 percent) of migrants to this question, suggesting that a labor hotline may indeed be an appropriate measure. Clearly reflecting greater integration into their community, the top response among surveyed state farm workers to this question was "let the state farm know" (64 percent).

Table 13-12

In the case of disputes over labor issues, what channel do you/will you use to resolve them (check all that apply)?

Survey Types A, C, and H

Channel for Resolving Labor Disputes	A: Villagers Renting Private Land to Stora Enso		C: State Farm Workers Working on Stora Enso Land		H: Migrant Workers Working on Stora Enso Land in Villages or on State Farms	
	Number	Percent	Number	Percent	Number	Percent
Let the company know	9	32.1	35	19.3	10	20.0
Let the forest farm know			115	63.5		
Let the local government know	5	17.9	15	8.3	4	8.0
Let the village committee know	7	25.0	0	0.0	0	0.0
Use legal means to resolve	4	14.3	48	26.5	0	0.0
Obstruct the project/cause problems	0	0.0	5	2.8	2	4.0
Other	0	0.0	8	4.4	6	12.0
No labor disputes occurred	3	10.7	39	21.5	33	66.0

N(A)=244, response rate (A)= 11.47% N(C) = 181, response rate (C)=100%; N(H) = 50, response rate (H)=100%; Note: only state farm workers were given the option of "let the forest farm know."

Health and Safety Issues

Fieldwork suggests that serious on-the-job health and safety problems are uncommon among those working on Stora Enso's Guangxi plantations. One village interviewee mentioned that rocks on the land he was helping to prepare were slippery, causing him to fall a couple of times, but he was not injured. Another village interviewee (who does not wear shoes) mentioned that he had stubbed his toes on rocks a couple of times. Stora Enso Guangxi reports that one fatal accident to date has occurred among plantation workers. When driving his motorcycle to buy food and cook for the others, a worker hit a tree on the road and died.

Despite the rarity of on-the-job health and safety problems, it is recommended that Stora Enso Guangxi provide written health and safety guidelines for contractors and institute a monitoring system, whereby Stora Enso staff visit work sites periodically to ensure that guidelines are being followed. As an example, sunstroke is one on-the-job health concern; and Stora Enso might require that contractors take adequate precautions, ensuring water if available and workers have appropriate headgear. Another important issue identified in the field is workers' lack of access to emergency services for cases such as urgent illness, injury, or exposure to natural disasters (like floods or landslide). (In the cases of migrants living on site, this issue applies to both their on-the-job and lodging environments.) To address this issue, Stora Enso may wish to ensure that all work teams have access, whenever possible, to mobile telecommunications (a cell phone) and to a vehicle as close to the site as possible. Also of importance, malaria and dengue have a presence in Guangxi and may pose health risks to plantation workers, particularly migrants or others sleeping in tents near work sites. To reduce the risk, Stora Enso may wish to encourage contractors to provide mosquito nets to workers staying in temporary shelters and include a check for such nets in the recommended contractor monitoring program. Finally, other work in China has found migrants to be particularly vulnerable to STDs and HIV. While this study did not identify problems in these areas, local governments should be aware of potential vulnerability and consider including migrants in any relevant public health awareness programs.

Stora Enso Guangxi is already taking important steps to improve health and safety standards; and the company is encouraged to maintain its commendable efforts in this direction. Since August 2004, the company has required all units to report all fatal and serious accidents (involving both Stora Enso's own employees and those of its contractors). In 2006, Stora Enso Guangxi will implement Occupational Health and Safety Management System 18001 (OHSAS 18001).

The survey team identified additional health and safety issues specific to migrants living on or near work sites. Lacking permanent local accommodation, most migrants (70 percent of those surveyed) live in simple work sheds or tents (provided by the contractor) near the work site (Table 13-13). Others live in abandoned houses that are in very poor condition. These shelters cannot provide them with adequate protection in the case of natural disasters; and exposure to mosquitoes is also a problem. Few have any access to electricity or modern forms of communication; and they are relatively isolated. In addition, sanitary conditions are not good. Mountain streams and springs are the predominant source of water (96 percent) for the migrants surveyed, though the quality of water in the streams has not been tested or monitored. A few migrant workers try to improve water quality by filtering the water with homemade filters.

In light of the poor housing conditions of migrant workers and given that migrants appear to make up over half of all plantation workers on Stora Enso land, the company may wish to consider taking actions to improve migrant accommodations. Conditions, however, are standard for the industry in Guangxi and therefore any action taken by Stora Enso could be considered as "raising the bar" and setting a laudable example. When possible, fixed living quarters could be constructed near to plantation work sites. These structures could be re-used at subsequent steps in the plantation cycle (e.g. fertilizer application, monitoring, and harvesting) and could also be used for forest protection workers. Stora Enso may also wish to address migrant drinking water issues by facilitating, when practical, alternatives such as wells near their living quarters.

Table 13-13
Housing of Migrant Workers Working on Stora Enso Land
Survey Group H

Shelter	Count	Percent	Per capita area (m ²)
House With Earth Wall And Tile Roof	14	28	3.7
House With Earth Wall And Straw Roof	1	2	5
Simple And Temporary Shelter	35	70	4.6

N(H) = 50, response rate (H)=100%

Table 13-14
Sources of Drinking Water for Migrant Workers Working on Stora Enso Land
Survey Group H

Sources Of Drinking Water	Number	Per cent
Public Drinking Water System	0	0.0
Private Well	2	4.0
Public Well With Pump	0	0.0
Simple Tap Water	0	0.0
Piped Tap Water	0	0.0
Other (specify with open response)	48	96.0
Mountain Spring (listed in open response)	36	72.0
Mountain Stream (listed in open response)	7	14.0
Stream With Simple Filter (listed in open response)	5	10.0

N(H) = 50, response rate (H)=100%

Migrants had mixed responses on pursuing healthcare locally, though it is clear this can become an important issue for some. While most migrant workers are relatively young and in good health, a major illness or injury can be a major blow, as they lack medical insurance. One migrant worker told the team about an operation she had in a local hospital that cost her 4,000 yuan, more than she had earned since arriving. Asked what they would do in the case of illness, while 58 percent of migrant respondents said they would go to a township or county-level hospital, another 30 percent said they

would take not action (Annex VII, Table 49). Asked to evaluate the level of health services in the area in which they were working, most migrants (60 percent) indicated unfamiliarity with the topic, having never seen a doctor since arriving for work on the plantations. Those who had visited a local hospital had mixed opinions on the medical service conditions. Some (22 percent) complained that seeing a doctor is either too costly or too far away from where they live, but others (18 percent) had positive opinions of local medical services (Annex VII, Table 50).

13.5 Migrant Labor Issues

Accounting for over half of the plantation workforce on Stora Enso land in Guangxi, migrants play a particularly important role in the project; and, thus, we devote this section to issues specific to migrant labor. The preceding discussion of health and safety has already covered some of the key issues pertaining to migrants, such as poor housing and sanitation and access to medical care. In this section we discuss additional issues specific to migrant laborers, including accompanying family members and visits home, relationships with local people, and problems encountered, as migrants, in their new locale. The section closes with a brief summary of migrant feedback for Stora Enso.

Accompanying Family Members and Visits Home

Survey results indicate that about one-third of migrant workers come to Stora Enso plantation sites with at least one of their family members (usually a spouse) (Table 13-15). As mentioned, fieldwork indicates that migrants do, however, come in groups with others from their home villages. Thus, in some sense, they do bring a support network with them whether or not they bring a family member. Also, migrants tend to go home periodically to visit their families, take care of their land, and spend the Chinese New Year holiday. Most migrants (74 percent) indicated that they visit home once every six to ten months. Many have left their small plots of individually contracted land to be looked after by their parents; and some have left their children to be looked after by their parents as well.

Table 13-15
Accompanying Family Members of
Migrant Working on Stora Enso Land
Survey Type H

Response	Count	Per cent
Migrant works with family member	16	32.0
Migrant does not work with family member	34	68.0

Note: N(H)=50, response rate (H)=100%

Table 13-16
Frequency of Migrant Home Visits
(Migrants Working on Stora Enso Land)
Survey Type H (units: months between visits home)

Time Interval	Count	Percent	Average Time Interval (months)
Less Than 6 Months	6	12.0	2.9
6-10 Months	37	74.0	6.2
More Than 10 Months	7	14.0	11.1
All Time Interval	50	100.0	6.53

N(H) = 50, response rate (H)=100%

Relationships with Locals and Problems Encountered

Both field interviews and the survey indicate that migrants have encountered some special problems with locals and that some migrants are not happy with their relationships with locals. Generally, issues related to these results are wider problems best dealt with by local governments. Stora Enso, however, can encourage its staff and contractors to treat migrants well through a corporate culture that encourages non-discrimination and egalitarianism.

Migrants appear quite aware that they are migrants and therefore at a disadvantage in disputes with locals. In an example mentioned earlier, migrants that were not paid by a contractor did not pursue the issue, because the contractor was a local and they are migrants. Forty-four percent of migrant worker respondents indicated that they are not satisfied with their relationships with locals. In open responses regarding their dissatisfaction, reasons mentioned include: "locals steal seedlings and belongings and damage shelter," "Stora Enso technicians have a bad attitude," and "local officials ignore public security concerns" (Table 13-17). Asked about their specific problems as migrants, public security problems (38 percent), no problems (36 percent), and bad living conditions (32 percent) were the main responses (Table 13-18). Fieldwork revealed some cases of migrants being either harassed or robbed by locals (see Box 13-2), suggesting that public security is indeed a concern. Some migrants told the team that, due to such concerns, they are afraid to keep money on hand.

Table 13-17
Are you satisfied with your relationship with local officials, staff of "the company," and local farmers? (Migrants Working on Stora Enso Land)
Survey Type H

Response	Count	Per cent
Satisfied with local relationships	28	56.0
Not satisfied with local relationships (open response of why not satisfied)	22	44.0
Locals steal seedlings and belongings and damage shelters (from open response)	17	34.0
Stora Enso technicians have a bad attitude (from open response)	5	10.0
Local officials ignore public security problems (from open response)	2	4.0

N(H)=50, response rate (H)=100%

Table 13-18
As a migrant worker, what are the main problems you have encountered in this locality (check all that apply)?
(Migrants working on Stora Enso land)
Survey Type H

Problems	Count	Per cent
Did not receive wages	0	0.0
Other problems (aside from wages) with managers	0	0.0
No health insurance	6	12.0
Disease/health problems related to plantation work	3	6.0
Difficulty in communication (language)	2	4.0
Difficulty of schooling for children	0	0.0
Public Security	19	38.0
Other (open-ended response invited)	34	68.0
Not any problem (from open-ended response)	18	36.0
Bad living conditions and drinking water (from open-ended response)	16	32.0

N(H)=50; response rate(H)=100%

Box 13-2

Problems Some Migrant Plantation Workers Have Encountered with Locals

Speaking with some Miao ethnicity migrants now working on Stora Enso land, the team learned that these migrants had more than once encountered problems with locals. When working at a previous location on a forest farm, local people, in conflict with the forest farm, used a knife to enter the migrants' tent and scare them. At another time, the migrants were robbed: "They came to our tent and took things. Their goal was to get us to give them money. We were afraid that something bad would happen, so gave them several hundred yuan." On another occasion and at another site, "two local collectives came to say the land belonged to them. The local people didn't dare go directly to the company, so came to us to let out their anger. They burned our tent – all our belongings inside were burned. Our team leader reported it to the police. The local police came and rounded up over ten people. The thing we are most afraid of is conflict."

Migrant Labor Feedback

While most (68 percent) of the migrant laborers surveyed did not have specific suggestions or requests for Stora Enso, the suggestions made in an open ended "suggestions" question of the survey provide additional insight on the situation of migrants working on Stora Enso land (Annex VII, Table 51). Most suggestions were related to work on the plantation sites. Five (out of 50) respondents suggested that Stora Enso provide higher quality seedlings so that re-planting could be avoided. The same number also suggested that the workload for migrant labor be reduced, with some respondents indicating they believe that the workload for migrant workers is higher than that of others planting trees. "Make payments on time" was a suggestion made by four respondents, suggesting that late payment of salaries may in some cases be an issue.

13.6 Employment Generation of the Stora Enso Plantation Project (Current and Future)

Table 13-19 below gives three estimates for employment generation: (1) current plantation jobs (at 20,000 ha), (2) plantation jobs at full scale and steady state (at Stora Enso's targeted area of 120,000 ha), and (3) direct and indirect jobs, including those on plantations, in trucking, at the mill, and in supporting service industries (once pulp mill is operating at full capacity). A figure of 4,400 current jobs is based on Stora Enso estimates of migrants, local farmers, and state farm workers working on Stora Enso land. This data, however, does not include information on whether these jobs are full-time. Full-scale plantation employment generation once operations have reached steady state is estimated to be between 12,400 and 14,400 full-time jobs. The methodology for this estimate includes approximating per hectare employment for all steps in the plantation process over 14 years (two seven-year eucalypt cycles) and averaging results on an annual basis. (See Annex VIII for details on number of full-time work days assumed for each step in the plantation process.) Finally, a rough industry standard of 30,000 to 35,000 full-time jobs is given for all direct and indirect jobs, both related to plantations and the pulp mill itself.

Table 13-19
Employment Generation from Stora Enso Plantation Project

Timing	Jobs	Method/Notes
Current, 2004 (20,000 ha)	4,400 direct jobs (plantations only)	Based on Stora Enso estimates of number of persons working for contractors at present. Does not include information on whether jobs are full-time
Full-scale, 2010 steady state (120,000 ha)	12,400 to 14,400 full-time direct jobs (plantations only)	Based on spread sheet estimates of steps in plantation process over two cycles (14 years): includes site clearing, site preparation, base fertilizer, planting, watering, weeding and coppice removal, follow-up

		fertilizer, guarding, and harvesting
Full-scale steady state (120,000 ha) and pulp mill at full scale	30,000 to 35,000 full-time direct and indirect jobs (plantations, transport, pulp mill, and supporting services)	Based on industry standards for mill of size Stora Enso is planning. Indirect jobs include those in service industries, such as clinics and restaurants, that are generated to support those engaged in work more directly related to the project (plantation workers, truckers, etc.)

Key Points from Chapter on Labor and Employment:

- Employment benefits other than wages are uncommon.
- In 2005, work opportunities on large pieces of Stora Enso land on some state farms will be substantial, so that six months or more of work per year for a worker and large annual net per capita income increments (i.e. 25-50 percent) will be possible.
- Workers on Stora Enso land find the work preferable to agricultural work, but suggest working conditions and income are similar to those they have had in the past and/or believe they could find elsewhere. (Workers at the Stora Enso nursery, in contrast, find their jobs unique and highly desirable.) For those workers that are locals, Stora Enso work has the advantage (compared to alternatives) of allowing them to stay near home, but may not offer as many months per year of work as out-migrant work. Involvement in other work opportunities (aside from the project) is common across all groups and out-migration to other provinces is also significant for all groups.
- The Guangxi Labor Bureau has minimum wage requirements and requires written contracts if work is both for over three months and for 30 or more hours per week. Stora Enso contractors generally meet wage requirements, though there may be exceptions. They rarely have formal written contracts with workers. Stora Enso should provide simple written labor guidelines to all of its contractors, including government regulations on employment contracts and minimum wage. Stora Enso might also provide contractors with a simple sample contract from the Labor Bureau.
- Serious on-the-job health and safety problems are uncommon among those working on Stora Enso's Guangxi plantations. The company, however, should provide written health and safety guidelines (e.g. availability of water and headgear to prevent sunstroke, provision of mosquito nets for workers living in tents, access to mobile telecommunications and vehicle for emergencies, etc.) for contractors and institute a monitoring system, whereby Stora Enso staff visit work sites periodically.
- Stora Enso Guangxi is already taking important steps to improve health and safety standards, requiring all units (including contractors) to report serious accidents. In 2006, SEG will implement Occupational Health and Safety Management System 18001.
- Most migrants live in simple work sheds or tents near the work site. While such living conditions are typical of the industry in the area, Stora Enso may wish to "raise the bar" by constructing fixed living quarters near to plantation work sites when possible.
- Migrants workers may encounter some special problems with locals, a result of wider issues best dealt with by local governments. Stora Enso, however, should encourage its staff and contractors to treat migrants well.
- Labor disputes have not become an important issue for workers involved in Stora Enso plantation development, but the company may wish to encourage written contracts between contractors and their workers and expand its grievance hotline to accommodate workers. Workers could be informed of the hotline during monitoring visits.
- Current employment on plantations is about 4,400 persons. Estimated employment on plantations at full scale is 12,400 to 14,400 full-time jobs. Using rough industry standard, total direct and indirect employment of mill, plantations, and supporting industries at full scale will be 30,000 to 35,000.

Chapter 14. Special Populations and Other Special Topics

This first part of this chapter is devoted to special populations. It covers the status and impacts of the project, in turn, on women, minorities, and the poor. The chapter then covers four special topics to complete our analysis of social impacts. The first three are (1) information flows about the project and the company to affected groups, (2) special risks of the project (with a focus on risks for affected groups), and (3) the flows of fiscal revenues to government departments and forest farms as generated by taxes and fees on the project. The chapter closes with (4) an examination of development status and needs in project areas, along with ideas of how Stora Enso might play a role in meeting the latter.

14.1 Women

Fieldwork results and discussions with government agencies suggest that, overall, women in project areas and in Guangxi more generally enjoy a relatively strong position in the home as compared to some other parts of China. According to popular thinking conveyed to the team, rural women in Guangxi are capable workers and therefore enjoy decent status in their homes. Village committees in Guangxi commonly have one or two female members; and many village secretaries or vice-secretaries in the province are women.²⁷ Also, significant numbers of women from Guangxi out-migrate to Guangdong for work and raise their status in the home by bringing in substantial income. Yet, survey results, as discussed below, indicate that, while women play a role in decision-making, they are still far from having equal voices in important household matters.

Stora Enso's project brings many of the same benefits to women as it does to men. A woman's household may be able to increase its income through rental; and women, like men, may take advantage of work opportunities in plantation development. Generally, the team found that fewer women than men took part in plantation work, though the number of women was not insubstantial. Also, almost all of the employees (about 80 persons) at Stora Enso's nursery on Shankou Forest Farm are women. In addition, the team identified one woman contractor, though all identified middle persons involved in land rental were men. Because much plantation work is paid on a task-accomplished basis, some men may be able to earn more than women (e.g. by digging holes faster) per day. The team, however, found the rate per task paid to men and women to be the same.

Women may appreciate the benefits of labor opportunities from the project for some reasons that are different than those of men. Some women, especially those with children, do not want to out-migrate for work and appreciate flexible opportunities to work near their homes. In some cases, women's roles in decision-making may be strengthened through increased income. Women in the field told the team that they use their income in areas that are especially important to them, such as paying school fees for children or saving for a new home. Negative impacts of the project on women seem to be similar to those that other employment opportunities would bring. Women that were not working before experience lengthened days and higher work burdens, as they must now carry out their new work and then return home to perform the usual household chores and, often, farm labor. In the long term, there may be negative impacts on the health and well being of these women.

The survey questionnaires contained questions on respondents' opinions of women's status, opportunities, and decision-making roles. Before presenting results, the report provides some relevant background on respondents. First, the majority of respondents were men, so it is likely there is some bias in responses. The proportion of women respondents varied from 6.2 percent in Group A (village households renting private land to Stora Enso) to 35.3 percent in Group F (households of state farm workers in non-project areas). Second, educational levels of respondents of different gender may not be that different. A preliminary analysis of the average number of years of education of men and women respondents for both A and B groups (the latter being village households in non-project areas)

²⁷ Meeting of social team with Guangxi Women's Federation, Nanning, May, 2005.

combined shows that women had a slightly higher average number of years of schooling (7.7 years) than men (7.2), but there is no significant statistical difference between the two.



Picture 7. Local Women Employed at Stora Enso Nursery

A survey question on decision-making for land rental shows that women still do not always play an equal role in important household decisions. Forty-six percent of households renting private land in project villages indicated that the male head of the household made the decision to rent land to the company (Table 14-1). Joint decision-making by spouses or the whole household, however, together make up a very significant proportion of responses (52.5 percent). Women may also play a role in collective decision-making at the village level. The team learned that in one village, about 30 percent of the household representatives at the meeting deciding whether to rent collective land to Stora Enso were women. The explanation offered, however, was that the women attended because the male household heads had other business.

Table 14-1
Who in your family decided whether to rent the household's land?
(Households renting private land to Stora Enso)
Survey Type A, units of percent (%)

Decision maker	Percent of respondents
Male head of household	45.9
Female head of household	1.6
Male and female head of household together	29.5
All household members together	23.0
Other	0.0

N(A)=244, response rate (A)=100%

In order to provide insights on whether the Stora Enso project provides work opportunities for women, the survey asked: (1) whether women are willing to work on "the company's" plantation project, (2) whether the project actually presents employment opportunities for women, and (3) whether employment opportunities presented are more than those for men. Box 13-1 below first presents a brief review of the many survey groups covered. Sixty percent or more of respondents in all groups except A (in which the level was 48 percent) believe that women would be willing to work on the plantation project, suggesting that indeed there is an interest in such employment opportunities among

women (Table 14-2). Belief that the project would generate employment opportunities for women was even higher (over 75 percent for groups A and B) (Table 14-3). A strong majority in all groups except F (non-project area state farm staff households), however, do not think that women's employment opportunities with the project will be higher than men's (Table 14-4).

Box 14-1

Brief Review of Survey Types Presented in Tables

Survey type A is village household renting land to Stora Enso, C is state farm household with interviewee working on Stora Enso land on state farm, E is state farm household in project area with no member working on Stora Enso land, D is villager living near state farm and working on Stora Enso land on the farm. *Non-project area groups (B, F, and G) are to right of their corresponding project area group and are italicized.*

Table 14-2
Are women willing to work on "the company's" plantation project?
units: percent (%)

Response	A	B	C	E	F	D	G
Yes	48.4	63.8	66.9	63.4	82.4	74.3	71.9
No	13.9	20.9	18.2	13.3	8.8	12.5	3.1
Don't know	37.7	15.3	14.9	23.1	8.8	13.2	25.0

N(A)=244, N(B)=196, N(C)=181, N(E)=143, N(F)=68, N(D)=136, N(G)=32; Response rates for all groups were 100 percent.

Table 14-3
Do you think that women have (would have) employment opportunities with the eucalypt project?
(Types A and B)

Response	A		B	
	Respondents	%	Respondents	%
Yes	185	75.8	170	86.7
No	57	23.4	26	13.3
Don't know	2	0.8	0	0

N(A)=244, response rate (A) = 100%, N(B)=196, response rate (B) = 100%

Table 14-4
Are (would) women's work opportunities for the eucalypt project (be) higher than those of men?
units: percent (%)

Response	A	B	C	E	F	D	G
Yes	24.6	39.8	11.6	11.9	26.5	16.2	18.8
No	73.4	59.7	86.7	88.1	47.1	83.8	31.2
Don't know	2.1	0.5	1.6	0	26.5	0	50.0

N(A)=244, N(B)=196, N(C)=181, N(E)=143, N(F)=68, N(D)=136, N(G)=32; Response rates for all groups were 100 percent.

In order to assess impacts on women's burdens, the survey asked households whether the eucalypt plantation project had (or would have) an impact on women's workloads. In order to gain some insight on women's workloads outside of work for the project, the survey also asked for average hours women spend in agricultural work and housework. Results show that in all groups, less than half of respondents expect an increase in women's workload as a result of the project (Table 14-5). Perhaps these results indicate that many respondents do not think women would become involved in the project. Figures on women's workload in agriculture and housework are relatively consistent across groups, ranging from 7.2 to 8.1 hours per day spent by females on agriculture and other physical work

and from 2.4 to 3.3 hours per day spent by the female household head on housework (Table 14-6). These results suggest that women in both project and non-project areas put in a substantial amount of work for the household daily. Involvement in outside work would require that someone else assist in this work or that women increase their overall workload. Indeed, interviews of women working at the nursery revealed that many of these women, while very glad to have their jobs, have increased their workload substantially. Box 14-2 provides snapshots of the schedules of two such women, as well as the benefits one derives from her work.

Table 14-5
Has (or would) the eucalypt project reduce(d) or increase(d) the workload of women?
units: percent (%)

Response	A	B	C	E	F	D	G
Decreases	0.0	6.1	1.7	1.4	1.5	0.7	0
Increases	28.7	36.2	19.9	25.17	48.5	29.4	28.1
no effect	49.6	43.9	50.3	51.1	39.7	43.4	25.0
don't know	21.7	13.8	28.2	22.4	10.3	26.5	46.9

N(A)=244, N(B)=196, N(C)=181, N(E)=143, N(F)=68, N(D)=136, N(G)=32; Response rates for all groups were 100 percent.

Table 14-6
Women's Average Daily Work Hours (in hours per day)

Response	A	B	C	E	F	D	G
Average hours women spend per day on agriculture	7.5	7.3	7.5	7.2	8.1	7.5	7.8
Average hours female household head spends on housework	3.3	2.8	2.7	2.4	3.1	2.4	3.2

N(A)=244, N(B)=196, N(C)=181, N(E)=143, N(F)=68, N(D)=136, N(G)=32; Response rates for all groups were 100 percent.

Box 14-2

Daily Schedules of Female Nursery Workers and Benefits from Work

1. Ms. A (state farm employee): Everyday Ms. A rises at 4 am to make breakfast and lunch. She works at the nursery from 7 am to 12 pm, when she returns home to eat lunch and buy food supplies for the household. She does not take a nap at lunchtime. She returns to the nursery to start work again at 2 pm and does three more hours work. At 5 pm she returns home to take care of the housework and also undertake any work that is needed in the 10 mu orchard that she and her husband have been allocated by the state farm. She goes to bed at about 10 pm.

2. Ms. B (villager): Ms. B lives in a three-room home built of earth, 3 km from the nursery and lives with her parents-in-law. She rises at 4 am and does the housework and feeds the pigs. She works at the nursery from 7 am to 12 pm. Between 12 pm and 2 pm she returns home to cook and take care of her three children. She returns to the nursery at 2 pm for her afternoon shift. She puts part of her wages into a bank account so that the family can build a brick house in the future. The rest of her salary is used for household expenses, the most important part of which are school fees for her two elder children. Earning a salary has enabled her to take part in the decision-making process for her son's schooling and the family's house building plans.

The village small group survey included open-ended questions about whether women, compared with men, are discriminated against in the following areas: educational and employment opportunities, decision-making, political and economic affairs, workload, wages, and division of labor. Responses show that some project area villagers still feel men have the edge over women. One respondent, for example, commented: "Household income comes mainly from the man; and the man has the higher status within the family. Women and men will discuss things before making a decision, but men's opinion is still key." Other respondents, however, firmly asserted that there is no major difference other than, perhaps, "Men might attend more meetings" or "Men have the edge over women in politics,

but women's say is significant with regard to economics." There was a similar division of opinion amongst attendees of village small group surveys in non-project areas. A representative comment of those feeling that men enjoy better status is "Women do the housework, men work outside [the home]; men earn more and enjoy having the say." A comment of one believing that women and men are of equal status is, "Men and women are the same in terms of schooling; whoever is free will attend meetings; women work outside [the home] more than men and both take care of the family's income." The same question when asked in small group interviews with forest farm workers produced a similar variety of responses.

It is believed that gender is an important issue for Stora Enso to be aware of as it implements its project in Guangxi. Experts have suggested that the progress towards gender equity seen during China's socialist era has stalled somewhat since the institution of economic reforms and that women's status has even declined. One of the main ways in which women face discrimination in China is in employment opportunities. The proportion of women in paid employment has dropped considerably over the past several years. Women's wage level in China is some 70 percent of men's; and the gap between the two genders' average wages is growing.²⁸ It is recommended that Stora Enso emphasize wage equity for its own employees and encourage its contractors to do the same.

14.2 Ethnic Minorities

Fieldwork findings suggest that, to date, the proportion of minorities involved in village land rental to Stora Enso is small, particularly when compared to their role in the population of Guangxi overall (38.4 percent). For example, out of 244 respondents in the survey of households renting private land to Stora Enso, only one was an ethnic minority. Yet, the counties and districts in which Stora Enso currently leases village land or in which it may lease village land in the future have a total minority population of about one million, or about nine percent of the total population of these areas (Table 14-7). The main minorities in current and future Stora Enso village project areas are Zhuang, Yao, and Jing.

Table 14-7
Counties/Districts in which Stora Enso Currently Rents Village Land or Plans to Rent Village Land in the Future that Have Significant Minority Populations

County or District	Main Ethnic Minorities	Minority Population	Total Population
Current village project areas			
Fusui County	Zhuang, small no. of Yao	340,000	417,000
Jiangzhou County	Zhuang	330,000	335,000
Other current village project areas	----	---	5,686,000
Future village project areas			
Fangcheng District, Fangcheng Municipality	Zhuang, Yao, Jing	125,000	365,600
Port District, Fangcheng Municipality	small number of Zhuang	---	474,500
Dongxing Municipality	Jing	20,000	104,300
Shangsi County	Zhuang, small no. of Yao	196,000	209,800
Other future village project areas	---	---	3,643,000
Total (including all village project areas)		1,011,000	11,235,200

Minorities appear to be much more prevalent among migrant workers on Stora Enso plantations. As mentioned earlier, migrant workers are believed to make up over half of all workers on Stora Enso

²⁸ Li Qiufang, Wang Simei, and Jiang Xiuhua, "The Circumstances of and measures for Chinese Women's Employment," *China Women's Express*, 6, 2003.

plantations. Of the 50 migrants surveyed, over half are minorities (mostly Miao and Zhuang), some of which come from other provinces, such as Yunnan.

Studies have shown that ethnic minority populations in China are particularly vulnerable to poverty.²⁹ For this reason, in addition to others, the project's impact on them merits special attention. In Guangxi, ethnic minorities make up over 80 per cent of the population below the official poverty line.

The numbers of minority respondents in most of the household survey groups are too small to undertake valid statistical analysis of differential responses between the Han (the majority ethnicity in China) and minority populations. Of the 1,000 household surveys (covering groups A – G), 12.6 percent are from ethnic minority populations, the majority of whom are Zhuang (12.0 percent of total respondents). The remaining 0.6 percent are made up of Yao, Miao, and Buyi. Only one member of an ethnic minority population was interviewed as part of survey Group A, though 40 percent (51 respondents) of group D (village households near state farms with a member working on Stora Enso land on the farm) respondents were minorities.

Visiting one future project area with a large Zhuang population, the team discovered well-integrated relations between Han and minorities. A Zhuang interviewee in one village told the team that she feels just as comfortable speaking with Han as Zhuang ("we're all people"). In another nearby village, with a population that is half Han and half Zhuang, the team interviewed a Han woman married to a Zhuang. She speaks Zhuang language as well as Chinese. Her sister-in-law (who is Zhuang) is married to a Han.

Despite this integration, there have been some reports that minorities are less willing to rent land to Stora Enso, because they find rental rates to be too low. While these reports have not been verified, it is recommended that further work be done to understand whether (and if so, why) minorities have a differentiated attitude towards rental. Any findings on this topic could inform Stora Enso's future communications with potential minority renters of land. As a part of our recommendation to step up its communication with all current and potential renters, then, a sub-recommendation is added that communications with minority populations be tailored, if appropriate, to their particular concerns. While it is anticipated that potential minority land renters will be able to communicate in Chinese, attention should also be paid to language issues and native language communication provided if necessary. An additional minority issue that Stora Enso will want to keep in mind and be sensitive to in its rental activities in minority areas is that certain locations and/or trees hold particular resonance for certain ethnic communities.

Box 14-3

Minority Migrant's Comments on Ethnic Dress Issues

"We are Miao ethnicity from border areas of Yunnan Province – we are a little poor – and what we wear is different from others. When the women come here, they still wear our ethnic dress. They mainly wear it to the work site and don't wear it if we go into town. If the Han see it, they laugh at us Miao. [In the past,] if we wore it into town and they saw us, they would stand for a long time looking—they found it very strange, but we would still wear our traditional dress – we didn't care. Later we began wearing clothes like everyone else – the same as Han. About our Miao clothing, the Han (the officials in the village where we are living) said to us: 'You've come to this place, you should change.' They meant for us not to wear our Miao clothing. Another problem is that when we wear traditional Miao clothing and take a bus, we will be victims of petty theft – the thieves target us minorities in particular. There was one time we were on the road from Yunnan to Guangxi—one of us lost several hundred yuan to a pick-pocket. Because of this, now, when we take the bus we don't wear our traditional Miao clothing – we're afraid of being cheated – so we've changed and wear Han clothing. But, when we go to the worksite we still wear our traditional ethnic clothing."

²⁹ *China: Overcoming Rural Poverty*, March 2001, World Bank Country Study, International Bank for Reconstruction and Development, Washington DC.

While relationships among local minorities and Han appear cordial, fieldwork revealed that minority migrants have had some problems. These problems may be linked to their migrant status and, as discussed in the preceding chapter on employment, include non-payment for work done and harassment by the local population. Comments by some minority migrant workers indicate that some tensions with clear ethnic relevance also exist. An example includes issues regarding traditional minority clothing as related by one Miao interviewee (see Box 14-3).

In general, recommendations for Stora Enso regarding its minority migrant workers will be the same as those for migrant workers generally. In addition, however, Stora Enso may wish to include in its contractor guidelines reference to the equal and appropriate treatment of ethnic minorities.

14.3 Poor Households

Judging by the large role of migrant labor in the project and the significant proportion of migrants from Northwest Guangxi, project areas appear not to be the poorest within Guangxi. As discussed in Chapter 11 ("Affected Groups"), average per capita net rural incomes of village households in project villages and of local village households with a member working on Stora Enso land on forest farms are higher than the average for Guangxi, but lower than the national average. Yet, some villages classified as "poverty villages" exist within the counties and municipal districts in which Stora Enso rents private land. Also, within villages that are not classified as "poverty villages," poor families exist.

According to sources at the Guangxi Poverty Alleviation Office, Guangxi has 4,060 "poverty villages." From 2005 to 2010, the province plans to conduct a poverty alleviation program for all these villages in three phases. The first phase will include 1,731 villages. Table 14-8 below shows the number of first phase villages in each of the counties and municipal districts in which Stora Enso currently has village land or plans to pursue village land in the future. Altogether, there are a total of 150 of these phase one "poverty villages" in the Stora Enso areas, making up about nine percent of phase one poverty alleviation targets. Among the Stora Enso counties and districts, the future project area Fangcheng District (of Fangchenggang Municipality) has the most (23) of these phase one villages; and the current project area Fusui County has the second most (18). While it is not clear which of the 150 villages are or will be villages in which Stora Enso rents land, it is almost certain that Stora Enso villages will include some of these "poverty villages." It is recommended that if Stora Enso chooses to pursue a philanthropic community development project as a part of its program in Guangxi, it target a project village that is also one of the 150 or that is targeted for future phases of Guangxi's poverty alleviation program.

Table 14-8
Number of "Poverty Villages" Listed under the First Phase of Guangxi's Current Poverty Alleviation Program in Counties and Districts in which Stora Enso Rents or Plans to Rent Village Land³⁰

County or District	Number of poverty villages under Phase I
Current Village Project Areas	
Beihai Municipality (including Hepu County)	12 (of which 8 in Hepu)
Qinnan District, Qinzhou Municipality	5
Lingshan County	14
Pubei County	9
Bobai County	11
Fusui County	18
Jiangzhou District, Chongzuo City	15

³⁰ *Namelist of First Set of "Zhengcun Tuijin" Poverty Alleviation Work Villages*, Guangxi Poverty Alleviation Office, February 2, 2005.

<i>Subtotal: Current Village Project Areas</i>	<i>84</i>
Future Village Project Areas	
Beiliu County	9
Luchuan County	5
Xingye County	7
Yuzhou District, Yulin Municipality	3
Fumian District, Yulin Municipality	4
Fangcheng District, Fangchenggang City	23
Gangkou District, Fangchenggang City	1
Shangsi County	13
Dongxing County	1
<i>Subtotal: Future Village Project Areas</i>	<i>66</i>
Total: Current and Future Village Project Areas	150

Note: "Poverty Villages" included in table are not necessarily those in which Stora rents or will rent land. Rather, they are villages located in the counties and districts in which Stora Enso rents or will rent land.

Income data from the survey indicates that while few if any in each respondent group had per capita incomes below China's "abject poverty" line or its "low income standard," significant numbers did have incomes substantially below both provincial and national average rural net per capita incomes (defined as cash income minus food costs). In 2004, China raised its "abject poverty" line to 668 yuan (per capita per year) and its standard for "low income" to 924 yuan. Average rural net per capita income in 2004 was 2,484 yuan in Guangxi and 2,936 at the national level. Table 14-9 below shows that, among the project area household survey groups, project village households renting private land to Stora Enso had the highest percentage (6.6 percent or 16 out of 244 households) with per capita net incomes of less than 1,000 yuan, or roughly below China's "low income line". All project area groups, aside from state farm workers not working on Stora Enso land, had 20 percent of respondents in the 1,000 yuan to 2,000 yuan net per capita income range, substantially below the Guangxi and national averages. It should be noted that commentary within in China has recently indicated that China's poverty line is artificially low and should be raised, a move that might put some of the respondents in this second range in the nation's "low income" category.³¹

Table 14-9
Low and Relatively Low Net Per Capita Income Households Among Project Area Survey Groups,
in percent (%)

units: percent of respondent households in per capita net income range given				
Income Ranges	A: villagers renting private land	D: villagers working project state farm land	C: state farm staff working project land	E: state farm staff not working project land
< 1000 yuan	6.6	0	1.1	0.0
1000 to 2000 yuan	26.2	29.4	21.6	11.9
Total (<=2000 yuan)	32.8	29.4	22.7	11.9

N(A)=244, N(D) = 136, N(C) = 181, N(E)=143, Response rate of all was 100%.

Note: Net per capita income is defined as cash income minus food costs.

While there have been significant improvements in average annual incomes in China and a marked percentage of households have been moved over the poverty line, incomes are not ensured. Many of these households are now vulnerable to small changes in their environment, both physical and economic, and could easily fall back below the threshold. Alleviating rural poverty is still an important priority for China. According to official statistics, there were 26 million rural people under the "abject poverty line" in the country in 2004 and 90 million below the international standard of

³¹ "Current Poverty Line Gives False Picture," *China Daily*, January 13, 2005.

US\$1 per day, when adjusted for purchasing power parity.³² China's rural poor exhibit marked geographic distribution and concentrate in upland areas and in the north, northwest, and southwest of the country. They exhibit high ratios of dependent persons to working persons and relatively high levels of ill health. They also experience other difficulties, such as lower rates of female participation in education and higher maternal mortality than the general population overall.³³

The leadership (township officials and forest farm management) survey module asked respondents who the most vulnerable groups in their communities (see Table 14-10). The Survey covered 12 Project Area Township Governments and 23 Project Area State Farms Management Teams. Project area township officials most often indicated "wubao hu" and lower income families as vulnerable populations; and project area state farm management most often indicated lower income families.³⁴ Asked to make estimates of "population in poverty," the estimates of township officials overall accounted for 3.3 percent of total population, while that of state farm management accounted for 12.5 percent of population. As income levels tend to be higher among state farm staff, it is assumed, these results reflect different understandings of the term "population in poverty."

Table 14-10
The Most Vulnerable Groups in Your Community (or in Forest Farm Locale)

Type of Household	Project Area Township Leaders (Number of Respondents)	Project Area State Farm Management (Number of Respondents)
"Wubao Hu" ³⁵	11	2
Lower income households	10	21
Families with ill or disabled members	9	15
Families without sufficient workforce	6	9
Other	0	0

Response rates were 100% for both groups.

Fieldwork suggests that some of the main reasons for poverty in project and future project areas are: (1) illness and health problems (leading to both medical expenses and inability to labor), (2) educational expenses, (3) natural disasters, and (4) lack of success in business or of initiative in trying to earn money. Box 14-4 below describes findings from the team's interview of a poor household in a future project area.

Fieldwork suggests that poorer households are willing to rent land to Stora Enso for four reasons: (1) They lack the financial resources to invest in the land themselves; (2) They do not have sufficient household labor to work the land themselves; (3) They urgently require capital for a particular reason, for example to pay for school tuition fees; and (4) They may wish to use rental money as a core investment to carry out their plan for rising out of poverty. Fieldwork also suggests that poor households may be more willing than rich ones (which generally do not have the aforementioned reasons for wishing to rent). Clearly, assuming the same amount of land is rented by a rich and a poor family at the same rental rate, the proportion income impact on the poor family will be greater. As mentioned in the preceding chapter, work opportunities generated by the project may also have a greater impact on those with relatively lower incomes, such as migrant workers coming from poorer regions. Some locals find the wages and hard labor associated with plantation work unattractive. It is

³² People's Daily Online (from Xinhua), <http://english.people.com.cn>, March 25, 2005.

³³ *China: Overcoming Rural Poverty*, March 2001, World Bank Country Study, The International Bank for Reconstruction and Development, Washington DC.

³⁴ "Wubao Hu" refers to those rural aged, crippled, and orphans who have lost the ability to work, have no-one to depend on, and lack economic income. "Wubao" refers to providing them with the "five guarantees": food, clothing, housing, burial, and education.

³⁵ See preceding footnote for explanation of "Wubao Hu."

likely, then, that persons from poorer households make up a larger proportion of the plantation work force than their representation in the general population.

Box 14-4

Example of Poor Household in Future Project Area

The team met with the senior member of a village household in a future project area. The township official accompanying the group explained that the township itself is not considered poor, but that some five percent of its households are poor. The interviewee's household had seven people, only two of whom are fit for work. The family's income comes from the construction industry, which is seasonable. The family has 3.5 mu of agricultural land, from which it derives no cash income. They find growing the crops a drain on their income, as they must purchase fertilizer and pesticides, which they pay for through their work in construction. Construction work also supplies tuition money for the household's two children. The interviewee explained that medical expenses have been a major drain on the household. They had spent much money on trying to cure his wife's illness before she died. He himself no longer works because of illness and finds medical expenses prohibitive. While the basic fee for a doctor's visit is not high, meeting expenses for hospitalization are highly problematic for this family.

Fieldwork also identified some problem areas with regard to the project's impact on poor households. First, direct communication with the poor is weak; and sufficient levels of trust have not yet been developed. Stora Enso usually interacts with village and collective leaders (or middle persons) in land rental. Here, we re-emphasize the team's earlier recommendation that Stora Enso make efforts to improve direct information flow to all household renting land, as efforts in this area will naturally improve contact with the poor among others. Second, the project has no articulated program within the overall project to ensure that the poor benefit. If Stora Enso decides to pursue additional philanthropic development projects in the area, special work should be done to ensure that benefits reach the poor. Some interviewees, particularly poor women, expressed the belief that the eucalypt plantation project is not relevant to them. Even if the company were to provide social development support, they believe this would be provided at the township or county level and would be unlikely to reach the natural village or collective, and even more unlikely to reach poor women in poor villages.

14.4 Information Flow to Affected Groups

As has already been discussed in previous sections of this report, improvement in the flow of information between Stora Enso and affected groups is strongly needed. Thus far, we have suggested that Stora Enso improve its communications to those renting land (and others in project villages) through a program that might include brochures, face-to-face open houses, and other means of conveying information on both the rental process and the environmental and health impacts of eucalypts. In order to effectively reach out to households with its communication program, Stora Enso should take as grassroots (as opposed to "top-down") approach as possible. The company may choose to work with township governments in getting information (e.g. brochures, etc.) to the villages, but the most effective communications program will also include in-person village visits by Stora Enso staff. It is also suggested that Stora Enso provide guidelines to township officials and village and collective leaders on the rental process and to contractors on employment issues, such as health and safety, workers contracts, and minimum wage. A monitoring system of plantation work might also provide the opportunity to get information to workers in the field and inform them of the company hotline. Finally, an innovative idea that could combine the need for improved information flow with a philanthropic community development project would be the establishment of small, village-based tele-centers (computer with internet connection) in project areas. Stora Enso could use computer communications to keep villagers updated of its activities or provide multi-media information on issues of concern, such as the environmental impacts of eucalypts.

At the same time that fieldwork showed the need for improved communications with stakeholders, it also revealed the need to strengthen the Stora Enso "brand" among stakeholders. Most stakeholders, particularly villagers renting out land and plantation workers, know little about Stora Enso, including the company's name. The potential for a successful stakeholder communications program will be improved if Stora Enso promotes its brand among stakeholders, perhaps adopting a name more easily remembered by stakeholders and a locally-appropriate logo, and raises their awareness of the company's worldwide socially responsible track record.

The survey gathered data both on the means through which stakeholders have learned about Stora Enso's rental and work opportunities and on their desire for more information. Results are presented below. The most striking overall finding, reinforcing our conclusion that improved communications is paramount, is the strong desire of stakeholders for additional information on the company and its project.

Household survey respondents were first asked questions on their sources of information about: (1) the company's plantation project, (2) opportunities to rent land to the company, and (3) opportunities to work on land rented by the company. For villagers renting private land, government publicity was the top information source in all three cases (Table 14-11, and Annex VII, Tables 52, and 53). (In the village small group survey, government publicity was also the top source of information about the project, Annex VII, Table 54.) Village committee meetings were the second most common source of information about the company's project and rental opportunities, but friends played that role in conveying information on work opportunities. State farm workers working on Stora Enso land got information on the project and work opportunities from "company staff" (their top information source) more often than other groups (Table 14-11 and Annex VII, Table 53). Though the questionnaire was meant to indicate Stora Enso staff by the term "company staff," it is likely that the question was interpreted to mean "state farm staff." The state farm small group survey indicates that the state farms have held meetings on the company's project and that these are workers' most important source of information about it (Annex VII, Table 54). Villagers working on Stora Enso's state farm land tend to depend most on friends (top choice) and "company staff" (second choice) for information both on the project and work opportunities. Government publicity also played a role (Table 14-11 and Annex VII, Table 53) in providing these two types of information to this group. A broad, rough conclusion drawn from all these results is that villagers are most often informed about the project and rental from government officials and about job opportunities from friends, while state farm workers are kept most informed about all topics by the state farm itself.

Table 14-11

How did you find out about "the company's" eucalypt plantation project (check all that apply)?
(units: percent of respondents, %)

Survey Types A, C, D, and E (all of whom live or work in project areas)

Response	A: villagers renting private land	C: state farm staff working project land	D: villagers working project state farm land	E: state farm staff not working project land
From company staff	15.6	48.7	25.7	31.5
Government publicity	82.0	25.4	12.5	33.6
Village committee held meeting	60.3	1.1	1.5	2.1
News and mass media	4.1	6.6	2.9	35.3
Neighbor or friends	32.0	17.7	34.6	42.7
Other	1.6	27.6	12.5	0
Don't know	2.9	12.2	36.8	48.5

N(A)=244, N(C) = 181, N(D) = 136, N(E)=143, Response rate of all was 100%.

Other survey questions reveal that, while many respondents do have information on a range of issues (plantation policies, rental policies and labor policies), they may not have obtained it from Stora Enso (Table 14-12 and Annex VII, Table 55). Across groups, migrants seem to feel the least informed, with only 12 percent indicating that they have information on the company's plantation policies and labor policies (Table 14-12). Asked specifically whether they had obtained information directly from Stora Enso on plantation policies and rental policy, all forest farm small groups responded that they had not (Annex VII, Table 55).

Table 14-12
What types of information do you have on "the company's" forestry project (check all that apply)?
Survey Types A, C, D, E, and H (all of which live or work in project areas)

Response	A: villagers renting private land	C: state farm staff working project land	D: villagers working project state farm land	E: state farm staff not working project land	H. Migrants working project land
Plantation policies	51.2	50.3	22.1	32.2	12.0
Rental policies	29.9				
Labor (hiring) policy		60.8	27.9	27.3	12.0
Other	4.9	43.9	70.6	62.2	0
Nothing	41.4	32.0	1.5	1.4	84

N(A)=244, N(C) = 181, N(D) = 136, N(E)=143, N(H)=50; Response rate of all was 100%. Areas shaded with stripes indicate that the designated option was not given to the particular respondent group.

Despite substantial indications of information already obtained, respondents' desire for additional information is quite high. Among those groups more directly affected by rental (villagers renting private land and state farm workers whose farm has rented), over three-quarters of each expressed a desire for additional information on rental policies and standards (Table 14-13). In terms of a desire for information on opportunities to work on "the company's" plantations, state farm staffs who are not working on project land (but whose state farm is renting to Stora Enso) indicated the highest proportion interest, suggesting that indeed they are interested in finding work with the project. Asked how Stora Enso should strengthen communication, both village and forest farm small groups in project areas chose as their top choice "regular meetings between the two sides." "Regular bulletins and brochures" were indicated by some and "telephone hotline" by a few, but responses for the face-to-face option (meetings) surpassed both of these by far, something Stora Enso may want to consider as it designs its communication strategy. Finally, township governments surveyed were asked, in an open response question, how their townships could increase people's understanding of policies and issues related to the project. Responses, including meetings, training, and broadcast and print dissemination, are given in Box 14-5.

Table 14-13
Do you have a desire for additional information on any of the following (check all that apply)?
Survey Types A, C, D, E, and H (all of which live or work in project areas)

Response	A: villagers renting private land	C: state farm staff working project land	D: villagers working project state farm land	E: state farm staff not working project land	H. Migrants working project land
"The company's" rental policies and rental standards	91.8	85.1	41.9	76.9	
Opportunities to work on "the company's" plantations	53.7	69.6	47.8	74.8	38.0
Technology and management	39.8	62.8	74.3	49.0	24.0

knowledge for eucalypt planting					
Policy on benefits/protection of rural labor					22.0
Other	1.6	7.2	7.4	10.5	52.0

N(A)=244, N(C) = 181, N(D) = 136, N(E)=143, N(H)=50; Response rate of all was 100%. Areas shaded with stripes indicate that the designated option was not given to the particular respondent group.

Box 14-5

Open Responses from Survey of Township Governments in Project Areas:

"How can township increase people's understanding of policies and management methods related to land rental contracts and forestland use?"

- Hold village assembly meetings, distribute materials on the topic, have officials go to the villages for promotion
- Government encourages and convinces farmers
- Use broadcast and print materials to disseminate information; hold training classes in each village
- Regularly inform the people about relevant policies
- Hold meetings of village chiefs and secretaries
- Hold village assembly meetings
- Organize series of training lectures; send out advertising and information cars
- Enhance coordination among leadership groups

14.5 Special Risks

This section examines special risks associated with the project both for those renting out their land and for Stora Enso.

Villager and Forest Farm Risks

Both the survey and the field team explored the issue of special risks for those renting out their land to Stora Enso. The team focused on the risks of Stora Enso withdrawal, non-payment of rent, and forest fire or other natural disaster associated with the eucalypt plantations. In the field, interviewees conveyed a feeling of not being very concerned about these risks. Perhaps if they were involved in a joint production agreement with the company, their feeling of risk would be higher. One farmer told the team that, while he at first had some concern the company would not pay its rent as promised, he is now not worried about the risks associated with rental to Stora Enso: "If the company doesn't pay the rent, I won't let them cut the trees. If the plantations burn down, whoever burns them will pay for it. If the company pulls out, that will not be a big problem for me."

Concerns about non-payment of rent are higher for some other farmers. As mentioned in an earlier discussion on middle-persons, village households in one township were suspicious of Stora Enso (reflecting suspicion of outside parties generally, rather than of Stora Enso in particular) and therefore agreed to have a township official rent from them and re-rent to Stora Enso. As discussed, past experience, in which land in the area was rented to a company that later pulled out and then was transferred by the government (without consultation of the people) to a second company, may have made them wary.

The village and forest farm small group surveys each included an open-ended question regarding risks associated with the project, namely the consequences of Stora Enso withdrawal or a fire or insect disaster in the plantation. Responses from each group are summarized in Box 8. Responses from the villagers show concern, should the company withdraw, for the difficulty of removing eucalypt roots and trying to work with soil that has been degraded in quality. An official at the Guangxi Agricultural

Bureau also raised with the team the difficulty of root eradication as a problem for farmers. Interestingly, many of the responses from the forest farm small groups indicate there would be no negative impact if the company withdrew. Both village and forest farm groups included responses on the negative impacts of fire and on the negative impacts of withdrawal on employment.

Box 14-6	
What would be the consequences to your community in the case that Stora Enso withdraws or there is fire or pest disaster on its plantations?	
Village Small Group Responses	Forest Farm Responses
• Affect sugar plantation • Burn the hills; make it dirty • Fire will affect nearby crops • It's hard to dig up roots; will spoil soil quality • Nearby villages won't rent out land; production will be affected • No jobs; inconvenience to gather firewood • Fire would cause great economic loss • Withdrawal would bring no effect, or positive impacts: more cultivable land available; fire does not have effect • Withdrawal gives no negative effect to farmers; fire could mitigate pollution, because eucalypt plantation have a big impact on the environment • Withdrawal would cause the trouble of digging up the trees. • Withdrawal affects nothing; fire will cause smokiness	• No impacts • Withdrawal has no impact on forest farm; fire might endanger other woods on farm • Withdrawal has no impact • Impact not big, hard to say • Peasant workers would suffer loss (salary, etc.) if withdrawal; no impact on forest farm; fire causes economic loss • If they withdraw, it's a good thing. • Withdrawal brings us no impacts; fire endangers forest farm's land • No impacts from withdrawal; fire affects farm's income • If company withdraws, jobs will be affected. If fire, more job opportunities produced, as more seedlings will be needed. • No impact on forest farm from withdrawal; fire endangers forest farm's woods. • Impact of lost jobs; fire endangers crop production and individual property

Other risks to local communities resulting from Stora Enso withdrawal might include the following:

- Uncertainty about finding buyers for the wood
- For collective land, problems in managing the plantation as a collective asset
- Negative impacts on health and well-being through stress and uncertainty
- Loss of trust in non-Chinese companies
- Land disputes

The communities might also lose some benefits (in addition to jobs) newly gained with Stora Enso's entry. For example, access to improved health and safety practices might be lost. Also, secondary benefits, such as ability to pay school tuition with earnings may be impacted.

Stora Enso Risks

While the risk assessment was focused on local parties, the team also identified some special risks for Stora Enso that are associated with land rental and plantation development. First, breach of contract by farmers is a risk. Second, the team discovered that land conflicts (e.g. between two collectives or between a forest farm and a collective) exist and can cause problems either in delaying the rental process or, once plantation development begins, through consequences of revenge, such as arson. Another risk is the unauthorized use of Stora Enso land by locals. In some cases, such use will not be a problem, but in others (such as use of land for grazing when trees have just been planted) it will. Finally, the team also identified theft of fertilizer as a problem occurring in project areas. Most explained such theft as motivated purely by economics, rather than by dissatisfaction with land rental.

14.6 Benefits to Fiscal Revenues

Earlier in this study, the multitude of taxes and fees on wood in China between harvesting and delivery to the mill gate, it was discussed. Many researchers and other stakeholders have recognized the disincentive and damage to the competitiveness of China's forestry sector created by high taxation on wood; and the government is taking steps to reduce the number and cumulative amount of taxes and fees.³⁶ The forestry tax has in theory been cancelled, so that only fees remain. The fees have been greatly reduced now, according to some experts, accounting for only 11 percent of revenues for harvested wood. Given the complexity of the topic, the assessment will not attempt to evaluate further the current status of taxes and fees at provincial and local levels. Instead, the assessment will note input given to the team by Guangxi officials and then use tax and fee rates that Stora Enso understands to estimate benefits to fiscal revenues.

Both Guangxi Government officials and state forest farm management indicated to the team that there have already been substantial reductions in taxes and fees on wood. According to several sources, the "special agricultural tax" (formerly 8 to 10 percent of wood's sale price) has already been cancelled. Also, because Stora Enso will be providing its own wood and will make its profit from processing and not wood sales, business income tax and value-added tax payments will be assessed at the pulp mill and not on the plantation operations. According to an official at the Guangxi Forestry Bureau, taxes and fees on wood harvesting in the province are now only a quarter of what they were before 2000. The main fee for Stora Enso on its plantation project will be a combined afforestation and forest management fee. Normally running 18 to 20 percent of the wood's equivalent sales price, the government has reduced the amount by half (so that it is 10 percent) for "fast growing plantations" to encourage their development. A portion of the combined afforestation and management fee, according to the official at the Guangxi Forestry Bureau, will be returned to enterprises when they conduct afforestation work. The official indicated that the amount refunded depends on the situation; and there is no maximum proportion for the refund.

Stora Enso understands the main taxes on its plantation operations, all payable to forestry departments, to be: 5 yuan per m³ for "harvesting design," 8 yuan per m³ for sales tax, 1 yuan per m³ for quarantine fee, 5 yuan per m³ for measuring fee, and 20 to 30 yuan per m³ for cultivating and replanting fee. The total, then, assuming a middle figure for the last fee, is 44 yuan per m³. Assuming a local eucalypt sales price of about 400 yuan per m³, as the team heard in interviews, the fees account for 11 percent of the wood's market value, or close to the 10 percent indicated by officials. Assuming 2.5 million m³ of pulpwood delivered to the mill per year, resulting fees are 110 million yuan (about US\$13.6 million). Based roughly on fiscal revenue sharing ratios presented in Lu Wenming *et al*, 2002 (now being applied nationwide), it is assumed that for wood harvested on village land, the province and prefecture each keep 20 percent of tax and fee revenues and the county forestry bureau keeps 60 percent.³⁷ Based on input from forest farm interviewees, it is assumed that, for wood harvested on forest farm land, the forest farm keeps 60 percent of fees and taxes; and 40 percent are paid to the provincial forestry bureau. Using these assumptions, in Table 14-14, the annual fiscal revenues is estimated, accruing from the project at full scale to government forestry departments at different levels and to state forest farms. Revenues accruing to prefectures in total are much less than those accruing to state farms (39.6 million yuan), the provincial forestry bureau (35.2 million yuan), or county forestry bureaus (26.5 million yuan).

³⁶ Lu Wenming, N. Landell-Mills, Liu Jinlong, Xu Jintao and Liu Can. 2002. *Getting the Private Sector to Work for the Public Good: Instruments for Sustainable Private Sector Forestry in China*. International Institute for Environment and Development, London.

³⁷ Ibid.

Table 14-14
Estimates of Annual Fiscal Revenue Flows from Stora Enso's Guangxi Plantations at Full Scale to Government Forestry Departments at Different Levels and to State Forest Farms³⁸ (units: million yuan)

	Total	Province	Prefectures	Counties	State Farms
Fiscal Revenues from village-based plantations (40 percent of total area)	44	8.8	8.8	26.4	
Fiscal Revenues from forest farm based plantations (60 percent of total area)	66	26.4			39.6
Total for all plantations	110	35.2	8.8	26.5	39.6

While the assessment lacks full information on the use to which these revenues will be put, it is likely that the majority of them will go to supporting forestry bureau (at various levels) and state farm expenses, though most companies receive some rebate of fees paid when they re-forest. The revenues may be used to pay salaries or for other expenses arising from the functions associated with each charge. For example, the cultivating and replanting fee may be used for afforestation and technical extension. As another example, the quarantine charge, in principle, is used for dissemination, technical training, labor, equipment for quarantine testing, and other costs associated with quarantine programs.³⁹

14.7 Development Needs

This section addresses the status of development in project areas (and, to a lesser extent, in migrant places of origin), development needs, and the potential role for Stora Enso in local development. Background on development status covers housing, health and medical services, and education. Background on household income, expenditures, and durables has been provided elsewhere in this study, though certain categories of expenditures are referenced here. The presentation on development needs focuses on priorities identified by survey respondents. Household interest in and access to loans is also covered, with reference to micro-credit. The brief closing discussion on Stora Enso's role in local development covers both how Stora Enso's plantation project can enhance local development and how philanthropic projects might best be designed to support local needs.

Background on Development Status

Housing

Over half of respondents in each group living or working in project areas indicate they live in either brick homes with tiled roofs or brick and cement homes, these two being the higher quality dwellings among the options offered. Field interviews indicate that some villagers in project and future project areas have the dream of building a new home so as to live in a higher quality structure and/or have more space. Forest farm workers, as may be expected, exhibit somewhat higher proportions of the "up-scale" options than villagers. Reflecting a lower level of development, significant proportions of respondents in migrant places of origin live in mud homes (Annex VII, Table 57). Dwellings of migrants near work sites, discussed in the chapter on employment, are often temporary (e.g. tents) and, as mentioned, are an issue Stora Enso may wish to address. Average per capita living space for rural households has been rising steadily in Guangxi since the 1990 Census and reached 26.1 m² per person by 2003.⁴⁰ Living spaces reported by survey respondents in village project areas were somewhat less

³⁸ Of the fee components indicated by Stora Enso as payable to forestry departments, the sales tax may revert to the tax bureau and not remain with forestry departments. In this case, all estimates in Table 71 should be reduced by 18 percent.

³⁹ Lu Wenming, op. cit.

⁴⁰ *Guangxi Yearbook*, Guangxi Statistical Bureau, 2004, p. 198.

(e.g. 20.1 m² per person); and living space reported by project area state farm workers was less than that reported by these villagers (Annex VIII, Table 57).

Health and Medical Services

Rural healthcare in China has suffered from inadequate funding during the Reform Era, as China moves to a market economy. Local areas have been slow to respond to calls for the re-establishment of rural health care co-operatives. Macro data shows that in 2003 there were 1,305 hospitals in rural areas of Guangxi. Data for the preceding year reveals that 83.5 percent of administrative villages in the province have some kind of medical facility, although the source offers no information on the number of doctors or nurses in these facilities or of the kind of equipment or resources available in each.⁴¹ The township government and state forest farm management surveys asked about the main causes of death and most common illness in communities. Natural death was estimated, on average, by project area township officials and project area township management to account for 76 and 77 percent, respectively, of deaths, while illness, on average, was estimated to account for 19 and 20 percent of deaths, respectively. Accidents accounted for the remainder in each group. Flu, hepatitis, and pneumonia are some of the "most common illnesses" listed by project area township officials, while flu, rheumatism, kidney stones, gastritis, and cancer are some of those listed by project area state farm management.

Groups affected by the Stora Enso project use a variety of medical services when sick. Based on survey results, township clinics or hospitals appear to be the most frequently used services among those living in or near project areas, though village services are also often used by many village respondents. This result suggests, but by no means verifies, that an appropriate target for improving routine health care services available to affected groups in project areas is the township clinic or hospital. In migrant places of origin, village doctors or clinics are the most frequently used, perhaps a reflection of lower income levels (Annex VII, Table 58). Almost no respondents in any of these groups use traditional healers. An encouraging aspect of results across groups is that few respondents indicated foregoing medical care ("no treatment"). This response category was highest for migrant place of origin households having a family member in project areas (14.8 percent).

With the decline of the rural cooperative medical care system during the Reform Era (the post-1978 period), affordability of medical services has become a critical issue in rural areas. As mentioned in the discussion of poverty, high medical bills can have a devastating effect on rural households. Many poor rural people simply cannot afford to pay and must therefore forego needed medical services. Asked to select options regarding their feelings on medical facilities in their area, the top response of all project area and migrant sending area respondents was "too expensive" (Table 14-15). Significant proportions of responses to other options ("hospital too far," "lack of necessary equipment and drugs," and "doctors lack qualifications") suggest a general dissatisfaction among these groups with the medical services available. Results, then, suggest that medical services and funding for medical care are realms in both project and migrant sending areas that could use increased support.

Table 14-15

What are your feelings about the medical facilities in this area (check all that apply)? (units: percent of respondents)

Survey Types A, C, E, D, I, and J (C and D work on Stora Enso state farm land; E is worker of project area state farm, but does not work on Stora Enso land; I has family member working in project area; J has family member migrating to non-project area.)

	A: villagers renting private land	C: state farm worker	E: state farm worker	D: villager near state farm	I: migrant place of origin household	J: migrant place of origin household
Too expensive	78.3	85.1	86.0	89.7	44.4	64.4
Hospital too far away	49.2	28.2	35.0	45.6	37.0	34.2

⁴¹ *Guangxi Yearbook*, Guangxi Statistical Bureau, 2004, p. 427.

Lack of necessary equipment or drugs	63.5	48.1	57.3	43.4	37.0	43.8
Doctors lack qualifications	55.7	42.5	48.3	29.4	7.4	23.3
Other	0	3.9	6.3	0	29.6	27.4

Note: N(A)=244, N(C)=181, N(E)=143, N(D)=136, N(I)=27, N(J)=73; Response rates for all were 100%.

During fieldwork, the team learned of both problems and progress in medical care in the area. One forest farm that is a major supplier of land to Stora Enso has health facilities with three doctors, but, according to an interviewee, the equipment is poor. Also, while the farm's branch farms used to have clinics, these have all been closed down. This situation reflects a general impression given by forest farms in project areas that, as a result of financial difficulties, social services once supplied to staff are deteriorating. On the positive side, the team learned from a project area township official that progress had been made in the locality in rural cooperative healthcare. According to the scheme used, farmers wishing to participate may pay 10 yuan per year directly to the township clinic. They receive a receipt for their payment and, then, discounts (usually ranging from 30 to 50 percent) on subsequent medical expenses.

Findings suggest that, should any individual working on Stora Enso land experience a work related injury, they and their family may experience difficulties in paying for adequate care. Health cover should be a matter for contractors to negotiate with their employees, but it may be helpful if Stora Enso could provide some recommendations in guidelines provided to contractors. Stora Enso may wish to monitor the progress of project area co-operative health care systems, such as that mentioned above, to assist contractors in identifying potential benefits for their workers.

Education

Lack of funding for schooling is an important problem in project areas. On the one hand, many households indicate that school tuition and fees are a heavy burden for them, while, on the other, schools lack the money they need for operations. A World Bank country study has noted that poor education is one of the main contributors to, and results of, absolute poverty in rural areas. According to the study, one of the main problems in developing education programs in poor counties of China is the lack of resources, partially a consequence of fiscal decentralization.⁴² In this vein, the team found that one school it visited on a forest farm is having trouble paying teacher salaries, a common problem across rural China. When the school was first established, teacher salaries were paid by the forest farm, but now these must be paid through student tuition. The team discovered, however, that 90 percent of the school's students are now from families that do not include a forest farm staff member. The World Bank report indicates that in poorer areas expenditure on education can account for up to 20 percent of household expenditure. Indeed, among surveyed households renting private land to Stora Enso, expenditures on education were, on average, 18.6 percent of total household expenditure (Annex VII, Table 5). The World Bank report further indicates that, despite national plans for achieving a universal nine-year basic education, the government has accepted that there are severe problems in rural areas and that a more limited number of years of basic education would be acceptable in poorer rural areas.⁴³

Development Needs

Most Significant Priorities

All survey instruments contained a question asking respondents to indicate and rank the most important development priorities of their communities. Overall, the most important priorities (by both average rank and percentage of respondents) to the various survey groups in village project areas were: irrigation, roads, medical services, and drinking water (Table 14-16 and Annex VII, Tables 59 and 60).

⁴² *China: Overcoming Rural Poverty*, March 2001, World Bank Country Study, International Bank for Reconstruction and Development, Washington DC.

⁴³ *Ibid.*

Roads, in particular, received the top rank from villagers renting private land, village small groups, and township officials. Trends among project area state farm respondent groups were somewhat different, reflecting the different nature of the community in which they live. While roads received top ranking from farm management, they were third in rank and percentage of respondents for the forest farm household and small group surveys. Provision for the aged (not offered as an option to the small groups and management) and medical services were more important to the households and medical services and living environment were most important to the small groups. For households surveyed in migrant villages of origin, the top response both in number of respondents and average ranking was roads. Other top responses were water supply, medical services, and housing (Table 14-17). While these results are quite general, they provide indications to how Stora Enso might integrate its plantation project (e.g. through road development) or non-profit development work (e.g. through work in healthcare, irrigation, or drinking water) to address the most pressing community development needs.

Table 14-16

What are the most urgent priorities for improving conditions in your community (check all that apply and rank, with "1" as most important)? (units: percent of respondents and average rank)
Survey Types A, C, E, and D (C and D work on Stora Enso state farm land; E is worker of project area state farm, but does not work on Stora Enso land)

Priority Area	A: villagers renting private land %	C: state farm worker %	E: state farm worker %	D: villager near state farm %	Average Rank			
					A	C	E	D
Roads	98.7	82.3	95.8	94.9	1	3	3	1
Medical service	92.6	85.6	97.2	94.1	3	4	2	2
Improved schools	83.4	76.2	95.1	90.4	4	6	4	5
Provisions for the aged	77.5	90.6	96.5	86.0	7	1	1	4
Housing conditions	79.9	90.6	93	91.2	6	2	4	3
Living environment	83.2	79.6	96.5	89.7	8	5	6	6
Water supply	88.1	65.2	92.3	81.6	5	7	7	7
Electricity	84.0	50.8	90.9	78.7	9	8	8	8
Cropland irrigation	99.2	43.6	88.8	73.5	2	11	10	10
Improved access to telephones/internet	75.8	47.0	91.6	72.8	11	9	11	11
Agricultural trade market	76.2	47.5	91.6	75.0	10	10	9	9
Other	1.2	9.9	14.0	10.3	12	12	12	12

Note: N(A)=244, N(C)=181, N(E)=143, N(D)=136; Response rates for all were 100%.

Table 14-17

What are the most urgent priorities for improving conditions in your community (check all that apply and rank, with "1" as most important)? (units: percent of respondents and average rank)
Survey Types I and J

Priority Area	I: migrant place of origin household with migrant in project area (%)	J: migrant place of origin household with migrant to non- project area (%)	Rank	
			I	J
Roads	70.4	63.0	1	1
Medical service	33.3	42.5	6	2
Improved schools	44.4	38.4	5	4
Provisions for the aged	14.8	8.2	---	---
Housing conditions	55.6	42.5	3	3
Living environment	3.7	4.1	---	---
Water supply	59.3	39.7	2	5
Electricity	25.9	17.8	---	---

Cropland irrigation	48.1	30.1	4	---
Improved access to telephones/internet	18.5	23.3	---	---
Agricultural trade market	25.9	21.9	---	---
Other	14.8	5.5	--	---

Note: N(I)=27, N(J)=73; Response rates for both were 100%.

Loans for Households

Motivated by the success of micro-credit in promoting increased incomes among rural peoples in some locales around the world, the household surveys explored access to and demand for loans in project areas. Results indicate that interest in getting a loan is high among affected groups in project areas: 50 percent among households renting private land, 47 percent among state farm staff working project land on their forest farm, 42 percent among state farm staff affiliated with a project state farm but not working on Stora Enso's land, and 29 percent among local villagers working on project state farm land indicate they would like to get a loan (Table 14-18). Indeed, for each of these groups, the proportion of respondents interested in getting a loan was lower than the proportion that believe they have access to loans. This result suggests that micro-credit may have a role to play among affected groups. Thus, Stora Enso may wish to consider this option if it wishes to pursue a non-profit development project. Those interested in getting a loan were asked what they would like to use it for. Most responses were related to income generating activities, though a few respondents indicated a desire to build a home with such money. Interestingly, in three of the groups, some respondents would use a loan to develop "tree plantations" (Table 14-18). As discussed in the chapter on rental, some local people would like to develop their own eucalypt plantations, but lack the necessary funding, knowledge, and technology. If Stora Enso were to decide it would like to support a micro-credit project, it might consider a project focused on small loans for eucalypt plantation development, perhaps tied with some technical assistance. This approach might be particularly appropriate if the company, at the same time, were to see benefits in promoting eucalypt production by others to facilitate availability of that portion of pulpwood it plans to buy on the market.

Table 14-18
Access and Demand for Loans (units: percent of respondents, %)
Survey Types A, C, E, and D (all of which live or work in project areas)

Can you get access to bank or credit cooperative loans?	A: villagers renting private land	C: state farm staff working project land	E: state farm staff not working project land	D: villagers working project state farm land
Yes	47.5	21.0	27.3	9.6
No	25.0	72.9	38.5	46.3
Don't Know	27.6	6.1	34.3	44.1
Would you like to get a loan?	A	C	E	D
Yes	50.0	47.0	42.0	28.7
No	34.8	46.0	44.8	52.9
Don't know	15.2	7.2	13.3	18.4
If so, what would you use it for? (open-ended question, selected responses)	A	C	E	D
	-do business -transport -build house -agriculture -livestock	-build house -tree plantation -livestock -fruit trees	-agriculture -fruit trees -tree plantation -car for transport	-pig breeding -tree plantation -fruit trees -agriculture and business

N(A)=244, N(C) = 181, N(E)=143, N(D) = 136. Response rate of all was 100% for first two questions. For third question, selected responses of those interested in getting a loan are given.

China has gained some good experience in micro-credit in recent years; and prospects for micro-credit in the country are strong. Barriers to long-term, self-sustaining micro-credit organizations, however, exist. At present, the main issue is that, while micro-credit can be carried out on a project basis, for the longer-term, organizations that are not approved as financial institutions cannot manage micro-credit funds. Stakeholders, however, have established a micro-credit association, which is working with the People's Bank of China (the relevant regulator) to develop a more favorable regulatory environment.

Role of Stora Enso in Local Development

Plantation Project and Community Development

At the same time as Stora Enso's plantation project contributes to employment generation, to household and state farm incomes through land rental, and to increased fiscal revenues, it may also contribute directly to local public goods. Village project areas have a strong demand for improved infrastructure and state farm management also believe that roads, in particular, are a priority. Therefore, if Stora Enso finds that it needs to invest in infrastructure for business reasons, it might consult with local people and governments to see if there is a way to integrate its investments (e.g. in roads or irrigation systems) with local priorities for such investments.

Philanthropic Projects to Support Local Development

Should Stora Enso wish to pursue a non-profit development project in affected communities, its choices and plans might be informed by some of the findings above. For example, for project villages, local priorities that may benefit from a development project are drinking water and medical services. On state forest farms, medical services is an area prioritized by stakeholders that may benefit from a development project. Education, while in most cases not ranked among the top three priorities (though ranked third by township governments), is a priority for large proportions of project area respondents. It is also a sector, as indicated in the discussion on education above, in which needs in the area are strong and which is conducive to development projects. Moreover, Stora Enso has already implemented a successful non-profit project in a state farm school, supplying computers. Micro-credit is another field both appropriate to development projects and in which there may be strong demand in project areas. Micro-credit for eucalypt planting might be a way to combine business interests and/or the potential of Stora Enso to raise farmer technical skills with a development project.

While villager respondents put a low priority (among other options) on telecommunications and internet, an idea mentioned above that would combine the company's needs to communicate with stakeholders, is village tele-centers. The concept would call for the installation of a computer with internet connection (when possible) in project area natural villages. Villagers could use the computer to access information on Stora Enso, communicate with the company, view materials on eucalypt plantations, and raise their own knowledge base and familiarity with the internet. These centers might be installed in local schools, so as to combine general community and educational components.

Stora Enso may also wish to consider a non-profit project in migrant villages of origin, keeping in mind their top-reported priorities of roads, water supply, medical services, and housing. Data on housing, incomes, and other standards has shown that these households are generally at a lower development level and perhaps in greater need of support than those in project areas. Experiences in carrying out the household survey in migrant villages of origin, however, have shown that identifying and finding the home village households of migrants working in project areas is not always easy. In addition, migrant workers may often change work. Thus, it may be hard to pursue a development project in these places of origin that benefits significant numbers of people that are involved with Stora Enso's plantations on a long-term basis.



Picture 8. A School with PCs Sponsored by Stora Enso

Currently, Stora Enso has a social investment policy: 1) Forest Farm development fund: GXSE pays 5 RMB/mu/year to this fund that is managed by the Forest Farms; 2) Rural community development fund: GXSE has a budget for 5 RMB/mu acquired land which is aimed for contributing to local peoples development projects. Stora Enso may package these possible micro-project initiatives into a social development fund as an umbrella mechanism to meet the priorities of development needs of the project communities in Guangxi.

Key Points from the Chapter on Special Populations and Other Topics:

Women

- Fewer women than men take part in plantation work, but the number of women is significant. (Also, almost all of the employees at Stora Enso's nursery are women.) Because much plantation work is paid on a task-accomplished basis, some men may be able to earn more than women, but the rate per task is the same. Some women, especially those with children, do not want to out-migrate for work and appreciate the flexible opportunity to work near home. Negative impacts of project work on women are similar to those of other employment opportunities (i.e. lengthened days and heavier work burdens). Women in project areas already have significant work burdens in agriculture and household chores. In the long term, they may suffer negative health impacts.
- Women face discrimination in China in employment opportunities. Stora Enso should emphasize wage equity and equal opportunity for its own employees and encourage contractors to do the same.
- Survey results on household and collective decision-making for land rental show that women still do not always play an equal role in important household decisions.

Ethnic Minorities

- The proportion of minorities involved in village land rental to Stora Enso is small, but the counties and districts in which Stora Enso currently leases village land or in which it may lease village land in the future have a total minority population of about one million, or about nine percent of the total. The main minorities in current and future Stora Enso village project areas are Zhuang, Yao, and Jing.
- Minorities are more prevalent among migrant workers on Stora Enso land than among land renters.
- Well-integrated relations between Han and minorities were found in future project areas, but minority migrants in the region have had problems with not being paid and harassment. Stora Enso may wish to include in its contractor guidelines reference to the equal and appropriate treatment of minorities.
- Some say minorities are less willing to rent land to Stora Enso. Further work might be done to probe this issue and communications tailored to address minority concerns.

Poor Households

- Project areas are not the poorest within Guangxi, but some poor village exist in these areas. Should Stora Enso choose to pursue a community development project, it should do so in a project village that is also among the key "poverty villages" targeted by the Guangxi Government.
- Poor households may be more willing to rent out land than rich ones (which may have more ability to develop the land themselves and less urgency for cash) and more willing to accept the relatively hard and low-paid plantation work opportunities.
- If Stora Enso decides to pursue community development projects in the area, special work should be done to ensure benefits really reach the poor at the village level

Information flows

- Improved information flow could be combined with a community development project through establishment of small, village-based tele-centers (computer with internet connection) in project areas. Stora Enso could use computer communications to keep villagers updated on its activities or provide information on issues of concern, such as the environmental impacts of eucalyptus.
- Stora Enso needs to strengthen its "brand" among stakeholders (e.g. through locally-appropriate logo, easily remembered name, etc.) to facilitate a successful communications program. Most villagers renting out land and plantation workers know little about Stora Enso.

- Stakeholders have a strong desire for additional information on the company. Asked how Stora Enso should strengthen communication, both village and forest farm small groups in project areas chose as their top choice "regular meetings between the two sides."

Special risks

- Households renting land do not appear very worried about Stora Enso withdrawal, but some have concerns about degraded soil quality and removing eucalyptus roots in the event of withdrawal. Households also have concerns about non-payment of rent.
- Stora Enso may face risks in breach of contract by farmers, conflicts over land use rights (e.g. between two collectives or between a forest farm and a collective), unauthorized use of Stora Enso land by locals, and fertilizer theft.

Fiscal revenues

- The main fee for Stora Enso on its plantation project will be a combined afforestation and forest management fee. Total fees are estimated at US\$13.6 million per year. The majority will likely go towards supporting forestry bureaux (at various levels) and state farm expenses.

Development needs

- The most important development priorities identified by groups in village project areas are: irrigation, roads, medical services, and drinking water. Results are general, but provide clues of how Stora Enso might integrate its plantation project (e.g. through road development or irrigation) with local infrastructure needs or use non-profit development work (e.g. in healthcare or drinking water) to address other pressing community needs.
- Results (including general dissatisfaction with medical services and a feeling they are too expensive) suggest that medical services and funding for medical care are realms in both project and migrant sending areas that could use increased support.
- Lack of funding for schooling is an important problem in project areas. Many households indicate that school tuition and fees are a heavy burden for them; and schools lack the money they need for operations. Education, while in most cases not ranked among the top three priorities, is a priority for a large proportion of project area respondents.
- Interest in getting a loan is high among affected groups and higher than perceived access to loans. Micro-credit may have a role to play and Stora Enso may wish to consider it for a development project. Some stakeholders are interested in using a loan for "tree plantation development," suggesting a loan program integrated with technical assistance.
- Stora Enso may also wish to consider a non-profit project in migrant villages of origin, keeping in mind their top-reported priorities of roads, water supply, medical services, and housing. Migrant villages, on average, may have greater needs than project villages, but it may be hard to pursue a development in these places of origin that benefit significant numbers of people that are involved with Stora Enso's plantations on a long-term basis.

Part V

Integrated analysis of Social and Environmental Impacts

Part V covers the team's integrated analysis of social and environmental impacts. It consists of four chapters. Chapter 15 introduces the methodology for integrated social-environmental analysis. Chapter 16 provides results of a simplified cost-benefit analysis of the project. The analysis covers financial profitability and economic analysis, direct and indirect social costs and benefits, and environmental costs and benefits across a range of key areas (e.g. water, soils, carbon sequestration, etc.). Chapter 17 presents findings of the social study on the strong concerns local people have about the environmental impacts of eucalypt plantation. Chapter 18 briefly reviews findings on potential project impacts on natural and cultural heritage. Based all analyses conducted, Chapter 19 provides a scenario analysis, comparing the case in which Stora Enso carries out its plantation project in Guangxi to the case in which it does not. The scenario analysis covers areas such as wood supply and benefits to sustained productivity and environmental and social values. Chapter 20 lastly suggests a monitoring framework to mitigate any of issues and potential risks identified by the ESIA.

Chapter 15. Methodology for Integrated Social-Environmental Analysis

Integrated social-environmental analysis consisted of three key components: (1) cost-benefit analysis, (2) affected communities' concerns about environmental impacts of eucalypt plantation and (3) scenario analysis.

For the cost-benefit analysis, due to insufficient financial data available, simple models, taking the scale of the plantation base as their basis, were developed to compute key elements in the framework. As with the environmental analysis discussed in a preceding section, environment-related information used in the integrated analysis comes mainly from expert testimonies and technical institutions. Similarly, social-related information is derived from the survey and field interviews used in the social analysis. In this integrated analysis, data from secondary sources, such as industry standards for job creation, is used too.

Affected communities' concerns about environmental impacts of eucalypt plantation are first hand information mainly based on the social survey conducted in the field.

The scenario analysis presents two windows of possibility: (a) with Stora Enso and (b) without Stora Enso. It then evaluates each of these scenarios at the national, provincial, and local levels. Industry forecasts, government input on policy, projected tax revenues, etc., and some results from the cost-benefit analysis (see below) are used in the scenario evaluation.

Chapter 16. Cost-Benefit Analysis

Data to establish financial parameters such as EIRR/IRR, ENPV/NPV, EBCR/BCR, and shadow price, was not available at the time of the ESIA. Based on the current situation and the simplified CBA framework developed, combined with information collected from field investigations and Stora Enso, the following analysis was conducted:

16.1 Financial Profitability and Economic Analysis

It is clear that eucalypt planting plays a positive role in promoting local economic development. Based on the data provided by Stora Enso, the related financial data of this project was calculated in the tables in Annexes VIII, IX, and IX. Two rotations (14 years) were set as calculation periods.

In the table in Annex X, the direct operational cost of this project for each year is RMB 317,314,285 Yuan (option 1). It includes land lease cost, RMB 72,000,000 Yuan per year; labor cost, RMB 115,714,285 Yuan per year; transport cost, RMB 129,600,000 Yuan per year.

In the table in Annex IX, the average annual turnover of this project will reach RMB 1,094,400,000 Yuan. So there is a margin of RMB 777,085,715 Yuan to cover Stora Enso's other indirect cost (such as financial cost, management cost and so on), tax, profit etc.

On the other hand, the local government and community can get many economic benefits from this project. This project can bring RMB 109,440,000 Yuan of tax revenue and RMB 1,094,400,000 Yuan of GDP contribution to the local government each year. Based on the table in Annex X (Operation Cost of the Project), each year, the project can also bring RMB 72,000,000 Yuan of land lease income to local forest farms and individual farmers; RMB 115,714,285 Yuan of labor income to the farmers and workers worked for plantation work of this project, from local and around provinces such as Yunnan and Guizhou; RMB 129,960,000 Yuan of transport income to the local transportation sector where the beneficiaries will include transport companies, workers involved in the local transport market and other related sectors, such as truck maintenance and services sectors.

With this project, it is apparent that the productivity of land will increase dramatically. The average wood production of fast-growing eucalypts in this project is around 3 times of pines or Chinese fir in the project area. It means this project can grow the same amount of wood fibre on one-quarter of the land. It will solve many problems of environment and land resources.

16.2 Direct and Indirect Social Impacts

This project creates direct employment and work opportunities through site clearing, site preparation, base fertilizer, planting, watering, weeding & coppice removal, follow-up fertilizer, forest guarding, and harvesting (see table in Annex VIII). Most importantly, this project provides employment opportunities for many people: it resolves the unemployment problem of state-owned forest farm workers or provides opportunities for changing their work positions. Villagers in the neighborhood of the eucalypt plantations (as well as migrant workers) also get employment opportunities, such as tree planting, fertilizer application, forest protection, etc. Migrant workers, such as those from Yunnan and Guizhou province may make up over 50 percent of plantation workers. It was also found that plantation work opportunities may attract those local people who have out-migrated to Guangdong province to return to their home villages. Based on the calculation result, this project can bring 4,628,571 work days of direct labor opportunity for local and around provinces' farmers and workers every year. It equals around 17,200 full-time employment positions. Based on the experience of other project, this project will create more than 30,000 indirect full-time employment positions.

16.3 Benefit of Environment Improvement and Cost of Environment Damage

Water

Based on the analysis in the above Part III (Chapter 6), there is no evidence that eucalypt plantations in project areas will deplete water resources and it seems likely that this project will have little impact on water resources in the project area. Water use by plantations and the impact to hydrological process in the region can be slightly improved by improved plantation management options. As Stora Enso adopts better site preparation methods, ground water recharge will improve and increase dry season soil moisture availability in the region.

Fertilization practices in eucalypt plantations could influence water quality through slightly increasing N and P contents of water runoff, but this increase is expected to be small compared to those from fruit orchards and agriculture.

Soil

Stora Enso's proposed site management program for their eucalypt plantations aims to protect soils and help reduce soil erosion. According to Stora Enso's guidelines for plantation management, only tractor ripping is used for site preparation ripping on flat lands in Beihai region and Dongmen, and hole site preparation by hand is used for hilly or mountainous lands. It seems that there is no soil compaction by machine use currently but this is likely to change once plantations are harvested. Stora Enso aims to minimise soil disturbance and soil erosion and maintain the physical properties of the soil and does not use total soil tillage. Where possible, all roots of former plantation trees are also kept at site (except to meet local community demands). Sustaining the chemical properties of the soils through fertiliser application and slash retention is very important for Stora Enso's plantation management.

Biodiversity

Stora Enso has committed itself to not converting biodiverse native forests to eucalypt plantation. The proposed eucalypt plantations of GXSE are a small proportion of the total ecosystems comprising the landscapes in southern Guangxi and it seems unlikely that they will directly impact on biodiversity at landscape level. No evidence has been found to demonstrate that eucalypts biologically invade indigenous ecosystems and disrupt functions and elements of flora and fauna or cause genetic and habitat erosion. If not mitigated, project operations may have indirect effects on biodiversity. Hunting by migrant workers and fuel collection by renters who face fuel deficits may impose additional costs for protection of nearby nature reserves. Eucalypt plantations arguably add diversity to the regional landscapes through spatial and temporal structures in combination with other forest and agricultural ecosystems. Plantations may exacerbate the trends of fragmentation of natural habitats that has led to decline in some species. Conversion of slope lands and degraded lands to eucalypts may foreclose on opportunities for expanding and connecting remaining natural habitat fragments through forest restoration with native species, and this opportunity costs may be high for sites adjacent to or between nature reserves and other natural forests.

Substitute for Natural Forest as Pulp and Paper Raw Materials

Due to China's rapid economic growth, more wood needs to be produced to meet the increasing demands for wood and wood products. The existing forests can not produce sufficient forest resources to balance supply and demand. The high and increasing demand for timber is increasing the pressure on Guangxi's (and China's) natural forests and threatening fragile biodiversity. This has also led to a significant increase in the import of wood and wood products from neighbouring countries and caused negative impacts to the sustainable management of forests in southeast Asia. This project can produce 2.8 million m³ of wood for making pulp and paper each year. This is the equivalent of the production from about 400,000 ha of natural forest in China and neighbouring countries.

Carbon Sequestration

As determined in Chapter 7 of Part III, the 120,000 ha eucalypt plantation in this project could sequester about 2.5 million tonnes of atmospheric CO₂ each year in paper products – about 4 times

that of pines or Chinese fir which were planted broadly in project area before this project. The current price for CO₂ in the international market ranges from USD 3-7 per tonne of CO₂.

Chapter 17. Social Analysis of Concerns about Envi. Impacts of Eucalypt Plantation

The results of reviewing available literature and experiences and the expert testimonies conducted indicate that eucalypt plantations will in general not affect water resource and water quality in the region and could be even helpful for soil and water conservation. Yet, one of the most striking findings of the social study is affected groups' high degree of concern regarding the negative environmental impacts of eucalyptus plantation. Both field interviews and survey results suggest this is a critical issue that should receive the attention of Stora Enso. The concern is apparent in both village and state farm project areas, though the magnitude of concern is greater in village project areas. Table 17-1 below shows that over 70 percent of households surveyed in project villages believe the project will have negative impacts on soil, air, water, and cropland productivity. Respondents, on average, ranked "degradation of soil fertility" as the most important negative impact, followed by "reduction in nearby water resources" and, then, "decrease in productivity of cropland." The small group survey in project villages shows a similarly high proportion of concern (degradation of soil fertility -80 percent, reduction of nearby water resources -67 percent, and decrease in productivity of cropland -60 percent), with the top three concerns being the same as those of the household survey (Annex VII, Table 29). Finally, concerns about environmental impacts are also widely present at leadership levels. Over 80 percent of the 12 township governments surveyed in project areas ranked most such environmental impacts as significant concerns (Annex VII, Table 30).

Table 17-1
Main negative impacts of land rental to "the company" for plantation development (please indicate all that apply and rank, with "1" as most important). (Households in Project Villages)
Survey Type A

Negative Impacts of Project	Respondents	Percent of those responding to question (%)	Percent of total survey group (%)	Average ranking given by those responding
Degradation in soil fertility	185	98.9	75.8	1
Dehydration of soil	178	95.2	73.0	4
Reduction in nearby water resources	178	95.2	73.0	2
Deterioration of air and water quality	174	93.1	71.7	7
Decrease in productivity of cropland	183	97.9	75.0	3
No more grazing land	178	95.2	73.0	6
Nowhere to collect fuel	176	94.1	72.1	5
Nowhere to gather construction timber	170	90.9	69.7	10
Nowhere to bury people	170	90.9	69.7	9
Harm to both human and animal health	172	92.0	70.5	11
Timber transport damages/pollutes roads	173	92.5	70.9	8
Other	8	4.3	3.3	12

N(A)=244, response rate (A) = 76.53%,

For cases in which an item was not ranked by respondents, the item was assigned a ranking of "13"

Each of the three types of project area state farm survey (household, small group, and state farm management) also evidence concern about the project's environmental impacts, though the percentage of each type expressing these concerns is less than that of the corresponding village or township group. For example, less than 40 percent of surveyed state farm households that work on Stora Enso land chose to respond to the question on negative environmental impacts, though 50 percent or more of

those that did were concerned about each of the environmental issues mentioned (Annex VII, Table 31). The project area state farm small group surveys also show some degree of concern for environmental impacts, though significantly less than in the village small group surveys (Annex VII, Table 32). Interestingly, state farm leadership expressed the strongest degree of concern among groups surveyed on project area state farms. Sixty-five percent or more of the 23 state farm management teams interviewed expressed concern about each of the negative environmental impacts listed (see Table 17-2).

Table 17-2
Main negative impacts of land rental to "the company" for plantation development (rank, with "1" as most important). (Project Area State Forest Farm Management)
Survey of 23 State Farm Management Teams in Project Areas

Negative Impacts of Project	Respondents	Percent of survey group (%)	Average ranking
Degradation in soil fertility	14	60.9	1
Dehydration of soil	15	65.2	2
Reduction in nearby water resources	15	65.2	3
Deterioration of air and water quality	15	65.2	5
Decrease in productivity of cropland	15	65.2	4
No more grazing land	15	65.2	6
Nowhere to collect fuel	16	69.6	8
Nowhere to gather construction timber	15	65.2	6
Nowhere to bury people	16	69.6	12
Harm to both human and animal health	15	65.2	11
Timber transport damages/pollutes roads	15	65.2	9
Other	5	21.7	10

N=23, response rate = 100%

Expert interviews in the field revealed that people's environmental concerns are indeed genuine and are generally directed at eucalypts as the chosen tree type. One woman living in a project village told the team that when the members of her collective agreed to rent collective land to Stora Enso, they had not been concerned. Now, however, 50 percent are worried about eucalypt toxicity and regret their decision (see Box 17-1 below for details). A young man in another project village, who had shared with the team several worries about land rental to the company, emphasized that his number one concern is the eucalyptus toxicity issue. He had heard that when eucalypts leave decay, they emit a toxin that affects water quality. As a somewhat different example, during fieldwork in a non-project village, the team learned that farmers in that area believe eucalypts reduce soil erosion and releases a gas that kills mosquitoes and decreases insect diseases associated with crops. Local farmers, however, worry the gas may also be harmful to people. Finally, the team discovered environmental concerns about eucalypts among state forest farm management. Comments from one branch farm manager on soil and water impacts are given below in Box 17-2.

It is recommended that Stora Enso take action to alleviate the environmental and health concerns of affected groups. The environmental analysis of this study suggests that rumour is largely responsible for driving the types of concerns described by people in the field. Yet, as illustrated by the village woman who sincerely asked the team whether eucalypt is toxic, people are genuinely worried. They deserve to be given the information they need to alleviate their fears, so that they may live happily and at ease with the new eucalypt plantations in their neighbourhoods. Indeed, it might be argued that these worries could unnecessarily impact the mental well-being and emotional comfort of villagers and that it is therefore a priority to address them. It is suggested that, as part of its broader information campaign, Stora Enso prepare a specific module to address people's environmental concerns about eucalypts. This education and awareness campaign should be addressed to all those villages in which Stora Enso has rented or plans to rent land. The approach could be multi-pronged. While simple brochures addressing concerns may be helpful, in-person presentations or "open-houses" in the field

with Stora Enso staff may be even more effective. The module should emphasize with photos that eucalypt is grown widely in developed countries (e.g. Australia) and is not a sort of "toxic pollution export." Other simple illustrations or diagrams should explain why eucalyptus leaves turn the water black (and what is contained in the black material), evidence about impacts on soil, and evidence about impacts on local water resources. More advanced articles could be disseminated to those with higher educational levels, including the management of the project area state farms and their branches.

Box 17-1

One Villager's Comments on Concerns about Eucalyptus' Environmental Impacts

At first declining to be interviewed, a village woman listened as others talked. She then asked the expert team whether eucalyptus is toxic. She said that she had heard that it is. While all in her collective had agreed to rent their collective land at the time the contract was signed, she explained, now they regret it, because they have heard eucalyptus is toxic, polluting the water and generating health hazards for people. When eucalyptus leaves fall in the water, they turn it black. (Another type of tree in the village turns the water black, she noted, but because it has been there for many years, people are not worried about it.) The interviewee emphasized that she does not know whether eucalyptus is toxic, but noted that 50 percent of the people in the village believe that it is. In a nearby village where eucalyptus has been grown, the people used to be anxious to get fuel wood when the trees were cut. Now that people are worried about toxicity, however, no one wants the fuel wood remaining from the harvesting. In November and December of last year [2004], the water in the wells was low; and many people wondered if it was because of eucalyptus. Finally, she noted that the company does not rent land in Guangdong nor in the US where people are rich, but comes to this poor place [her village] instead, because the people are poor and there is therefore less concern for their safety.

Box 17-2

Concerns of Branch Forest Farm Manager about Eucalyptus' Environmental Impacts

The manager, working for a branch of a state forest farm in a project area, mentioned that he had heard eucalyptus is bad for the soil and believes that it may reduce water resources. Seven or 8 years ago, before the branch farm had planted eucalyptus, the area had plentiful natural spring water. Now, since eucalyptus introduction, there is less and less spring water. Reservoir levels are declining; and the reservoirs are almost dry. Other trees have not caused this sort of problem. The manager has recently read an article, "Eucalyptus Against the Country," that outlines such negative impacts. Finally, the manager also mentioned that the forest farm has had some problem securing land from neighbouring villages, because some villagers believe eucalyptus is toxic and are therefore not willing to have it planted on their land.

Key Points from Chapter on Stakeholder Concerns About Eucalyptus Plantation:

- Affected groups have a high degree of concern regarding the negative health and environmental impacts of rental. People's concerns are genuine and directed at eucalyptus as the chosen tree type.
- Stora Enso should take action to alleviate the concerns of affected groups. As part of its broader information campaign, the company could prepare a specific module to address concerns. While simple brochures may be helpful, in-person presentations or "open-houses" in the field with Stora Enso staff may be even more effective.

Chapter 18. Natural and Cultural Heritage

Based on the information collected during field studies, no major structures or sites of natural or cultural heritage significance were identified in the project area. The project does not involve the movement of large amounts of earth and thus does not have a high potential for impacting cultural relics. According to some sources, however, Hepu County and other areas include ancient sites associated with the coastal part of China's earliest Silk Road. So, in developing forestry in these areas, measures to protect these cultural relics should be strengthened. Measures might include making contractors aware of cultural relic issues and passing this information on to their workers. Also of particular note, "*feng shui*" forests identified as vital remnants of the original vegetation owe their existence to the local cultural and spiritual beliefs that have fostered their preservation. These sites are recommended for protection because of their important spiritual and cultural values and because of their contribution to biodiversity conservation. The extent and location of these sites and their ownership and management are all far from clear and related studies sponsored by Stora Enso would offer long-term cultural and environmental benefit.

Tombs and burial sites within plantations are believed to be a common issue to be addressed. During the field visits and discussions with field managers and villagers, the team did not observe any evidence of conflicts on such an issue. At one point, round gravesites on a nearby hillside were visible from where the ESIA team interviewed village leaders. The leaders explained that they have a policy of not renting out the graves and an area of 3 meters around them. The community leaders told the team, there were no conflicts between rental and the graves. Apparently the "gravesite" policy used in the villages above is an acceptable one to the villagers and also one that Stora Enso has accepted. Existing graves, then, might be easy to deal with. The team's concern might then be "future graves." In some parts of rural China, a designated "fengshui" person will help look around to identify a good, high spot for a grave once someone dies. Rental of land might limit the options in terms of grave sites. Perhaps to avoid misunderstandings, SE would want to have a clear policy about (1) whether/how it would adjust the rental area if there was a need to add new graves on SE rented land or (2) clearly state that new graves should not be placed on rented land. The latter choice, however, may cause potential social conflicts with the communities around plantation sites.

Chapter 19. Scenario Analysis: What if the Stora Enso Project did not proceed?

An investment of the size proposed by Stora Enso has the capacity to make an influence at the national, provincial and local levels. The company has adopted the strategy of establishing a secure plantation base in southern China before committing to the pulp mill and developing their pulp capacity. The eventual area planted and productivity of land secured will influence the size and nature of the pulp investment. Should the Project not proceed this will reflect a lost opportunity but might open up alternative possibilities. Based on the team's comprehensive analysis on the impacts of eucalypt plantation, each of these scenarios (with Stora Enso and without Stora Enso) is evaluated at the national, provincial, and local levels.

19.1 At the National Level

Several recent studies have highlighted the substantial increase in demand for wood-based pulp in China. He and Barr (2004) have provided an excellent overview and concluded that the enormous increase in China's projected demand for wood-based pulp from 9 million tonnes in 2003 to 15 million tonnes in 2010 (equivalent to one additional new world class pulp mill per year for 5 years) will have substantial impacts upon regional and global supplies and place considerable new pressures on the country's internal wood supply. If China does not produce this pulp itself, it will need to be imported. Based on the assumptions of He and Barr (2004), that on average, across all grades, 4.3 m³ of roundwood (overbark) are needed to produce 1.0 air-dried tonne of pulp, the volume of wood consumed annually by China in the form of wood pulp - whether produced domestically or externally - will rise from just under 40 million m³/yr in 2003 to 65 million m³/yr in 2010. If it is assumed that about one-half of the raw materials will be grown in China, then new plantations will be expected to produce an additional 12.5 million m³ per year. Based on assumptions of 6 year rotations and average growth rates for new plantations of 20m³/ha/yr, a notional area of 650 000 ha of plantations will be required.

The *With GXSE Forestry Company Project Scenario* of plantation investments in Guangxi is consistent with national Chinese government policies relating to expansion of its pulp, paper and wood processing industries to meet projected needs. Eucalypt plantations are an integral part of the expansion.

The *Without GXSE Forestry Company Project Scenario* would not contribute to policy at the national level and would not change established Government policies regarding establishment in fast-growth, high-yield plantations and encouragement of foreign investment in the wood fiber, pulp, paper and wood processing sectors. From the information available to the ESIA team, it appears that the absence of Stora Enso's Guangxi project would have no impact upon national policies relating to the role of eucalypts for fast-growth, high-yield plantations.

19.2 At the Provincial Level

The Government of Guangxi Autonomous Region has recognized plantation forestry as a profitable and environmentally friendly land use opportunity and has developed supportive policies. The Guangxi Government is supporting the establishment of 2 large integrated pulp and paper projects, one based at Qinzhou (APP) and the other at Beihai (Stora Enso). The Government has decided that forest land in 7 cities (38 counties) and 8 State-owned Forest Farms should be dedicated towards supporting the raw material needs for these projects. This will be done in 2 ways – through rent/contract for suitable land at acceptable prices and benefit sharing arrangements. There are an estimated 350 000 ha of eucalypt plantations in Guangxi plus an equivalent of 100 000 ha in “four-sided” plantings. The 10th 5-Year Plan aims to increase this area to a total of 670 000 ha by 2010.

Further expansion of Guangxi's plantation base will be supported by a proposed World Bank Project which will finance the establishment of about 200 000 ha of timber plantations, much of which will be eucalypts.

The ***With GXSE Forestry Company Project Scenario*** of plantation investments in Guangxi will generate a Rmb 1.1 billion GDP contribution to the local government annually. It will offer tax revenues of an estimated tax Rmb 109 million annually. Behai City has estimated that should the full Stora Enso pulp mill and plantation project proceed, city revenues will increase by Rmb 1.3 billion (from the current Rmb 1.6 bill). Experience in other countries with substantial labour forces indicate that a pulp mill and plantation base of the size proposed by Stora Enso can generate about 30 000 new jobs in the community through the pulp mill, plantation management, harvesting, transport and service and supply industries (Eugene van As *pers comm.*)

Stora Enso's presence will offer a world class standard to the plantation and pulping sector in Guangxi offering transparency and world class commitments to sustainability, the environment and to corporate social responsibility.

The ***Without GXSE Forestry Company Project Scenario*** would not influence the magnitude of eucalypt planting in Guangxi. The Provincial Government's policies are clear regarding expansion of an industrial plantation base. From the information available to the EISA team, it appears that the absence of Stora Enso's Guangxi project would have no impact upon the ambitious establishment of a large industrial resource of eucalypt plantations. If Stora Enso withdraws from the project it is highly likely that other companies and investors will fill the void and establish eucalypt plantations. Competition for available land is stiff and eucalypts remain an attractive land use.

Should Stora Enso withdraw however, Guangxi faces the prospect of having a large eucalypt plantation resource without a substantial accompanying modern processing facility. This would represent a considerable loss of opportunity to the Province.

19.3 At the Local Level

At the local level, the ***With GXSE Forestry Company Project Scenario*** of plantation investments in Guangxi offers landholders and stakeholders the stability associated with 120 000 ha of sustainably managed plantations linked to a modern mill. It brings with it Stora Enso's technologies and commitment to Corporate Social Responsibility and sustainable plantation management. This will inject land lease and rental monies in excess of Rmb 72 million annually to local forest farms and farmers in some of Guangxi's poorer counties. In addition to direct employment opportunities through staffing, the project offers labour opportunities of 4.6 million days of labour annually worth approximately Rmb 115 million to the local and migrant labor market. As the plantations are established, opportunities for skills enhancement will emerge as mechanics, harvesting operators; drivers etc. are required for plantation operations. The project has the potential to provide a reliable market for trees grown by smallholders. .

Part of the annual tax revenue of over Rmb 109 million generated by through the project will flow back to communities in the form of government services and infrastructure. Improvements for in the social and environmental approach adopted by Stora Enso have been identified and are manageable and there are no technical impediments to sustainable production from the plantations provided Stora Enso maintains its commitment to Corporate Social Responsibility and to the principles of sustainable plantation management. The ESIA has identified a number of ways through which the project can potentially offer environmental benefits and contribute to biological diversity.

With the ***Without GXSE Forestry Company Project Scenario***, establishment of plantation eucalypts will remain an attractive land-use option. Field interviews have demonstrated that a strong interest exists with local leaders and entrepreneurs to make investments in eucalypt plantations. Such expansion of the eucalypt resource without the stability offered by a pulp mill, will introduce an

element of commodity risk to local farmers. The ESIA village and forest farm interviews (Chapter 14.5) received a number of local responses regarding the consequences of a Stora Enso withdrawal. These reflected a general feeling that a Stora Enso withdrawal would have little impact. Also included in these responses were:

- Uncertainty about finding buyers for the wood
- For collective land, challenges in managing the plantation as a collective asset
- Loss of trust in non-Chinese companies
- Land disputes
- Loss of employment opportunities

The indifference expressed to the possibility of the Stora Enso withdrawal could be linked to the general lack of knowledge about the project within the community. There was strong evidence from the field interviews and inspections that local investors and growers did not share the same commitment as Stora Enso to sustained productivity or social and environmental values. If Stora Enso is unable to establish a resource base then its pulp mill project will not proceed and opportunities lost.

From the evidence available to it, the team was unable to identify any meaningful attraction in the *Without GXSE Forestry Company Project Scenario*. In the balance, the economic benefits of the project and Stora Enso's strong public commitment to the environment and social values, far outweighs perceived disadvantages.

Key points of the Chapter on Scenarios:

- Should the Stora Enso Project not proceed, national policies for fast-growth, high-yield plantations, and related proposals and projects to expand eucalypt plantations in southern China will remain unchanged
- At the provincial level, plans and projects for an expansion of eucalypt plantations will remain unchanged.
- The consequences of Stora Enso's withdrawal at the local level were regarded as neutral by local people but as negative by authorities with loss of employment and income generation as major issues.

Chapter 20. Risks and Monitoring

20.1 Risk Analysis

Management of risk will be a strong influence on the success of Stora Enso's plantation project in Guangxi. The project in Guangxi is long term and will face many risks over the life of the project. Some of these can be controlled directly by the Company and others it can only influence. Experience elsewhere has demonstrated that productive, environmental and social risks for eucalypt plantations change with time. The risk profile can change as company operations and the plantations mature and relationships with the local communities stabilise. There are undoubtedly some unknown risks which may emerge as the result of as yet undiscovered technologies in growing trees and processing wood or because a more profitable land use options have been identified. During the course of the study a number of risks were identified and have been discussed in the text of this report.

Risks to productivity can change with time. The risk of damage to the soil, for example, is higher at site establishment and harvesting than during the growing phase and fire risks are higher during the growing phase when flammable undergrowth and litter may have accumulated. Plantation managers in Guangxi have identified Year 2 of the rotation as the period of greatest risk from typhoons whereas the risk posed by pests and diseases remains constant and vigilance is required throughout the rotation. Risks to biodiversity are greater when sites are cleared for plantation establishment, and at harvesting and subsequent re-planting.

Social risks also change with time, especially as relationships between the company and the community mature, trust develops and the corporate commitment to CSR becomes obvious to local stakeholders. If Stora Enso is perceived as a reliable and trustworthy partner, it is highly likely that risks associated with land access will decline with time. Whilst timely supply of rural labour might be a risk at plantation establishment, availability of skilled workers for harvesting and transport might be a risk at the end of the rotation. The communities also face risks which will influence their attitudes and actions towards Stora Enso. Will they be paid on time for land rental? Is the agreed rental fair and representative of market rates? Is the company presence preventing the rural communities and villagers from taking new opportunities? Some social risks will be associated with the consequences of China's rapid economic changes and the impacts of rural communities, for example, employment opportunities elsewhere and the availability of labour in rural areas.

Social impacts and risks may also change with the stage in the plantation cycle. It should be recognized that the social assessment conducted only touches upon the early phases of the plantation cycle: the early days of the land being idle, land clearing, and planting. Future stages, particularly harvesting, which will include heavy activity on the land and increased truck traffic, may have impacts that stakeholders have not yet envisioned. It will be important for follow-up monitoring work to cover all phases of the plantation cycle in order to identify any unanticipated issues.

The ESIA team was unable to make any detailed assessment of financial risks associated with the project as figures associated with financial analysis remain confidential to the company. The team observed however that it was highly unlikely that an international company of the size and reputation of Stora Enso would make a project commitment unless the financial risks were acceptable and manageable. However, financial risk may evolve if, for example, the international prices for pulp drop markedly.

The greatest risks to the sustainability of the Project relate to the capacity of Stora Enso to maintain its corporate commitment to transparency, its laudable policies of Corporate Social Responsibility and to

the principles of sustainable plantation management. These commitments and obligations address all of the above issues and could change through adjustments to Stora Enso's corporate policies or through the company being prevented from fulfilling CSR obligations because of conflicts with Chinese policies or accepted practices at a national or provincial level. The ESIA found no evidence that Stora Enso or the Chinese Government and the Guangxi Administration had anything other than the best intentions for the plantation project, and were committed to CSR and the principles of sustainable plantation management. However company policies and Government imperatives and directives can change with time and such changes might foster adjustments to operational practices and approach. In addition, it is known that there is often a gap between central policies and on-the-ground implementation in China. Although the Company and Government may have the best of policies and principles, effective implementation will be perceived as the proof of these commitments. The most important step in mitigating risk will be an effective and transparent program of engagement with local communities, diligent monitoring during all phases of operations, and accountability of local management for breaches.

It is expected that Stora Enso will follow normal corporate practices and install a comprehensive corporate risk strategy for its operations in Guangxi. This strategy would logically include technical, social, environmental and financial elements and include a comprehensive series of mitigating measures. The ESIA therefore provides a series of enhancement and mitigation measures in this Chapter that Stora Enso might consider. Adherence to the principles of sustainable plantation management and CSR will be powerful mitigating factors in minimising risk.

20.2 Monitoring

To prepare for risks and to ensure that the project remains successful, comprehensive monitoring systems are essential. Such systems will enable both the Government and Stora Enso to respond to issues which might affect productivity, the environment or the community. These systems will also provide the data against which Stora Enso's own commitments to Corporate Social Responsibility and sustainable plantation management will be judged. The ESIA has identified requirements for monitoring and an integrated environmental and social monitoring plan is suggested. Table 20-1 offers the possible elements and potential indicators for a monitoring plan which could be used for assessing corporate performance and offering inputs to the risk management plan.

Maintenance of plantation productivity requires ongoing monitoring and this is being done by Stora Enso via the network of Permanent Sample Plots (PSPs) and Stora Enso's forest inventory database (SimSilva). The PSPs represent all main clones, geographic location, major soil types and site preparation types. Through this system, clonal distribution, operations and silvicultural treatments are recorded and monitored and trends in tree growth, soil quality and nutrition assessed. This central information base will provide basic data for assessments of long-term productive sustainability.

Monitoring of and indicators for the social issues and risks identified should focus on the two core areas of land rental and plantation labor. One of the chief recommendations for Stora Enso in the rental area is an information campaign that will encompass many sub-issues, such as villager concerns about the health and environmental effects of eucalyptus, villager lack of clarity on adjustment or rental rate, etc. The information campaign should include site visits to rental villages by Stora Enso staff. The various components of the information campaign will be monitored chiefly by their extent of coverage and implementation. A key question, then, will be what proportion of stakeholders (whether it is private renters or members of collectives renting out land) have been reached by the campaign. Site visits by Stora Enso staff to villages and face-to-face meetings with villagers will be an opportunity to gather qualitative information on the effectiveness of the campaign. Villagers can be asked about their current attitude towards eucalyptus, their understanding of rental terms, etc. In order to gauge the effectiveness of other measures taken in the rental area, a second social survey (perhaps less extensive than the first) might be conducted within two years, with questions addressing satisfaction with the private rental process, means by which collective rental decisions are made, etc.

For labor issues, it is recommended Stora Enso institute a formal monitoring system. Through this system, Stora Enso staff should visit a site of each contractor periodically and at least annually. Monitoring visits should probe compliance with health and safety, minimum wage, and contract criteria (all guidelines previously provided to contractors in writing), as well as aim to identify any new problems that may have arisen. The monitoring visits may also be used to inform workers of Stora Enso's grievance hotline. For further assessment, plantation workers might also be included in the aforementioned follow-up social survey.

Table 20-1
Framework for Monitoring and Risk Assessment

Issue Area and Risks	Suggested Measure	Sample Indicators
<i>Production Issues</i>		
Plantation management unable to maintain site productivity	• Stora Enso offers public commitment to Sustainable Plantation Management • Communication program for sustainable plantation management in place.	• Wood production data available via PSP • Soil physical properties data available via PSP • Soil chemical properties available via PSP and fertiliser needs identified • Fertiliser application managed to ensure effectiveness • Soil cover practices are working – undergrowth and litter layer via PSP • Continuous improvement via R&D • Litter and slash managed appropriately during harvesting • Local fuelwood needs assessed and accommodated through appropriate policies
Pests and Diseases outbreaks in plantations	• Pest and Disease Monitoring Program in place • Pest and Disease Monitoring Program communication program in place	• Identification and pest/disease management skills available • Monitoring program operational • Response strategies in place • Wide array of clones available and used with different clones segregated in blocks. • Pest/disease resistance incorporated into tree breeding program.
Best clones are used to ensure high productivity	• Tree breeding program in place • Best available clones used	• Tree breeding program produces superior clones • Engagement with other breeders to facilitate exchange/ purchase of superior clones
Fires damage plantations.	• Fire protection and response strategy in place • Fire protection strategy communication program in place.	• Fire protection strategy in place and implemented. • Fire breaks established and strategic alignment of roads • Suppression equipment and trained staff available • Engagement with local communities and neighbours.
Typhoons damage plantations and/ or infrastructure	• Typhoon response program in place	• Typhoon response program in place with field

	• Typhoon response program understood by staff and stakeholders.	• operations. • Appropriate site management practices in place • Appropriate clones being used
Harvesting and Transport offer community risk; are expensive or inefficient.	• Harvesting and Transport strategy and plans in place. • Harvesting and Transport strategy communicated to all stakeholders	• Harvesting and Transport strategy and plans operational • Skilled operators available and working for SE • Contractors and operators follow corporate standards for safety, site protection and the environment. • Adequate systems in place to prevent threat and ensure accurate sharing of possible benefits with growers. • Transport system sympathetic to local use of roads in place – timing of transport and selection of routes • Adequate repair, maintenance and rest facilities available • Links with community engagement programs
Corporate Governance Issues		•
Stora Enso CSR policies are not observed	• Stora Enso CSR policies available in both English and Chinese languages • Stora Enso CSR policies widely distributed and discussed during community engagement	• CSR policies understood by stakeholders • Possible inconsistencies with Chinese national and provincial regulations and practice identified • Dialogue with national, provincial and local authorities continues • Stora Enso follows CSR policies
Stora Enso policies on fibre procurement are not observed.	• Stora Enso's fibre procurement policies available in both Chinese and English • Stora Enso fibre procurement policies widely distributed and discussed during community engagement	• Fibre procurement policies understood by stakeholders • Stora Enso follows fibre procurement policies
Stora Enso commitment to sustainable plantation management is not observed	• Stora Enso's interpretation of sustainable plantation management in place. • Stora Enso's interpretation and obligations to sustainable plantation management widely disseminated	• Stora Enso policies shared and understood • Stora Enso commits to sustainable plantation management in China • Stora Enso follows sustainable plantation management principles • Community and contractors understand policies.

Government policies and practices preventing Stora Enso from achieving corporate policies.	- Guangxi Government maintains transparent policies. - Guangxi's policies are communicated effectively to Stora Enso	- Stora Enso policies shared and understood by Government stakeholders - Maintains a dialogue with SE to identify policies and practices which might be inconsistent with achievement of SE CSR - Tax issues and obligations clarified and communicated with all levels of administration in Guangxi
<i>Environmental Issues</i>		
Negative affects on biodiversity conservation	- Stora Enso puts operational standards consistent with CSR in place - Operational standards communicated	- Operational standards understood by staff, contractors and the community. - Native forest remnants identified and assessed for species composition - Riparian zones are protected during operations - Conservation programs for key species in place - Landscape diversity issues discussed with Government and other land users - Appropriate harvesting procedures in place to minimise site disturbance - Active dialogue with local communities and native forest managers in place - Local priorities for biodiversity have been identified and considered
Negative affects on soil protection and conservation	- Operational standards for soil conservation in place - Operational standards effectively communicated.	- Soil runoff (quantity and quality) - Soil cover maintained in line with Management guidelines - Treatment of soil assessed during establishment and harvesting operations. - Roads designed and aligned to minimise soil movement
Negative affects on water quality and quantity	- Operational standards for water quality and quantity in place - Operational standards effectively communicated.	- Demonstration catchment and water balance study established at a site <1200 mm rainfall - Groundwater and run-off quality monitored. - Strategically placed groundwater level monitoring stations put in place and regular measurements made - Regular dialogue and information sharing with local communities is ongoing

Stora Enso operations present undue risks due to chemical Hazards	• Stora Enso operational standards for hazards management are in place • Stora Enso operational standards for hazards management effectively communicated.	• All chemicals are safely stored • Response strategies, trained staff and equipment are in place for spills • Regulations for chemicals use are well understood by staff and contractors • Oils from machines and vehicles are disposed of appropriately.
Negative effects on air quality	• Stora Enso operational standards for air quality and noise management are in place • Stora Enso operational standards for air quality and noise management effectively communicated	• Stora Enso policies shared and understood • Noise and dust from timber trucks • Carbon sequestration possibilities measured and considered.
Negative effects on cultural heritage	• Stora Enso operational standards for effective cultural heritage management are in place and consistent with CSR • Stora Enso operational standards for cultural heritage effectively communicated	• Community dialogue in place to identify sites • Sites recorded • Feng shui forests respected • Tombs/ gravesites respected
Negative effects on natural habitat and native biodiversity	• Stora Enso operational standards for effective natural heritage management are in place and consistent with CSR • Stora Enso operational standards for natural heritage effectively communicated	• Dialogue with community and experts in place to identify natural sites • Sites recorded and mapped • Native forests and protected areas respected • Hunting and collection by migrant laborers controlled • Fuelwood deficits mitigated (see below)

<i>Issue Area and Risks</i>	<i>Suggested Measure</i>	<i>Sample Indicators</i>
Land Rental: Transparency, Voluntarism, Equity		
People in project villages continue to be concerned about health and environmental impacts of eucalyptus.	• Stora Enso develops and implements information campaign module on health and environmental impacts of eucalyptus.	• Within one year, site visits and "open houses" carried out by Stora Enso staff in 50% of project villages; brochures on health and environmental impacts distributed in 100% of project villages.
Speculators become involved in re-rental of land to Stora Enso.	• Stora Enso maintains data on re-rental margins (based on re-renter's original contract with land-holder); unreasonable margins brought to the attention of local governments and more equitable solutions sought	• Database of re-renters and their re-rental margins updated in timely fashion. No margins over a predetermined rate (e.g. 10%).
More and more farmers feel uninformed or not fully in control of decision to rent their private land.	• Stora Enso monitors private rental process and provides input to improve situation through information sheets, contract or contract summaries, and guidelines for local officials.	• Within one year, information sheets provided to all households involved or potentially involved in private land rental; contracts or one-page contract summaries provided to all households renting private land; guidelines provided to all involved local officials. • Follow-up survey in two years finds 90% or higher satisfaction with private land rental process.
Decision to rent collective land rarely made by voting.	• Stora Enso encourages local governments to adhere to voting policy, asks small team leaders to verify vote by signature, and provides information sheets to involved families.	• Within one year, small team leaders verify that vote was held in 90% of new collective land rental cases; information sheets provided to 90% of families involved or potentially involved in collective rental • Follow-up survey in two years finds that 90% or more of collective land rental decisions were made by 2/3 vote
Villagers are concerned about or actually short of fuel wood due to land rental.	• Prior to rental, Stora Enso clearly enunciates its policy for making litter and harvesting scraps available	• Within one year, 90% of villagers renting private or collective land are informed about Stora Enso's litter and harvesting scraps policy through either village visits of Stora Enso staff or distributed brochures. • Follow-up survey in two years finds that

		90% or more of households do not suffer from newly introduced fuel wood shortage.
Village households dissatisfied with rental of private land because rental period too long and rental rate too low.	• Stora Enso informs households of its policy to adjust rental rates every seven years.	• Information on rental rate adjustment disseminated to 90% of villagers involved in private rental through brochures or Stora Enso staff site visits within one year. • Follow-up survey in two years confirms that 90% of villagers aware of rental adjustment policy
After village land rental, plantation development is slow to proceed and farmers worry they will not receive rental payments.	• Stora Enso contractors initiate plantation development within 3 months of contract signing OR Stora Enso informs households of expected timing.	• Within one year and for all new rental contracts, plantation development proceeds within 3 months of signing or 90% of involved parties informed of expected delay. • Follow-up survey in two years confirms strong majority (>80%) not concerned with slowness of land development.
Labor: Health and Safety		
Sunstroke, malaria, dengue, or other ailments become common problems among plantation workers.	• -Stora Enso provides written health and safety guidelines including provision of headgear and water to prevent sunstroke and provision of mosquito nets for workers living in tents to prevent mosquito-borne illnesses • -compliance monitored; monitoring system also designed to detect any other health problems	• Within one year, health and safety guidelines provided to 100% of contractors • Within one year, monitoring of all contractors shows 90% compliance with sunstroke prevention measures and provision of mosquito nets as required. • Within one year, any new health problems detected through monitoring are dealt with in timely fashion
Because of poor living conditions in tents, migrant workers suffer mosquito-borne disease or are injured by natural disaster	• Stora Enso consider "raising the bar" by building or otherwise providing permanent shelter near migrant plantation work sites	• Within one year, permanent shelter offered to at least 20 groups of migrants.
Fatalities or injuries due to slow emergency response occur	• In health and safety guidelines for contractors, Stora Enso provides direction on emergency response, including availability of mobile telecommunications to remote workers and vehicle availability when possible • Compliance monitored	• Within one year, guidelines on emergency response provided to all contractors as part of health and safety guidelines. • Within one year, monitoring shows that all remote work teams have access to

		mobile telecommunications; vehicles are provided when possible
Labor: Wages and Contracts		
Contractors do not meet Guangxi's minimum wage requirements	• Stora Enso provides contractors with written guidelines (including minimum wages by area as obtained from Guangxi Labor Bureau) and monitors for compliance	• Within one year, minimum wage guidelines distributed to 100% of contractors; Stora Enso monitoring visits to work teams of all contractors verifies compliance
Contractors do not meet Guangxi's employee contract requirements	• Stora Enso provides contractors with written guidelines situations for which Guangxi Labor Bureau's requires contracts; sample contract obtained from Labor Bureau also provided to contractors	• Within one year, employee contract guidelines distributed to 100% of contractors; Stora Enso monitoring visits to work teams of all contractors verifies compliance in any cases in which contracts required
Labor: Labor Disputes		
Unresolved labor disputes (e.g. non-payment of wages, etc.) become common on Stora Enso plantation land, disrupting progress	• Stora Enso encourages contractors to provide workers (or groups of workers) with written contracts, even when not required by law • Stora Enso expands its grievance hotline to accommodate workers • Workers informed of hotline during monitoring visits	• Within one year, 75% of workers aware of grievance hotline • Within one year, monitoring visits reveal few, if any, labor disputes.
Women and Minority Issues		
Women are discriminated against in employment opportunities at Stora Enso Guangxi or with its contractors; women are paid lower wages	• Stora Enso emphasizes wage equity and equal opportunity for women among its own employees and encourages contractors (through contractor guidelines) to do the same • Stora Enso includes the issue of compensation of female workers in its contractor monitoring framework	• Within one year, monitoring shows that contractors pay women equally for equal work
Minorities have problems getting paid by contractors and are increasingly harassed by locals	• Stora Enso includes in its contractor guidelines reference to equal and appropriate treatment of minority migrant workers	• Within one year, monitoring shows that problems between contractors and minority migrant workers are minimal
Minorities unwilling to rent land to Stora Enso because of poor communications and misunderstandings	• Stora Enso further investigates issues of minority land rental and develops communications tailored to address minority concerns	• Survey in two years shows local minority relations with the company are positive
The Poor		
Funds from Stora Enso community development project do not reach the poorest or neediest	• Stora Enso chooses one of the key "poverty villages" targeted by the Guangxi Government for its community development project • Measures are taken to ensure benefits reach the poor at the village level	• Within two years, community development project implemented in key "poverty village" • Follow-up survey in three years shows benefits are reaching the poor at village

		level
Information Flow		
Stakeholders do not have a clear idea of who Stora Enso is and see it as "just another company" so that information campaign is not effective	• Stora Enso works to strengthen its brand with stakeholders through logo, name, or other measures	• In follow up survey in two years, 90% of households in project villages are very clear of who Stora Enso is
Stakeholders desire for additional information is unmet	• Stora Enso implements information campaign, including face-to-face exchanges between Stora Enso staff and villagers • Stora Enso develops a database of all households involved in either private or collective rental and records liaison with them	• Within a year, Stora Enso staff have held "open houses" (as above) in 50% of project villages; various information sheets distributed to all project villages • Within a year, database of stakeholders up and running and relatively complete (90% of affected households included)

Part VI

Conclusions, Recommendations and Suggestions

Eucalypts are a preferred source for high quality fibre for China's expanding modern pulp and paper industries. Given the positive and supportive policies at national and provincial level and the pressing market needs, it is inevitable that the commercial eucalypt plantation estate in southern China and specifically Guangxi will expand substantially. Provided the principles of sustainable plantation management are respected and followed, eucalypt plantations offer an economically, socially and environmentally attractive option for supply of high quality raw material to meet national needs.

Stora Enso has a strong and publicly expressed policy of corporate social responsibility and a clearly stated set of Principles for Sustainable Wood and Fibre Procurement and Land Management which are consistent with the principles of sustainable plantation management and its components of productivity, the environment and social responsibility. Their activities in Guangxi have not contributed to environmental degradation or loss of biodiversity and have not resulted in any social dislocation. If their corporate commitment to corporate policies and principles is maintained, Stora Enso can make a positive contribution to Guangxi's expanding estate of commercial eucalypt plantations and offer a benchmark for operational practices of international standard.

Given the complex land ownership/ land tenure issues in southern China, it is highly unlikely that any one company will be able to control the entire resource base necessary to supply a large modern pulp mill. It is inevitable that smaller growers and plantation managers will become an intimate part of the wood supply equation and industry partnerships with smallholders will expand. The ESIA has found that while the issues surrounding sustainable productivity and the environment (specifically water and biodiversity) can be adequately addressed, the greatest challenges facing Stora Enso in its Guangxi operations are those relating to effective and positive engagement with landholders and the local communities. Communities, in general, have a poor level of information about Stora Enso's Guangxi project and harbour many popular negative misconceptions regarding eucalypt plantations. Enhanced engagement and information flow with the land-using communities in its project area will be the linchpin to Stora Enso's success in southern Guangxi.

Whilst the Environmental and Social Impacts Assessment of Stora Enso's eucalypt plantation project in Guangxi had an obvious focus upon the company's operations, other needs were identified during the fieldwork and surveys. Some needs which deserve attention from both Government administrations and Stora Enso are:

Tax. The study has demonstrated that the Stora Enso project will deliver substantial revenues through taxes, fees, levies and other administrative imposts from local governments. In the past, a significant part of the mill door delivered cost of wood in Guangxi was taxes and fees. While these have been reduced substantially, there is still some lack of clarity with regard to taxes and fees. Earlier studies in Guangxi in 2003 identified some 30 different taxes, fees, government charges, and other levies, which were due between harvesting and delivery to the mill gate. In Jiangxi, similar studies have identified some 14 "unofficial forestry fees" imposed by county, prefecture, township and village administrations. Whilst these taxes can obviously benefit the broader community, they have in the past also acted as a serious disincentive to growers of commercially grown wood and successful and competitive wood processors. The issues surrounding tax on commercially grown eucalypt wood in Guangxi are far from clear and there is a pressing responsibility for Governments and administrations at all levels to provide clear and unambiguous rulings.

Advocacy for viable land use options on private and community lands. Stora Enso has an understandable corporate commitment to promote the merits of plantation forestry as a viable land use alternative in southern Guangxi. The Provincial government and administrations at city, county and commune level have a similar commitment to Government policies which promote plantation establishment. The ESIA study could not identify any source of impartial advice for farmers and communities wishing to assess and discuss independently land-use options for their private and community lands. This obviously places the land-users at a severe disadvantage when discussing and negotiating plantation proposals with companies or forestry bureaux. ESIA team suggests that such a mechanism be put in place. There are obviously overlapping roles for Government and the Company in this exercise. The benefits of such impartial information lie in better-informed land-users with a greater commitment to the land-use they have chosen. The ESIA team is of the view that leadership for this exercise is a Guangxi Government responsibility as they have the authority, the extension infrastructure and range of knowledge and technical skills to effectively deliver such a service.

Maintenance of landscape diversity. In promoting and expanding the substantial eucalypt plantation base in Guangxi, maintenance of landscape diversity will remain an important consideration in sustainability for all plantation growers. There is a role for the Provincial authorities to offer coordination in southern Guangxi to balance the legitimate commercial needs of Stora Enso, Asia Pulp and Paper, Guangxi Oji Plantation Forest Co and other growers with the needs to maintain a healthy landscape diversity.

Government support for Stora Enso's policies of CSR and the principles of sustainable plantation management. Whilst Stora Enso has a corporate commitment to CSR and to transparency, these worthy principles can only be delivered within the context of China and Guangxi. If Guangxi is to benefit from Stora Enso's high technical, environmental and social standards, then the Government is encouraged to work with them to facilitate achievement of these standards. Examples where such dialogue and cooperation might be required are via equitable and transparent systems for land acquisition, treatment of migrant workers and exchange and transfer of hybrid clones. This issue should remain a regular item of discussion between the company and the Guangxi authorities and is critical in the possible absence of media coverage or supportive NGOs.

Monitoring. Both the Government and Stora Enso will need to monitor and respond to issues which might affect productivity, the environment or the community. Monitoring systems will provide the data

against which Stora Enso's own commitments to Corporate Social Responsibility and sustainable plantation management will be judged. An environmental and social monitoring plan is important and would be integrated with the regular monitoring of plantation productivity and should logically incorporate the following elements:

- **Production.** Maintenance and improvement of site productivity, clone performance,
- **Environment:** Issues relating to soils, quality and quantity of water and biodiversity at species, ecosystem and landscape levels.
- **Social:** Issues relating to skills development, poverty, access to infrastructure and services, quality of life (including health and housing), gender and levels of community consultation and participation.

Within the context of these broad themes, the ESIA offers the following findings, conclusions and recommendations.

Theme: Technical Knowledge and Sustained Productivity

1. Findings and Conclusions

Water. Whilst the issue of eucalypts and water use is not expected to become a constraint in the high rainfall/ high humidity conditions of south and south-east Guangxi, the assessment on water balances demonstrated that there was little publicly available information available on water balance on sites with <1200 mm rainfall (such as Dongmen). There is also little information available on the impacts of intensive silviculture (such as high fertiliser application) on water quality of runoff. There is a need to monitor water quality under commercial plantation management.

Site Management. Enhancing the chemical and physical properties of soils will be the foundation for sustained productivity of Stora Enso's plantations. Given experience in China and in other countries, it is expected that Stora Enso's plantation program will sustain and improve soil fertility in successive rotations. For these reasons, ongoing experiments in nutrition should be a feature of Stora Enso's R&D program. This will also guard against using excess fertiliser.

Pests and diseases. Given the capacity for diseases and insect pests to inflict severe and rapid damage upon clonal eucalypt plantations, a disease and pest monitoring program should be part of Stora Enso's R&D program. Insect pest threats include the recently-described, gall-forming wasp, *Leptocybe invasa* which is known to have clonal preferences in attack. The eucalypt rust *Puccinia psidii* poses a potential threat to the eucalypt forest industry in southern China and has recently been recorded in Hawaii. Any proposals to transfer germplasm from South America to southern China should be discouraged or given the greatest phytosanitary caution.

Tree Improvement and Breeding. Eucalypt plantations in Guangxi are increasingly relying on planting material from a very narrow genetic base. A lengthy program of clonal reproduction and selective breeding has produced eucalypt hybrids that have very desirable growth properties but may be susceptible to environmental stresses and diseases. A small number of clones of a small number of hybrids compose the majority of the industrial eucalypt plantations in Guangxi and this offers a serious risk to productivity through predation by pests or diseases.

A disease resistance genetic selection program and a broader selection of high yielding clones selected for wood quality will be vital components of Stora Enso's R&D program. Given that some wood will come from outgrowers, and the ease of clonal propagation, it is unlikely that Stora Enso will be able to maintain exclusive proprietary use of any newly-developed germplasm. It would be logical for eucalypt growers in southern China to work together on the development of new clones and on a response program for

eucalypt diseases. The concept of a cooperative R&D program to bring all growers and research providers together deserves careful consideration. Models which might be studied include the Southern Tree Breeding Association (STBA) in Australia for *E. globulus* and *E. nitens*.

Despite reports from Brazil and the Congo that that replanted trees were usually more productive than coppice, it is recommended that coppice should be adopted for the second rotation of eucalypt plantations on poor sites unless better genetic material is available for planting in south China

Biodiversity Conservation. Stora Enso's corporate commitment to Guangxi's extraordinary natural biodiversity is valued. The company has skills and experience which can contribute to the conservation of native species drawn from the region's *fengshui* forests, in particular, the development of suitable propagation techniques for lowland rainforest species. The *fengshui* forest sites are recommended for protection because of their important spiritual and cultural values and because of their contribution to biodiversity conservation. Stora Enso might consider concentrating its efforts for meaningful restoration of native vegetation upon a single block of ecological forest within a catchment area in the project area. This would ensure long-term protection and collaboration with Government agencies.

2. Recommendations

Stora Enso should maintain its commitment to a robust program of applied R&D and maintain its engagement with research providers in China and other countries. Important elements of the R&D program should include:

- Monitoring of water quality of runoff from intensively managed plantations and water use at sites where rainfall is less than 1200 mm.
- Experiments in nutrition to maintain and improve the chemical and physical properties of soils.
- A monitoring program for pests and diseases
- A breeding program which seeks to develop (or gain access to) a broader suite of clones as early as possible.
- Consideration of a cooperative breeding program with other commercial eucalypt growers in southern China.
- Adoption of coppice management for the second rotation on poor sites until a broad suite of better genetic material is available for planting
- A program of practical biodiversity conservation that captures the valuable biodiversity of the *fengshui* forests and focuses efforts on one site, utilising the technical skills within the company to restore biodiverse native forest and recover populations of threatened species.

Theme: Engagement with Society

1. Findings and Conclusions

Effective and positive engagement is critical to the success of the project. Stora Enso's plantation program when functioning fully will affect a population of the order of 650 000 people in 130,000 households for land rental alone. This offers substantial challenges in engaging and communicating effectively. The overall project (including the proposed pulp mill) is expected to generate employment opportunities for the wider community of up to 30 000 people. Poor initial engagement with affected communities could offer considerable risks to Stora Enso's plantation business. Should communities refuse to rent land, or offer labour or, in the worst case, prevent Stora Enso conducting its legitimate operations through civil disobedience, the business attraction of the Guangxi project will be diminished. A number of examples from the Social Assessment demonstrate the need for enhanced engagement with communities.

The eucalypt rumour mill. There has been an unfortunate gap between rumour and reality relating to perceptions of the environmental impacts of eucalypts in the project area. The Environmental Assessment team was unable to locate any reliable scientific information to substantiate popular claims about eucalypts or examine credible examples of environmental damage in the field or reports from the expert testimonies and the international literature search. Despite a wealth of scientific evidence which demonstrates that eucalypts are benign if managed correctly, the Social Assessment clearly showed that the villagers have a genuine concern that eucalypts may have a negative impact upon human health, reduce water tables, and poison the soil along with other negative environmental effects. Stora Enso must treat these community concerns seriously and sympathetically. This information gap needs to be addressed as a matter of some urgency and will be of interest to the Provincial Government and other commercial plantation owners.

The Stora Enso rental offer. At the level of land-user there remains a lack of information regarding the nature of the rental arrangement offered by Stora Enso. Elements of the rental proposal were not understood in some communities or were misinterpreted or had not been supplied by community leaders. A large number of individuals interviewed were unhappy with the rental option because of the 30 year term but were unaware of the clause for review at 7 years. Finally, while middle persons (both those that help the company secure land and those that rent land from others and re-rent to Stora Enso) do not appear to be benefiting excessively, Stora Enso may wish to monitor their involvement. The company may also wish, to the extent possible, to work directly with those renting their land, so as to avoid association with the increasing income disparities emerging in some parts of rural China.

Information flow and transparency. A critical need exists to improve the flow of information from the company to its "village rental" and other stakeholders and to ensure greater transparency in the process. Information relating to land rental must reach those who use the land not simply village and community leaders. Brochures and posters may not be the most effective media and the company could employ a number of additional means such as:

- Utilising the foreign novelty of Stora Enso and to maintain a greater presence of foreign staff in the field helping to explain the project.
- Development of peer support groups within villages.
- Establishment and support for forest plantation associations which include land users and managers, contractors and other stakeholders.
- Expanding the functions of the company's Hotline
- A strengthened schools' program and additions to the curricula.
- Development of telecentres (web-based information systems) as a part of the school computer program.
- In the longer term, an annual opportunity to look over the pulp mill.

Concerns regarding fuelwood. The poorest in the community still depend upon fuelwood collected from community and private forest land. There are common perceptions that they will be denied access to collect fallen woody branches or woody harvesting residues from areas under Stora Enso's management. Discussions with Stora Enso managers suggest that the company wishes to keep leaf and bark residues on site for soil protection, nutrient recycling and water conservation and are willing to allow collection of fallen woody branches and woody harvesting residues for fuelwood. This important message has not yet reached the affected people.

Records of village stakeholders. Accessible records will be important tools for company as it strengthens its contacts with village and community stakeholders. The large numbers suggest that computer-based systems will be very useful and the company should upgrade its information systems to accommodate a

database including, to the extent possible, the name, location, and nature of rental, of each and every household involved in the project. The database might also keep a record of company liaison with and information flow to each of these households and provide further opportunities for engagement and a route for comment and feedback through regular review procedures.

Perceptions of slowness. The team also learned in the field that there were some concerns about Stora Enso being "slow" to develop the land and that rental payments were delayed because of slowness in determining exact land area and borders. Farmers are generally concerned about being cheated and, when Stora Enso does not develop the land for some time after rental, their concerns tend to grow. Prompt payment is central to developing trust in any contract in any culture and situation and must be high on Stora Enso's administrative priorities.

Participation in community decision-making. The study found that community participation in the decision to rent collective lands to Stora Enso was weak and there are indications that this explained why the community satisfaction with the land rental option was often low. Stora Enso could request that township officials work with the village collectives to ensure that the procedure of 2/3 vote is followed during decision making regarding plantations on collective land. Participation of state-owned forest farm workers in the decision to rent state-farm land is also weak. Opinions vary as to whether such participation is necessary. As such, the issue of state-farm worker participation in rental decisions or at least that of their being informed of and benefiting from rental should be further examined.

Participation in tree growing. The preferred model of cooperation with the company's plantation development appears 'overwhelmingly' for farmers to plant trees on their land and sell them to the company. If farmers are to play a significant role in future as outgrowers to supply wood, the local authorities (and Stora Enso) may need to consider matters such as the availability of low interest loans and felling permit regulations. These have been identified in other studies as inhibiting smallholder enterprises (e.g. Liu 2003).

2. Recommendations

- The company strengthens its communication practices with local communities and seeks expert advice on means through which more effective and transparent flow of information to all levels of affected communities can be achieved.
- The company addresses a matter of urgency, issues surrounding clarity and transparency of rental agreements, fuelwood collection and community perceptions of slowness.
- As a specific module in its communication program, the company (and its Government supporters) should not leave the eucalypt rumours within the communities unaddressed. Brochures, field demonstrations and face to face meetings with concerned communities should all be a part of a program that seeks to respond sympathetically to community concerns and reinforce the environmental credentials of the eucalypt program.
- Stora Enso works with the Provincial Forest Department to enhance the capacity of local farmers to participate in private eucalypt growing in the project's area of activities. Specifically low interest loans and felling regulations should be addressed.

Theme: Commitment to Stora Enso's corporate principles

1. Findings and Conclusions

The ESIA team noted that there is a difference between what is legally acceptable for establishment of plantations in rural Guangxi and the highly regarded CSR and sustainability principles of Stora Enso. Based on feedback from forest farms and individuals who have established private plantations, Stora

Enso's commitment to corporate policies relating to Corporate Social Responsibility (primarily community engagement, sustainable productivity and environmental issues) will inevitably incur additional costs which are not required by other growers. Whilst this might place the company at a short-term cost disadvantage compared with its direct competitors, long-term investments in community engagement and environmental sustainability invariably offer pleasing long-term returns.

The survey's results suggest that the working conditions and income afforded by the Stora Enso-related opportunity are similar to those workers believe they would find elsewhere. Survey results also indicate that the majority of workers on Stora Enso land find that work to be preferable to agricultural work in their own fields.

The study noted that Stora Enso is already taking important steps to improve health and safety standards and the company is encouraged to maintain its commendable efforts in this direction. Since August 2004, the company has required all units to report all fatal and serious accidents (involving both Stora Enso's own employees and those of its contractors). In 2006, Stora Enso Guangxi will implement Occupational Health and Safety Management System 18001 (OHSAS 18001).

Stora Enso has clearly defined corporate guidelines for treatment of its own directly employed staff. Contractors play a vital role in Stora Enso's operations and there is a reasonable company expectation that they will offer safe, fair and attractive working conditions to their contracting crews. It is in Stora Enso's own best interest to ensure that contractors look after their workers and that work on the company land is seen as attractive and the company becomes an employer of choice. This will ensure that they retain skilled workers with knowledge of plantation standards. As part of this process, regular technical updates for contractors should help maintain high standards in field operations.

Contractor Services. The field studies suggest that serious on-the-job health and safety problems are uncommon among those working on Stora Enso's Guangxi plantations. The contractors interviewed who have contracts with Stora Enso were abiding by legal needs and the accepted standards in Guangxi. However, Stora Enso should provide simple written guidelines to all of its contractors for the minimum standards expected regarding levels of payment and health, work and safety practices to which it expects them to adhere. These guidelines should be available to all who work for contractors on Stora Enso land.

Compliance with these guidelines might even be included as a clause in Stora Enso's contract with the contractors. Health concerns include availability of adequate clean drinking water, sunstroke and access to emergency services for cases such as urgent illness, injury, or exposure to natural disasters (like floods or landslide). Stora Enso may wish to ensure that all work teams have access, whenever possible, to mobile telecommunications (a cell phone) or to a vehicle as close to the site as possible. Whilst not practiced presently in rural Guangxi, Stora Enso contractors can be encouraged to reimburse costs for treatment of work related injuries and provide some paid days to recover.

Migrant Labour. The study found that migrant workers play an important role in the establishment of Stora Enso plantations, constituting over one half of the plantation workers on their land. They face issues additional to those of local people when working for contractors. These workers operate under difficult conditions, living and working for months in remote locations with few amenities. Lacking permanent local accommodation, most migrants (70 percent of those surveyed) live in simple work sheds or tents (provided by the contractor) near the work site or live in abandoned houses that are in very poor condition. These shelters provide little protection in the case of natural disasters and exposure to mosquitoes is a problem. In addition, sanitary conditions are not good with streams and springs the predominant source of water.

The company could encourage contractors to improve migrant accommodations through construction of improved living quarters or use of high quality tents near to plantation work sites. These structures could be re-used at subsequent steps in the plantation cycle (e.g. fertilizer application, monitoring, and harvesting) and could also be used for forest protection workers. Drinking water issues could be addressed by facilitating, when practical, alternatives such as wells.

Both field interviews and the survey indicate that migrants have encountered some special problems with locals and that some migrants are not happy with their relationships with locals.

2. Recommendations

To maintain a position as an employer of choice for plantation workers in southern Guangxi, Stora Enso will offer a safe and healthy work environment. The following recommendations are offered:

- Stora Enso provides clear guidelines for minimum working conditions and wages to its contractors, and makes these publicly available to the local communities and migrant workers.
- A comprehensive monitoring system is introduced for contractors to ensure that the legal requirements for minimum wages are met and that they follow corporate guidelines.
- In light of the important part migrant workers play in Stora Enso's plantation business, it is recommended that the company work with contractors to improve their living conditions and consider supply of minimum standard temporary accommodation and drinking water.
- Whilst migrant relationships with local communities are wider problems best dealt with by local governments, Stora Enso, can set an example through encouragement of its staff to treat migrants well through a corporate culture that encourages respect.
- The company, in consultation with local authorities, should develop processes to resolve labour disputes should these arise, especially given the general absence of written labour contracts between workers and the contractors.

Finally, Stora Enso has expressed an interest in continuing to pursue development projects in affected communities. ESIA results indicate that top development priorities of stakeholders in village areas are irrigation, roads, medical services, and drinking water, while for forest farm communities these are medical services, roads, provision for the aged, and improvement of living environment. Education is also an important area for a large proportion of respondents in both groups. Stora Enso may wish to consider these priorities in crafting a development project, perhaps, for example, focusing on drinking water or medical services, or doing more work in the education area. Given the high interest in loans expressed by surveyed households, Stora Enso may also wish to consider a micro-credit project in affected communities. The loan fund might have a general scope or might target eucalypt planting, with the corollary benefit of increasing the supply of market pulpwood. Finally, village tele-centers are an alternative idea for a development project. These could provide computer and internet access in project villages and might also be used by Stora Enso to communicate with villagers about the project and provide them with educational information on relevant topics, such as the impacts of eucalypts.

To demonstrate its attitude of corporate social responsibility in a comprehensive manner, Stora Enso may also consider packaging these possible micro-project initiatives into a *social development fund* as an umbrella mechanism to meet the priorities of development needs of the project communities in Guangxi.

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The ESIA Analysis Report - Annexes

Annex I: Stora Enso Environmental and Social Responsibility Policy

Responsible Business

Stora Enso is committed to developing its business towards ecological, social and economic sustainability. These tasks are recognised as shared responsibilities within Stora Enso enabling a continuous improvement of our operations.

Eco-perspective

Stora Enso's objective is to supply customers with products and services that satisfy various needs related to printed communication, packaging and construction purposes. These products are mainly produced from renewable raw materials, and are recyclable and safe to use.

The concept of product life cycle guides our environmental activities and provides the framework for our efforts. We expect the same commitment from our suppliers and partners so that at every stage, from raw material to the end product, the impact on the environment will be minimised.

Social Respect

As an international company, Stora Enso acknowledges its role as a model company in the global, national and local society. Our attitude shall be characterised by respect for the cultures, customs and values of individuals and groups in countries where we operate. When developing our business to earn credibility, we will comply with and when necessary go beyond the requirements of national standards and legislation.

Transparent Interaction

In order to continuously strengthen our operations and develop environmental and social issues in a sustainable way, Stora Enso considers an open discussion and interaction with all stakeholders, both governmental and non-governmental, as fundamental.

Annex II: Results of Expert Testimony on Environmental Effects of Eucalypt Plantations

A. Results of Expert Environmental Questionnaire

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
1. on the local natural vegetation (a) positive (b) negative (c) Nil	c	a b	c	C	C	c	c	c	a	c	c	c	a	3 a 1 b 10 c
2. on the local landscape: (a) positive (b) negative (c) Nil	a	a b	c, positive for plantatio ns establishe d on wildland	A	A	a	a forest landscape	a	c	a	b	a	a	10 a 1 b 2 c
3. In southern Guangxi, the original vegetation disappeared (a) prior to (b) after the establishment of eucalypt plantations	a	a	A	A	a due to human activities	a	a	a	a	a	a	a	a	13 a
4. In southern GX the initial change of the landscape due to (a) agricultural activities (b) urbanization (c) exotic forest plantations	a b	a b c	A	A	A	a\b	b	a d due to human activities	a b	a	a	b c	a	11 a 5 b 2 c
5. on the local microbe, insects and animals: (a) positive (b) negative (c) Nil	a	a b	A	Relatively	C	c	a	c	b	a b	c	a	a b	7 a 4 b 4 c

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
6. Eucalypts can escape from forest plantation ecosystem and cause biological invasion (a) yes (b) no	(b)	b	b	a	B	b	b eucalypts can be controlle d	b	b	b	b	b c	b	1 a 12 b 1 c
7. Eucalypts can be integrated into local ecosystems and coexisted in harmonization with other animal and plant elements (a) yes (b) no	(a) in GX mixed plantatio ns of Eucalypts with <i>P.masson iana</i> , stand age over 20 years	a	a	a	a	a	a more than 150 species found in eucalypt plantatio ns in 100 years after introducti on	a	a	a	a	a	a	13 a
8. Have you ever seen naturally regenerated eucalypts in southern GX? What species if yes?	b	b	b	b	b	b	a <i>E. exserta</i> <i>E. leizhou no.1</i>	a <i>E. exserta</i> <i>C. citriodor</i> a <i>E. robusta</i>	a	b	a	a	b	5 a 8 b
9. Eucalypts have shown allelopathy in GX: (a) yes (b) no	(b) <i>Corymbi a citriodor</i> <i>a</i> only, ground vegetatio n is constrain ed due to leaf secretion if spacing > 2000 trees per ha	a (accordin g to report)	b	No general conclusion , there is no undergrow th in <i>Melaleuca</i> plantations in GX	b without references	b	b	a	a	b	b	b	b	3 a 9 b

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
10. Eucalypts can be used to establish agroforestry ecosystems (a) yes (b) no	a	a	a	b	a	b	a with pineapple and sugarcane	a	a	a	a	b	a	10 a 3 b
11. Effect of eucalypt plantations on human health causing cancer and etc. (a) positive (b) negative (c) Nil	b	b (without evidence)	b	No report	b	a	b not heard yet after planting for 50 years	b	a	b	b	b	a	3 a 9 b
12. Effect of eucalypt plantations on the atmosphere: (a) positive (b) negative (c) Nil	a	a	a	a	a	a	a	a	c	a	a	a	a	12 a 1 c
13. Function of eucalypt plantations in carbon sequestration in comparison with other tree species: (a) positive (b) negative (c) Nil	a c	a	c	No research results support special function of carbon sequestration of eucalypt plantations	a	b	a	b	a c	c	a	a	a	8 a 2 b 3 c
14. Function of eucalypt plantations can mitigate typhoon damage to agricultural crops (a) yes (b) no	a	a	a	a	a	a	a	b	a	a	a	a	a	12 a 1 b

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
15. Eucalypt plantations cause reduction of agricultural crop production: (a) yes (b) no	b	b	b	b	b	b	b	b	b	b	b	b	b	13 b
16. Eucalypt plantations cause quality degradation of nearby water resources (a) yes (b) no	b	b (without evidence)	b	b	b	b	b	b	b	b	b	b	b	13 b
17. Effect of eucalypt plantations on the coastal and maritime ecosystems (a) positive (b) negative (c) Nil	b	b	b	b	b	b	b	b	b	b	b	b	b	13 b
18. Producing equivalent of biomass eucalypts consumed more water than <i>Pinus massoniana</i> , <i>elliottii</i> and Chinese fir: (a) yes (b) no	b	b	b	b	b	a	b	a	b	a	b	b	b	3 a 10 b
19. Producing equivalent of biomass eucalypts consumed more soil nutrients than <i>Pinus massoniana</i> , <i>elliottii</i> and Chinese fir: (a) yes (b) no	b	b	b	b	b	a	b	a	a	a	b	b	b	4 a 9 b

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
20. Eucalypt plantations have a positive function for soil and water conservation, (a) yes (b) no	a	a	a	a	a	a	a	a	a	a	a	a	a	13 a
21. Soil erosion in eucalypt plantation caused by (a) biological traits of species (b) incorrect silviculture or management	b	a b	b	b	b	b	b	b	a b	b	b	b	b	2 a 13 b
22. Site productivity decline in eucalypt plantation caused by (a) biological traits of species (b) incorrect silviculture or management	b	b	b	b	b	b	b	a b c (site)	a b	b	b	a	b	3 a 12 b 1 c
23. Eucalypts can be used for (a) timber production (b) land reclamation (c) landscape improvement	a	a b c	a	a	b	a\c	a c	a	a b c	a	a b c	a b c	a	12 a 5 b 6 c
24. Eucalypt plantations provide ecological benefits: (a) yes (b) no	a	a	a	a	a	a	a	b	a	a	a	a	a	13 a

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
25. Under the same site conditions and silvicultural technology, productivity of eucalypt plantations is (a) higher or (b) lower than that of pines and Chinese fir	(a)	a	a	a	a	b	a	a	a	a	a	a	a	13 a
26. Under the same site conditions and silvicultural technology, productivity of eucalypt plantations is (a) higher or (b) lower than that of acacias and indigenous hardwoods	a	a	a	a	a	a	a	a	a	a	a	a	a	13 a
27. Compared with Brazil, the productivity of eucalypt plantations in China is lower due to (a) genetic materials (b) site quality (c) silviculture	c	a b c	b	b c	a b c	b C	b	a b c	a b c	b c	a b	a c	a b	7 a 10 b 8 c
28. Undergrowth (a) should (b) should not be maintained in order to conserve biodiversity	a	a	a, first year after planting	a	b in commercial plantations	b	a	a	a	a	a	a	a	11 a 2 b
29. Undergrowth (a) should (b) should not be maintained in order to increase timber production	a	a	a, first year after planting	a	b in commercial plantations	b	a intercropping with legumes	b	b	a	a	a	b	8 a 5 b

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
30. Integrated industrial complex of tree-growing and paper-making is (a) or not (b) the best norm to develop paper industry	a	a	a	a	a	a	a	a	a	a	a	a	a	13 a
31. Species selection for integrated industrial complex depends on (a) growth rate (b) wood property, (c) ecological function	a b	a b	a	b	a b c	a\b	b high fiber and pulp yielding	a	a b	b	a b	a b	a b	10 a 11 b 1 c
32. What is acceptable area if eucalypt plantations are continually planted across landscape in a region?	≤200ha	100-200ha	20-200ha	accepted if pure stand is not formed in planting areas	150-200ha	No certain number since without experiment	difficult to determine, better with a number of clones	species 200ha, clone 20ha	200~300 ha	3000-5000ha		>6 ha	200	
33. Species selection for integrated industrial complex should be decided by (a) the industry (b) governmental authorities	a	a	a	b	Decided by scientists and land owner based on research results	a	a	a	a	a	a		a	10 a 1 b
34. Indigenous species (a) should be (b) should not be planted as corridor of path in the plantations of eucalypts	a	a	b	b	b	a	b for fire prevention	b	a	b	a	b	a	6 a 7 b

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
35. Is it necessary to plant native species in a certain proportion as preconditions for establishing large scale industrial plantations of eucalypts? (a) no (b) yes	b	a	b	a	b	a	b eucalypts can be regarded as native since they have been grown for over 100 years	b	a	a	b	b	a	6 a 7 b
36. Eucalypt plantations can be (a) or not be (b) sustainably managed	a	a	a	a	a	a	a Leizhou FB has set a good example	a	a	a	a	a	a	13 a
37. Suppose that you be on the position of decision maker of a state forestry enterprise and environmental conditions be all suitable for the following species, you would choose (a) <i>Pinus massoniana</i> (b) <i>P. elliottii</i> (c) acacia (d) indigenous hardwoods eucalypts (f) others	a d	a e	e	a c e	e, first choice f, if fiber quality and growth rate are higher	b e	e	a b d	e、a	e	a e	e	e	6 a 2 b 1 c 1 d 11 e

Factors	Names and Selections of Experts Tested													Over all
	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
	Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agro.	For-scientist	Tech officer	Tech officer	
38. Suppose that you be on the position of decision maker of a private forestry enterprise and environmental conditions be all suitable for the following species, you would choose (a) <i>Pinus massoniana</i> (b) <i>P. elliottii</i> (c) acacia (d) indigenous hardwoods eucalypts (f) others	d	a e	e	e c	e, first choice f, if fiber quality and growth rate are higher	e	e	d	e	e	a e	e	e	2 a 1 c 2 d

B. Result of Environmental Leopold Matrix: Integrated Ratings of Experts Consulted

Environment and Biodiversity		Elements	Ratings Given by Experts Consulted with Leopold Matrix													Mean
			Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	
			Forester	Ecologist	Tech officer	Envi.	Forester	FF manager	Forester	FF manager	FF manager	Agri.	Scientist	Tech officer	Forester	
Physical environment	Soil	Type	5	3.0	5.0	5.0	5.0	0.0	8.0	3.0	4.0	8.0		0.0	1.0	47.0
			6	5.0	3.0	7.0	2.0	0.0	8.0	8.0	8.0			2.0	1.0	50.0
		pH	6	4.0	4.0	7.0	4.0	4.0	5.0	3.0	1.0	6.0		2.0	3.0	49.0
			8	6.0	7.0	8.0	1.0	6.0	5.0	8.0	6.0			3.0	3.0	61.0
		Erosion	4	5.0	3.0	7.0	2.0	4.0	1.0	1.0	1.0	2.0		1.0	4.0	35.0
			8	5.0	2.0	7.0	1.0	5.0	2.0	1.0	2.0			1.0	4.0	38.0
		Geomorphology	6	3.0	2.0	9.0	5.0	0.0	0.0	2.0	2.0	3.0		0.0	2.0	34.0
			7	2.0	2.0	9.0	3.0	0.0	0.0	2.0	8.0			0.0	2.0	35.0
	Water	Rivers	0	5.0	3.0	7.0	1.0	3.0	2.0	3.0	2.0	4.0		1.0	2.0	33.0
			2	5.0	2.0	7.0	3.0	4.0	1.0	3.0	2.0			4.0	2.0	35.0
		Lake and reservoir	1	3.0	3.0	7.0	1.0	0.0	2.0	2.0	2.0	4.0		1.0	4.0	30.0
			3	4.0	3.0	7.0	3.0	0.0	1.0	2.0	1.0			4.0	3.0	31.0
		Coastal zone	4	3.0	1.0	0.0	1.0	0.0	5.0	0.0	0.0	2.0		1.0	1.0	18.0
			7	3.0	2.0	0.0	1.0	0.0	5.0	0.0	1.0			4.0	2.0	25.0
		Sea quality	0	2.0	0.0	0.0	1.0	5.0	0.0	0.0	0.0	1.0		0.0	1.0	10.0
			0	1.0	0.0	0.0	1.0	4.0	0.0	0.0	0.0			0.0	1.0	7.0
		Underground water table	5	6.0	2.0	5.0	2.0	5.0	0.0	1.0	1.0	5.0		1.0	7.0	40.0
			8	7.0	3.0	5.0	1.0	5.0	0.0	0.0	4.0			5.0	7.0	45.0
		Water consumption	3	6.0	2.0	5.0	3.0	0.0	2.0	9.0	3.0	6.0		2.0	2.0	43.0
			5	7.0	3.0	5.0	1.0	0.0	2.0	9.0	2.0			2.0	5.0	41.0
	Climate	Annual mean temperature	8	1.0	7.0	8.0	7.5	0.0	3.0	7.0	1.0	3.0		3.0	5.0	53.5
			9	1.0	1.0	8.0	9.0	0.0	3.0	7.0	6.0			6.0	5.0	55.0
		Absolute minimum temperature	8	1.0	8.0	8.0	9.0	0.0	5.0	9.0	1.0	1.0		2.0	1.0	53.0
			9	1.0	0.0	8.0	9.0	0.0	5.0	9.0	8.0			4.0	1.0	54.0
		Absolute maximum temperature	0	1.0	6.0	8.0	6.0	0.0	1.0	1.0	2.0	1.0		3.0	3.0	32.0
			3	1.0	0.0	8.0	4.0	0.0	1.0	1.0	3.0			5.0	3.0	29.0
		Annual mean rainfall	5	3.0	7.0	9.0	7.0	0.0	2.0	6.0	2.0	0.0		4.0	3.0	48.0
			8	5.0	2.0	9.0	5.0	0.0	3.0	6.0	5.0			6.0	3.0	52.0
		Number of typhoon per year	4	1.0	2.0	0.0	6.5	0.0	0.0	2.0	1.0	0.0		3.0	6.0	25.5
			6	1.0	0.0	0.0	4.5	0.0	0.0	9.0	6.0			6.0	8.0	40.5
biological	Flora	Types of	2	5.0	0.0	5.0	3.0	3.0	1.0	1.0	1.0	3.0		0.0	4.0	28.0

Landscape		natural forest	4	6.0	0.0	5.0	2.0	4.0	1.0	2.0	1.0			0.0	6.0	31.0
		Forest plantations (by species)	0	3.0	3.0	9.0	3.0	0.0	5.0	1.0	1.0	5.0		0.0	3.0	33.0
			0	4.0	2.0	9.0	2.0	0.0	8.0	1.0	3.0			0.0	3.0	32.0
		Fruit orchards (by species)	1	3.0	2.0	6.0	3.0	0.0	1.0	1.0	1.0	3.0		0.0	3.0	24.0
			2	4.0	1.0	6.0	2.0	0.0	1.0	0.0	1.0			0.0	3.0	20.0
		Endemic tree species	2	2.0	2.0	0.0	3.0	0.0	0.0	1.0		4.0		0.0	4.0	18.0
			3	3.0	1.0	0.0	2.0	0.0	0.0	0.0				1.0	6.0	16.0
		Medical plants	0	3.0	3.0	0.0	3.0	3.0	0.0	1.0	3.0	6.0		0.0	4.0	26.0
			0	4.0	1.0	0.0	2.0	4.0	0.0	0.0	1.0			3.0	6.0	21.0
		Indigenous tree species	2	4.0	2.0	6.0	3.0	0.0	4.0	2.0	3.0	2.0		0.0	6.0	34.0
			4	4.0	2.0	6.0	2.0	0.0	4.0	1.0	1.0			0.0	7.0	31.0
		Introduced (exotic) tree species	0	3.0	2.0	6.0	3.0	1.0	5.0	1.0	2.0	3.0		0.0	3.0	29.0
			0	4.0	2.0	6.0	2.0	1.0	5.0	3.0	1.0			0.0	4.0	28.0
		Major agricultural crops	0	2.0	3.0	0.0	5.0	0.0	0.0	0.0	1.0	1.0		0.0	4.0	16.0
			0	2.0	1.0	0.0	2.0	0.0	0.0	0.0	1.0			3.0	5.0	14.0
		Sea-grasses	0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0		0.0	1.0	7.0
			0	1.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0			0.0	1.0	5.0
	Fauna	Major forest insect pests	3	4.0	3.0	7.0	5.0	0.0	5.0	5.0	2.0	7.0		1.0	3.0	45.0
			5	5.0	2.0	7.0	7.0	0.0	2.0	7.0	2.0			1.0	2.0	40.0
		Major forest diseases	4	6.0	3.0	7.0	8.0	2.0	5.0	7.0	3.0	6.0		1.0	4.0	56.0
			5	7.0	2.0	7.0	7.5	2.0	3.0	8.0	6.0			1.0	4.0	52.5
		Mammals	0	6.0	1.0	7.0	2.0	2.0	0.0	1.0	3.0	5.0		0.0	1.0	28.0
			0	7.0	1.0	7.0	1.0	2.0	0.0	1.0	1.0			0.0	1.0	21.0
		Birds	2	5.0	2.0	8.0	7.5	1.0	3.0	1.0	2.0	5.0		3.0	4.0	43.5
			3	5.0	2.0	8.0	3.5	1.0	3.0	1.0	1.0			4.0	4.0	35.5
		Fresh water fish	0.0	3.0	1.0	0.0	0.0	2.0	0.0	0.0	1.0	2.0		0.0	3.0	12.0
			0.0	3.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0			0.0	3.0	9.0
		Reptiles	1.0	6.0	1.0	8.0	1.0	1.0	0.0	1.0	0.0	4.0		2.0	2.0	27.0
			2.0	6.0	2.0	8.0	1.0	2.0	0.0	1.0	0.0			3.0	2.0	27.0
Landscape	Ecosystem	Zonation vegetation	3.0	6.0	1.0	9.0	3.0	1.0	2.0	3.0	2.0	5.0		0.0	4.0	39.0
			5.0	6.0	2.0	9.0	2.0	1.0	2.0	5.0	1.0			0.0	4.0	37.0
		Original vegetation disappearance	2.0	3.0	0.0	0.0	1.0	0.0	0.0	6.0	1.0	2.0		0.0	2.0	17.0
			4.0	3.0	0.0	0.0	1.0	0.0	0.0	3.0	1.0			0.0	2.0	14.0
		Vegetation types of 20years ago	0.0	1.0	0.0	0.0	1.0	0.0	3.0	0.0	1.0	0.0		0.0	3.0	9.0
			0.0	1.0	0.0	0.0	1.0	0.0	3.0	0.0	1.0			0.0	3.0	9.0

		Plantation species before eucalypts	2.0	1.0	0.0	9.0	1.0	0.0	4.0	3.0	1.0	0.0		0.0	7.0	28.0
			2.0	1.0	0.0	9.0	1.0	0.0	4.0	5.0	1.0			0.0	5.0	28.0
		Nature reserves and national parks	2.0	2.0	0.0	0.0	3.0	0.0	0.0	3.0	3.0	1.0		4.0	1.0	19.0
			3.0	2.0	0.0	0.0	3.0	0.0	0.0	5.0	1.0			7.0	1.0	22.0
		Protected species	0.0	3.0	2.0	0.0	3.0	0.0	0.0	2.0	3.0	1.0		5.0	2.0	21.0
			2.0	4.0	1.0	0.0	1.0	0.0	0.0	6.0	3.0			8.0	2.0	27.0
		Land use patterns	2.0	6.0	3.0	7.0	6.0	2.0	3.0	6.0	5.0	2.0		5.0	4.0	51.0
			3.0	6.0	2.0	7.0	4.0	2.0	3.0	8.0	2.0			8.0	2.0	47.0
		Natural heritage	0.0	3.0	0.0	0.0	1.0	0.0	0.0	1.0	1.0	0.0		0.0	1.0	7.0
			0.0	4.0	0.0	0.0	1.0	0.0	0.0	1.0	1.0			5.0	1.0	13.0
		Cultural heritage	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0		0.0	1.0	5.0
			0.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0			5.0	1.0	10.0
		Wilderness quality	2.0	7.0	0.0	0.0	3.0	0.0	0.0	1.0	5.0	2.0		0.0	5.0	25.0
			4.0	7.0	0.0	0.0	1.0	0.0	0.0	2.0	5.0			2.0	3.0	24.0

Annex III: Additional Information on Social Survey Methodology

1. Notes on Survey Process

A. Pre-Test

Three members of the social team, accompanied by four assistants, conducted a pre-test of the survey. The pre-test team concluded that: (1) The questionnaire was too long; (2) The structure needed revision; and (3) Further important sub-groups needing their own questionnaire existed and should be added to the survey. The conclusions of the pre-test were integrated into the survey process with revisions to the questionnaires and targeted groups.

B. Full Survey: Respondent Identification for Household/Individual Module

For households renting land to Stora Enso, the company provided the survey team with lists from which the social assessment team randomly selected households. The team used other methods to identify other household interviewee types. The survey team informed the interviewees in advance and asked the householder to be at home at a specific time when the interview would take place. Interviews took place on a face-to-face basis with the interviewer reading the questions to the respondent and completing the form. Interviews lasted approximately one hour.

Migrants working for Stora Enso were identified using a different methodology, as the company has no records on this population. Migrants were understood to group together in known locations. Interviewers travelled to those locations and interviewed as many migrants as were willing to participate. When migrant groups had moved on from their last known location, problems occurred. In these cases, interviewers sought out alternate groups. Further difficulties in locating migrant interviewees, however, meant that the total number of interviews was less than expected.

Interviews in migrant origin areas in Yunnan and Northwest Guangxi involved the family members of migrants when these members were still in origin areas. When there were no family members available, neighbours were interviewed. Interviewers faced extreme difficulties finding interviewees in the home villages of the migrants – some migrants proved to live in remote sub-villages rather than the villages they had originally identified as their home. In certain areas, the remote terrain and unseasonable weather prevented access to origin communities. This last group represents a very difficult population to trace; and the problems experienced here are by no means unique.

C. Full Survey: Rate of Response among Targeted Households

If the identified householder was not at home, the interviewer would either attempt to conduct the interview at a later time or would go to the fields where the interviewee could normally be found. If a householder could not be found, the interviewee would survey a neighbour. Thus, an unwillingness to take part might be expressed through absence. Numbers of those targeted households not to be found, however, were reportedly low.

Of those who were available for interview, all agreed to take part in the survey. The Statistical Bureau explained the achievement of such a good response rate with reference to their previous work in these areas, a highly experienced interview team familiar with local conditions, and their ability to persuade any reluctant interviewee through expressions of trust and support. The team gave each interviewee an information sheet and consent forms. The information sheets outlined for respondents the nature of Stora Enso's project, including plantation development, management, land usage, and environmental and social responsibilities. After the successful conclusion of the interview, the team gave the respondent a souvenir worth the equivalent of about US\$1 (about RMB 8.17 yuan).

2. Instructions for Social Survey

An Instruction for the ESIA Social Survey of Stora Enso Guangxi Eucas Plantation June 2005

A. Information sheet

An *information sheet* detailing Guangxi Stora Enso plantation and the reasoning behind the social survey will be designed by Stora Enso and UNDP. This will ensure that all participants receive from the interviewers the same information whether they are able to read or need to have the information read to them. Informants should have an opportunity to ask questions important to them.

B. Social Survey Tools

- 2-1 Community Characteristics Questionnaires for Guangxi plantation and/non plantation areas – on forest farms, by NBS together with Forest Institute of Guangxi University;
- 2-2 Community Characteristics Questionnaires for Guangxi plantation and/non plantation areas – in townships, by NBS together with Forest Institute of Guangxi University;
- 2-3 Community Characteristics Questionnaires for out-migrants communities in north western Guangxi/Yunnan– in townships, by China Agricultural University;
- 2-4 Household Questionnaire for Guangxi plantation areas – on forest farms, by NBS together with Forest Institute of Guangxi University;
- 2-5 Household Questionnaire for Guangxi SE non plantation areas – on forest farms, by NBS together with Forest Institute of Guangxi University;
- 2-6 Household Questionnaire for Guangxi plantation and/non plantation areas – in villages, by NBS together with Forest Institute of Guangxi University;
- 2-7 Household Questionnaire for in-migrants in Guangxi plantation areas – on forest farms and in villages, by China Agricultural University;
- 2-8 Household Questionnaire for out-migrants communities in North western Guangxi/Yunnan – in villages, by China Agricultural University;
- 2-9 Stakeholder Group Interview Protocol for Guangxi plantation and/non plantation areas – on forest farms, by China Agricultural University;
- 2-10 Stakeholder Group Interview Protocol for Guangxi plantation and/non areas – in villages, by China Agricultural University;
- 2-11 Stakeholder Group Interview Protocol for out-migrants communities in North western Guangxi/Yunnan – in villages, by China Agricultural University.

The National Bureau of Statistics, will develop *an guideline for each questionnaire* in term of each question's definition and interpretation to ensure that interviewers inform and explain the question to interviewees accurately with responded answers consistently among all questions for future analysis. These questionnaires will also be coded by the Bureau.

C. Records of the survey process

The team and interviewers need to be very aware of the intensive nature of the interview process and the need to keep accurate and very detailed records of the survey processes, including the logging in and out of questionnaire scripts, problematic aspects, quality control etc.

A working and progress report (standard form to be developed jointly by UNDP core expert team with the Bureau) should be delivered by the implementing institution right at the end of the survey. The report must include the full description of the survey implementation, particularly on how the quality is controlled.

The survey quality check includes the following steps: the interviewers' self-check and the supervisors/consultants' check and back check by the sub-contracted institutions and particularly the Bureau of Statistics. The criteria are as follows:

- Clear handwriting,
- No omit questions;
- No logic error;
- Sound answers.

For the Back-check, 5% of the questionnaires and interview protocols conducted by the survey institutions will be back-checked by NBS on completed questionnaires and protocols by telephone. The contents of the back-check include the basic questions and the key questions.

Morale amongst interviewers needs careful tending. Hold frequent feedback meetings. Ensure that the interviewers received comprehensive training and have had plenty of time to practice the questionnaires.

D. Post-questionnaire process

This will include notably coding and data entry.

The survey teams should deliver all the completed questionnaires to NBS for data entry and processing. The data will need cleaning after data entry: the better the data entry the less cleaning will be needed.

The questionnaires should be counted in the order of counties/townships to ensure that the number of questionnaires the NBS received is the same as the number of questionnaires reported to them. During the counting, the questionnaires should be checked to make sure that all questionnaires are filled in correctly. Questionnaires judged to be of poor quality should be deleted from further analysis. Security of the questionnaires is protected to be sure that they stay in the right order, and no questionnaires to be moved or removed without permission. At the end of the data processing, all questionnaires should be delivered and stored in UNDP, for confidentiality and for further checking.

Double data entry is required to assure accuracy of entry. The information in each questionnaire should be entered twice, each questionnaire by two different people. The entries will then be compared. If the two were not exactly the same, the entry should be rechecked and corrected. A database should be developed in line with analytical purpose, for instance, cross-table analysis, correlation analysis etc. it is recommended to utilize the Statistical Package for the Social Science (SPSS) or other similar statistical packages.

Checking the database is the last step in the data entry process. After entering all the data from the questionnaires, the data entries are examined against a set of expected ranges of responses.

E. Ethical procedures

The ethical procedures which need to be attached to the interview process. The participants need to be assured of anonymity, confidentiality and the right to withdraw from the consultation process without forfeit. The interview team needs to get agreement of confidentiality. Ethical procedures are outlined in the body of all interview tools as follows.

“Explain to the interviewees that questions are sometimes standard answer-given questions, and sometimes questions are open-ended or with multiple-choices. Interviewees should be guaranteed of anonymity and secrecy, and of the right to freely withdraw from the interview. An agreement on confidentiality should be made beforehand between the interviewers and the interview”.

As part of the ethical process the interviewees should receive appropriate feedback. Feedback has important implications for future relationships and must also be timely.

F. Plantation affected/associated stakeholders

5-1. Six different types of households:

- a. Households in villages in which Stora Enso has already rented land
- b. Households in villages in which Stora Enso plans to rent land in the future
- c. Migrants working land that Stora Enso has rented.
- d. State-owned/community forest farm workers that are working on land that Stora Enso has rented in state-owned forest farms.
- e. Households in villages near or on state-owned farms, with the interviewee being an individual that has worked on Stora Enso land on state-owned farms;
- f. Also households in villages in which Stora Enso has not plantation plan by far

5-2. Township/forest farms and local governments:

- a. Township governments of townships in which Stora Enso has rented land.
- b. Township governments in townships in which Stora Enso plans or even not intends to rent land.
- c. Forest farms in which Stora Enso has rented land.
- d. Forest farms in which Stora Enso plans or even not intends to rent land.

5-3. Focus Groups

- a. Villages/farms in which Stora Enso has already rented land.
- b. Villages/farms in which Stora Enso plans to or even not intends to rent land

5-4. Households from Migrant Place of Origin, western Guangxi, Guizhou and Yunnan

5-5. Townships and communities from Migrant Place of Origin, western Guangxi, Guizhou and Yunnan.

Other key stakeholders: Middlemen, Dahu (sub-contracted households with forest), forest migrants, women and minority groups.

G. Sampling

6-1 General principles

The sampling will follow a scenario analytical strategy with 70% on SE plantation communities and lands, and 30% on SE potential plantation and non-plantation areas (semi controlled area) with the counties and forest farms that the Government of Guangxi Autonomous Region has

approved for Guangxi Stora Enso to operate for eucalypt plantation. A conventional non-project (controlled) area does not exist for this project as such SE non-project areas fall in the plantation area of another pulp&paper giant, Asia Pulp&Paper (APP).

The valid sample ratio must be above 95%. For household and focus group survey, women interviewees should be ensured in the range of 55-60%.

The selection of communities, stakeholder groups, and individual households will be conducted with quota as the first step, and then individual group and household selection as the second step should follow a criterion of random, representative, well/balanced distribution in communities. To avoid external interference and influences, non pre check and pre arrangement with them should be permitted. Such random selection principle will also intentionally avoid the use of exclusive principle by incorporating subjective criteria.

Middlemen, Dahu (sub-contracted households with forest), forest migrants, women and minority groups for specific interviews and analysis (conducted by the core social expert team) should not be necessary to follow such random selection. More criteria should be employed to select and interview them. The core expert team should come up with such criteria and conduct the selection based on information provided by Guangxi Stora Enso.

The survey teams can make some field adjustments in the communities after prior approval from UNDP. The willingness of local targeted interviewees to participate in the survey should be respected and revision of the sample is allowed without any enforcement, indication of penalty to those withdraws from interviews.

In some instances, it may be necessary to ask Stora Enso managers, township officials and village heads, as well as middlemen to help facilitate the survey. But the survey takers should be able to make his/her own random selections of the rural households/groups to be interviewed.

6-2 SE plantation areas

a) Household questionnaire:

- The households will be selected by quota of each community as a first step, with township level forest farms each 20 HHs, and each village 10 HHs; after then, under the quota, households are selected randomly given the household list SE to provide.
- 700 households in SE plantation area: 1) 460 from forest farms, with equal ratio between a) 1/3 to managers and farm workers on plantation, b) 1/3 to villagers from neighborhood communities working on the plantation, c) 1/3 residents not working on plantation; 2) 240 from townships/villages, with ratio between a) 2/4 households participating collective land rentals, 1/4 households participating in private land rentals, 1/4 villagers from the local or neighbor village working on the plantation. Random selection in 2) will be based on SE provided information of list of contracted villagers.

In case, HHs in the sample pre-randomly selected are not well/balanced located/distributed, or not available, replacement shall be chosen not far from the original targeted HHs.

- 50 migrant workers from North-western Guangxi, Yunnan and Guizhou interviewed in Guangxi plantation area, to be conducted by China Agricultural University, randomly selected from the list Guangxi SE provided.

- 100 households interviewed in migrant community of origin (targeting 50 households with workers on SE plantation in Guangxi (60) and Yunnan (40), to be conducted by China Agricultural University.

b) Community characteristics questionnaire:

- Each interview will involve 3 local officials (the head of the township or forest farm, forest division chief and agricultural division chief or chief for statistics) in a township or forest farms;
- 36 total to forest farm/township governments in current project area and 15 townships/forest farms from potential and no project area in Guangxi, to be conducted by the National Bureau of Statistics together with Forest Institute of Guangxi University;
- 5 total to township governments in migrant communities of origin in North-western Guangxi (3) and Yunnan (2), to be conducted by China Agricultural University. Selection will be based on SE provided list of migrant workers on their plantation.

c) Focus stakeholder group interview protocol:

- 6-8 interviewers in each group; suggest separate focus groups because mixed focus groups may be compromised through differential power interactions. As a result certain issues may not be discussed fully or leading to biased results. Further consultation with core expert group and SE will be conducted on numbers of various social groups to be interviewed, to ensure enough women, minority, migrants etc. covered.
- 50 groups in current (70% or 35 groups, with 20 on forest farms, 15 at plantation villages project area and (30% or 15 groups) non-project communities, to be conducted by China Agricultural University;
- 10 groups where the SE outsourced migrant workers come from in Western Guangxi (6) and Guizhou (4), to be conducted by China Agricultural University.

Special interviews to middlemen, migrant workers, women and minorities etc. will also be conducted by the ESIA social expert team. Check lists of issues for further analysis should be developed by the social team before field interviews.

6-3 Stora Enso potential or non-project areas

The selection of 30% SE potential and non-project areas will be implemented based on consultation between National/Guangxi Bureau of Statistics with local county bureaus and as well as with Guangxi SE, to ensure these communities have forest plantations, similar environment, forest and social conditions.

The selection of townships/forest farms will be conducted according to quota first then random to chose individuals and groups. 5 forest farms and 10 townships will be selected, with 100 forest farm households and 200 households respectively. The same process used in SE plantation areas will be introduced for household selection, that is to give quota of each community as a first step, with township level forest farms each 20 HHs, and each village 20 HHs; after then, under the quota, households are selected randomly.

3. Information Sheet on Stora Enso Forest Plantation Project in Guangxi Distributed to Survey Respondents

A. An Integrated Forest-Pulp-Paper Project

Stora Enso aims to develop an integrated forest-pulp-paper industry in southern China, mainly in the Guangxi Zhuang Autonomous Region. The raw material forest base of Stora Enso Guangxi is distributed primarily in 15 counties or cities including Beihai, Fangcheng, Bobai, and Yulin, among others. Currently, Stora Enso Guangxi manages 20,000 ha of plantations mainly consisting of eucalyptus. The unit plans to manage 120,000 ha of plantations by 2010. Stora Enso and its international as well as local partners are committed to conducting full Environmental and Social Impact Assessments (ESIA) on the plantations, and to ensuring that all of its operations adhere to Chinese regulations and Chinese and international standards for environment, health and safety.

B. Construction and Management

All plantation establishment activities are carried out by contractors, with the company staff managing land lease agreements, cost and quality control, and forest resource monitoring. During the planting phase, sites are prepared mechanically in flatland regions and manually on hills and other areas not conducive to machine use. Plantations are established using high quality eucalyptus clones which have been developed by Chinese agencies over the past 20 years. The unit has also started to develop new clones which are even better suited to the planting sites and have even more desirable wood properties. Stora Enso Guangxi will use high efficiency fertilization and cultivation methods. A database system will be implemented to manage and supervise forest resource development.

Mechanical site preparation



Manual site preparation



High quality hybrid euca. Species



Strong rooted cuttings



C. Land Usage

Stora Enso Guangxi's overall development plan is guided by the Guangxi government's stated priority to develop fast-growing, high-yield plantations as a key industry for the region. Government authorities identify appropriate land and facilitate the acquisition process. Stora Enso Guangxi acquires land and establishes plantations in lands that are designed by law as forestry land. These lands are often already covered by eucalyptus or pines. Some plantations are established on former agricultural sites that the government has decided to transfer to forestry. All land for plantations is leased for a certain period of time from Forest Farms or local farmers. A 30-year rental contract is signed for collective land leases, and a 50-year rental contract is signed for stated-owned forest farm land leases, but sometimes contract terms are shorter due to practicalities. The contract is designed, agreed, and signed according to Chinese law, willingness of both parties, and equality and mutual benefit. All activities on the plantation site shall obey relevant Chinese laws and regulations concerning cultural and historic site protection.

D. Environmental and Social Responsibility

In order to bring additional benefit to local communities, Stora Enso Guangxi has set up a community development fund that will address social needs as determined by the community itself. It is also assisting local infrastructure construction, such as the building of roads and schools, and contributes to basic education, medical care and welfare for residents in the counties in which it operates.

Plantation development plans also emphasize local biodiversity concerns. For example, the unit has launched a biodiversity protection project to protect and recover local tree species and the internationally recognized mangrove forests located on Guangxi's coast. Stora Enso Guangxi is currently preparing its operations to certify to third-party verified management systems for quality (ISO 9001), environment (ISO 14001), and occupational health and safety (OHSAS 18001).

Annex IV: Biodiversity List

A list of 137 native woody species that are protected in Guangxi, of which 116 are in the 1984 Species List of Endangered and Threatened Plants for Conservation promulgated by the Environmental Conservation Committee, State Council, China and 21 are listed by the State Forestry Administration and the Environmental Conservation Committee of Guangxi Autonomous Region.

A. Guangxi Protected Plants List

Species	Family	Level in the national conservation programme
1. <i>Abies yuanbaoshanensis</i>	Pinaceae	2
2. <i>Abies ziyuanensis</i>	Pinaceae	2
3. <i>Acrocarpus fraxinifolius</i>	Caesalpiniaceae	3
4. <i>Alsophila spinulosa</i>	Cyatheaceae	1
5. <i>Amentotaxus argotaenia</i>	Taxaceae	3
6. <i>Amesiodendron tienlinensis</i>	Sapindaceae	3
7. <i>Annamocarya sinensis</i>	Juglandaceae	2
8. <i>Anticaris toxicaria</i>	Moraceae	3
9. <i>Apterosperma oblate</i>	Theaceae	2
10. <i>Aquilaria sinensis</i>	Thymelaeaceae	3
11. <i>Archiboehmeria atrata</i>	Urticaceae	3
12. <i>Artocarpus hypargyraeus</i>	Moraceae	3
13. <i>Bhesa chinensis</i>	Celastraceae	2
14. <i>Bretschneidera sinensis</i>	Bretschneideraceae	2
15. <i>Burretiodendron esquirolii</i>	Tiliaceae	2
16. <i>Burretiodendron hsienmu</i>	Tiliaceae	2
17. <i>Caesalpinia sappan</i>	Caesalpiniaceae	G
18. <i>Calocedrus macrolepis</i>	Cupressaceae	3
19. <i>Camellia chrysantha</i>	Theaceae	1
20. <i>Camellia crapnelliana</i>	Theaceae	2
21. <i>Camellia euphlebia</i>	Theaceae	2
22. <i>Camellia grijsii</i>	Theaceae	2
23. <i>Camellia impressinervia</i>	Theaceae	G
24. <i>Camellia limonia</i>	Theaceae	G
25. <i>Camellia longgangensis</i>	Theaceae	G
26. <i>Camellia longzhouensis</i>	Theaceae	G
27. <i>Camellia pingguoensis</i>	Theaceae	2
28. <i>Camellia pingguoensis</i> var. <i>terminalis</i>	Theaceae	G
29. <i>Camellia pubipetala</i>	Theaceae	2
30. <i>Camellia sinensis</i> var. <i>assamica</i>	Theaceae	2
31. <i>Camellia tunghinensis</i>	Theaceae	2
32. <i>Carallia diplopetata</i>	Rhizophoraceae	3
33. <i>Caryota urens</i>	Arecaceae	2
34. <i>Castanopsis concinna</i>	Fagaceae	3
35. <i>Castanopsis kawakamii</i>	Fagaceae	3
36. <i>Cathaya argyrophylla</i>	Pinaceae	1
37. <i>Cephalomappa sinensis</i>	Euphorbiaceae	3
38. <i>Cephalotaxus mannii</i>	Cephalotaxaceae	2
39. <i>Cephalotaxus oliveri</i>	Cephalotaxaceae	2
40. <i>Cinnamomum camphora</i>	Lauraceae	G
41. <i>Cinnamomum micranthum</i>	Lauraceae	3
42. <i>Cleidiocarpon cavaleriei</i>	Euphorbiaceae	3
43. <i>Craigia kwangsiensis</i>	Tiliaceae	3

44. <i>Craigia yunnanensis</i>	Tiliaceae	3
45. <i>Cycas micholitzii</i>	Cycadaceae	2
46. <i>Cycas siamensis</i>	Cycadaceae	3
47. <i>Deutzianthus tonkinensis</i>	Euphorbiaceae	2
48. <i>Dimocarpus longan</i>	Sapindaceae	3
49. <i>Dipentodon sinicus</i>	Celastraceae	2
50. <i>Diplopanax stachyranthus</i>	Araliaceae	2
51. <i>Dracaena cochinchinensis</i>	Liliaceae	3
52. <i>Duangbanga grandiflora</i>	Sonneratiaceae	G
53. <i>Emmenopterys henryi</i>	Rubiaceae	2
54. <i>Erythrophleum fordii</i>	Caesalpiniaceae	2
55. <i>Erythropsis kwangsiensis</i>	Sterculiaceae	G
56. <i>Euchresta japonica</i>	Papilionaceae	3
57. <i>Eucomia ulmoides</i>	Eucammiaceae	2
58. <i>Eurycorymbus cavaleriei</i>	Sapindaceae	2
59. <i>Euryodendron excelsum</i>	Theaceae	2
60. <i>Forkienia hodginsii</i>	Cupressaceae	2
61. <i>Garcinia paucinervis</i>	Clusiaceae	2
62. <i>Ginkgo biloba</i>	Ginkgoaceae	2
63. <i>Glyptostrobus pensilis</i>	Taxodiaceae	2
64. <i>Gmelina hainanensis</i>	Verbenaceae	3
65. <i>Hainania trichosperma</i>	Tiliaceae	G
66. <i>Halesia macgregorii</i>	Styracaceae	3
67. <i>Handeliodendron bodinieri</i>	Sapindaceae	2
68. <i>Heliciopsis terminalis</i>	Proteaceae	3
69. <i>Hopea chinensis</i>	Dipterocarpaceae	2
70. <i>Horsfieldia hainanensis</i>	Myristicaceae	3
71. <i>Hydrocarpus hainanensis</i>	Flacourtiaceae	3
72. <i>Ilex kudingcha</i>	Aquifoliaceae	G
73. <i>Illicium difengpi</i>	Illiciaceae	3
74. <i>Ixonanthes chinensis</i>	Ixonanthaceae	3
75. <i>Juglans regia</i>	Juglandaceae	2
76. <i>Keteleeria calcarea</i>	Pinaceae	3
77. <i>Keteleeria fortunei</i>	Pinaceae	3
78. <i>Keteleeria pubescens</i>	Pinaceae	3
79. <i>Kmeria septentrionalis</i>	Magnoliaceae	G
80. <i>Knema globularia</i>	Myristicaceae	G
81. <i>Kydia glabrescens</i>	Malvaceae	G
82. <i>Laportea urentissima</i>	Urticaceae	3
83. <i>Liliodendron chinense</i>	Magnoliaceae	2
84. <i>Litchi chinensis var cuspontanea</i>	Sapindaceae	2
85. <i>Litsea dillenifolia</i>	Lauraceae	3
86. <i>Madhuca pasquieri</i>	Sapotaceae	2
87. <i>Magnolia henryi</i>	Magnoliaceae	3
88. <i>Magnolia officinalis ssp. Biloba</i>	Magnoliaceae	3
89. <i>Magnolia sieboldii</i>	Magnoliaceae	3
90. <i>Malania oleifera</i>	Oleaceae	2
91. <i>Mangifera silvatea</i>	Anacardiaceae	2
92. <i>Manglietia aromatica</i>	Magnoliaceae	2
93. <i>Manglietia grandis</i>	Magnoliaceae	3
94. <i>Manglietia insignis</i>	Magnoliaceae	3
95. <i>Manglietia megaphylla</i>	Magnoliaceae	3
96. <i>Mesua ferrea</i>	Clusiaceae	2
97. <i>Michelia hedyosperma</i>	Magnoliaceae	3
98. <i>Morinda officinalis</i>	Rubiaceae	3

99. <i>Mussaenda anomala</i>	Rubiaceae	2
100. <i>Oncodostigma hainanensis</i>	Annonaceae	2
101. <i>Ormosia henryi</i>	Papilionaceae	G
102. <i>Ormosia microphylla</i>	Papilionaceae	G
103. <i>Parakmeria lotungensis</i>	Magnoliaceae	3
104. <i>Parakmeria yunnanensis</i>	Magnoliaceae	3
105. <i>Parashorea chinensis</i>	Dipterocarpaceae	1
106. <i>Phoebe bournei</i>	Lauraceae	3
107. <i>Pinus fenzeliana</i>	Pinaceae	G
108. <i>Pinus kwangtungensis</i>	Pinaceae	3
109. <i>Pinus taiwanensis</i> var. <i>damingshanensis</i>	Pinaceae	G
110. <i>Podocarpus fleuryi</i>	Podocarpaceae	3
111. <i>Podocarpus imbricatus</i>	Podocarpaceae	3
112. <i>Pseudotaxus chienii</i>	Taxaceae	2
113. <i>Pseudotsuga brevifolia</i>	Pinaceae	2
114. <i>Pseudotsuga sinensis</i>	Pinaceae	3
115. <i>Pteroceltis tatarinowii</i>	Ulmaceae	3
116. <i>Pterostyrax psilophylla</i>	Styracaceae	3
117. <i>Reevesia rotundifolia</i>	Sterculiaceae	3
118. <i>Rehdrodendron macrocarpum</i>	Styracaceae	2
119. <i>Rhododendron haematodes</i>	Ericaceae	3
120. <i>Rhoiptelea chilantha</i>	Rhoipteleaceae	2
121. <i>Semiliquidamber cathayensis</i>	Hamamelidaceae	2
122. <i>Sinia rhodoleuca</i>	Ochnaceae	2
123. <i>Stewartia sinensis</i>	Theaceae	3
124. <i>Strophoblachia fimbriicalyx</i>	Euphorbiaceae	G
125. <i>Tapiscia sinensis</i>	Staphyleaceae	3
126. <i>Taraktogenos annamensis</i>	Flacourtiaceae	3
127. <i>Taxus chinensis</i>	Taxaceae	G
128. <i>Taxus mairei</i>	Taxaceae	G
129. <i>Terminalia myriocarpa</i>	Combretaceae	3
130. <i>Tetrathyrium subcordatum</i>	Hamamelidaceae	2
131. <i>Toona ciliate</i>	Meliaceae	3
132. <i>Toongiodendron odorum</i>	Magnoliaceae	2
133. <i>Tsuga chinensis</i>	Pinaceae	3
134. <i>Tsuga longibracteata</i>	Pinaceae	3
135. <i>Vatica quangxiensis</i>	Dipterocarpaceae	2
136. <i>Xerospermum bonii</i>	Sapindaceae	3
137. <i>Zenia insignis</i>	Caesalpiniaceae	3
Note: G indicates provincially protected.		

B. A list of terrestrial vertebrates from Guangxi that are included in the IUCN Red List, including 14 species considered globally Critically Endangered (CR), Endangered (EN) or Vulnerable (Vu), as well as Data Deficient (DD) and Near threatened (NT) or Lesser risk (LR) species.

Common Name(s)	Genus	species	Class	Order	Red List	Justification
WHITE-HEADED LANGUR	Trachypithecus	poliocephalus	MAMMALIA	PRIMATES	CR	A2cd
CHINESE THREE-STRIPED BOX TURTLE	Cuora	trifasciata	REPTILIA	TESTUDINES	CR	A1d+2d
ASIATIC WILD DOG	Cuon	alpinus	MAMMALIA	CARNIVORA	EN	C2a(i)
CHINESE STRIPE-NECKED TURTLE	Ocadia	sinensis	REPTILIA	TESTUDINES	EN	A1cd
BIG-HEADED TURTLE	Platysternon	megacephalum	REPTILIA	TESTUDINES	EN	A1d+2d
FOUR-EYED TURTLE	Sacalia	quadriocellata	REPTILIA	TESTUDINES	EN	A1d+2d
SEROW	Capricornis	sumatraensis	MAMMALIA	ARTIODACTYLA	VU	A2cd
BEAR MACAQUE	Macaca	arctoides	MAMMALIA	PRIMATES	VU	A1cd
CLOUDED LEOPARD	Neofelis	nebulosa	MAMMALIA	CARNIVORA	VU	C2a(i)
KING HORSESHOE BAT	Rhinolophus	rex	MAMMALIA	CHIROPTERA	VU	B1+2c
FRANÇOIS'S LANGUR	Trachypithecus	francoisi	MAMMALIA	PRIMATES	VU	A1cd+2cd
WHITE-NECKLACED PARTRIDGE	Arborophila	gingica	AVES	GALLIFORMES	VU	C2a(i)
SILVER ORIOLE	Oriolus	mellianus	AVES	PASSERIFORMES	VU	C1
CABOT'S TRAGOPAN	Tragopan	caboti	AVES	GALLIFORMES	VU	C2a(i)
TUFTED DEER	Elaphodus	cephalophus	MAMMALIA	ARTIODACTYLA	DD	
COMMON OTTER	Lutra	lutra	MAMMALIA	CARNIVORA	NT	
PALE HARRIER	Circus	macrourus	AVES	FALCONIFORMES	NT	
YELLOW-BREASTED BUNTING	Emberiza	aureola	AVES	PASSERIFORMES	NT	
JAPANESE PARADISE-FLYCATCHER	Terpsiphone	atrocaudata	AVES	PASSERIFORMES	NT	
BLACK-BREASTED HILL TURTLE	Geoemyda	spengleri	REPTILIA	TESTUDINES	NT	
BLACK-SPOTTED POND FROG	Rana	nigromaculata	AMPHIBIA	ANURA	NT	
HAIRY-FOOTED FLYING SQUIRREL	Belomys	pearsonii	MAMMALIA	RODENTIA	LR/nt	
CHINESE WATER DEER	Hydropotes	Inermis	MAMMALIA	ARTIODACTYLA	LR/nt	
EURASIAN HARVEST MOUSE	Micromys	Minutus	MAMMALIA	RODENTIA	LR/nt	
LITTLE JAPANESE HORSESHOE BAT	Rhinolophus	cornutus	MAMMALIA	CHIROPTERA	LR/nt	
THOMAS'S HORSESHOE BAT	Rhinolophus	thomasi	MAMMALIA	CHIROPTERA	LR/nt	
HARLEQUIN BAT	Scotomanes	Ornatus	MAMMALIA	CHIROPTERA	LR/nt	
PRATT'S ROUNDEAF BAT	Hipposideros	Pratti	MAMMALIA	CHIROPTERA	LR/nt	
ASIATIC ROCK PYTHON	Python	Molurus	REPTILIA	SQUAMATA	LR/nt	

C. A list of 62 globally threatened plants from Guangxi that are included in the IUCN Redlist, including species that are considered Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN) or Vulnerable (Vu).

Genus	Species	Family	Order	Red List
Firmiana	major	STERCULIACEAE	MALVALES	EW
Abies	yuanbaoshanensis	PINACEAE	CONIFERALES	CR
Aristolochia	westlandii	ARISTOLOCHACEAE	ARISTOLOCHIALES	CR
Dendrobium	officinale	ORCHIDACEAE	ORCHIDALES	CR
Hopea	chinensis	DIPTEROCARPACEAE	THEALES	CR
Reevesia	rotundifolia	STERCULIACEAE	MALVALES	CR
Mangifera	hiemalis	ANACARDIACEAE	SAPINDALES	DD
Annamocarya	sinensis	JUGLANDACEAE	JUGLANDALES	EN
Begonia	peltatifolia	BEGONIACEAE	VIOLALES	EN
Bretschneidera	sinensis	BRETSCHNEIDERACEAE	SAPINDALES	EN
Cymbidium	nanulum	ORCHIDACEAE	ORCHIDALES	EN
Cyrtomium	hemionitis	DRYOPTERIDACEAE	BLECHNALES	EN
Dendrobium	wilsonii	ORCHIDACEAE	ORCHIDALES	EN
Fissistigma	cupreonitens	ANNONACEAE	MAGNOLIALES	EN
Garcinia	paucinervis	GUTTIFERAE	THEALES	EN
Ginkgo	biloba	GINKGOACEAE	GINKGOALES	EN
Ilex	brachyphylla	AQUIFOLIACEAE	CELASTRALES	EN
Ilex	chuniana	AQUIFOLIACEAE	CELASTRALES	EN
Ilex	peiradena	AQUIFOLIACEAE	CELASTRALES	EN
Neocheiropteris	palmatopedata	POLYPODIACEAE	POLYPODIALES	EN
Paphiopedilum	dianthum	ORCHIDACEAE	ORCHIDALES	EN
Phoebe	nanmu	LAURACEAE	LAURALES	EN
Pseudotaxus	chienii	TAXACEAE	CONIFERALES	EN
Ulmus	chenmoui	ULMACEAE	URTICALES	EN
Actinidia	chrysantha	ACTINIDIACEAE	THEALES	VU
Alphonsea	monogyna	ANNONACEAE	MAGNOLIALES	VU
Amentotaxus	argotaenia	TAXACEAE	CONIFERALES	VU
Aquilaria	sinensis	THYMELAEACEAE	MYRTALES	VU
Aralia	chinensis	ARALIACEAE	APIALES	VU
Aristolochia	hainanensis	ARISTOLOCHACEAE	ARISTOLOCHIALES	VU
Artocarpus	hypargyreus	MORACEAE	URTICALES	VU
Burretiodendron	esquirolii	TILIACEAE	MALVALES	VU
Burretiodendron	hsienmu	TILIACEAE	MALVALES	VU
Calamus	egregius	PALMAE	ARECALES	VU
Calocedrus	macrolepis	CUPRESSACEAE	CONIFERALES	VU
Camellia	euphlebia	THEACEAE	THEALES	VU
Camellia	grijsii	THEACEAE	THEALES	VU
Camellia	tunghinensis	THEACEAE	THEALES	VU
Castanopsis	concinna	FAGACEAE	FAGALES	VU
Cleidiocarpon	cavaleriei	EUPHORBIACEAE	EUPHORBIALES	VU
Cycas	segmentifida	CYCADACEAE	CYCADALES	VU
Dalbergia	balansae	LEGUMINOSAE	FABALES	VU

Dalbergia	odorifera	LEGUMINOSAE	FABALES	VU
Dalbergia	tonkinensis	LEGUMINOSAE	FABALES	VU
Diplopanax	stachyanthus	CORNACEAE	CORNALES	VU
Dysosma	versipellis	BERBERIDACEAE	RANUNCULALES	VU
Fagus	longipetiolata	FAGACEAE	FAGALES	VU
Gmelina	hainanensis	VERBENACEAE	LAMIALES	VU
Gymnostachyum	kwangsiense	ACANTHACEAE	SCROPHULARIALES	VU
Habenaria	fordii	ORCHIDACEAE	ORCHIDALES	VU
Halesia	macgregorii	STYRACACEAE	EBENALES	VU
Hydnocarpus	hainanensis	FLACOURTIACEAE	VIOLALES	VU
Ixonanthes	chinensis	IXONANTHACEAE	LINALES	VU
Madhuca	pasquieri	SAPOTACEAE	EBENALES	VU
Malania	oleifera	OLACACEAE	SANTALALES	VU
Manglietia	aromatica	MAGNOLIACEAE	MAGNOLIALES	VU
Oleandra	hainanensis	OLEANDRACEAE	DAVALLIALES	VU
Pittosporum	pauciflorum	PITTOSPORACEAE	ROSALES	VU
Rhododendron	cyanocarpum	ERICACEAE	ERICALES	VU
Rhododendron	jucundum	ERICACEAE	ERICALES	VU
Rhoiptelea	chiliantha	RHOIPTLEACEAE	JUGLANDALES	VU
Tapiscia	sinensis	STAPHYLEACEAE	SAPINDALES	VU

Annex V. Nature Reserves in Guangxi

Nature Reserves in Guangxi Established before 2005 and under approval of the State Council or Provincial Government

No	Reserve name	Located county	Located municipality or district	Total area ha	Core area ha	Buffer zone ha	Experimental zone ha	Target species or habitats	Approving organization	Year Established	Administrative agency
1	Huiping	LongshengLingui	Guilin	15133.30	4891.30	3668.10	6573.90	<i>Cathaya argyrophylla</i> and evergreen broadleaved forests	State Council	1978.11	Forestry
2	Nonggang	Longzhou, chongzuo	Chongzuo	10077.50	3104.80	2910.80	4061.90	Karst seasonal rainforest and monkeys	State Council	1980	Forestry
3	Dayaoshan	Jinxu	Laibin	24907.30				<i>Cathaya argyrophylla</i> , crocodile-lizard, water conservation forest	State Council	2000	Forestry
4	Mulun	Huanjiang	Hechi	8969.00	5482.00	1647.00	1840.00	Karst Evergreen broadleaved mixed forest ecosystem	State Council	1998.08.18	Forestry
5	Fangcheng Golden Cammellia	Fangcheng district	Fangchenggang	9195.10				Golden camellia	State Council	1994.04.05	Environment
6	Hepu dugong	Hepu	Beihai	35000.00				wild animal Dugong	State Coucil	1992.10.	Environment
7	Shankou Mangrove Community	Hepu	Beihai	8000.00				Maritime ecosystem-Mangrove community ecosystem	State Coucil	1990	Ocean
8	Beilun River Mouth Ocean	Fangcheng district, Dongxing	Fangcheng-gang	3000.00				Mangrove community ecosystem	State Council	2000	Ocean
9	Maoershan	Xingan, Ziyuan, Longsheng	Guilin	17008.50	6991.00	3038.40	6979.10	<i>Cathaya argyrophylla</i> , water conservation forest	State Council	1976.10.01	Forestry
10	Damingshan	Wuming, Mashan, Binyang, Shanglin	Nanning	16694.00	8823.00	4358.00	3813.00	Water conservation forest and landscape	State Council	1982.06.08	Forestry
11	Jiuwanshan	Rongshui, Luocheng, Huanjiang	Liuzhou, Hechi	25212.80	10488.60	6782.20	7942.00	Water conservation forest	Provincial Gov	1982.06.08	Forestry

12	Qianjiadong	Guanyang	Guilin	12231.00	6470.20	1999.00	3761.80	Water conservation forest	Provincial Gov	1982.06.08	Forestry
13	Qinwanglaoshan	Tianlin, Lingyun	Baise	18994.00	7062.00	5957.00	5975.00	Water conservation forest	Provincial Gov	1982.06.08	Forestry
14	Yuanbaoshan	Rongshui,	Liuzhou	4158.70				Water conservation forest and rare animals	Provincial Gov	1982.06.08	Forestry
15	Sijianshan	Rongshui	Liuzhou	692.30				Salamander	Provincial Gov		Fishery
16	Longhushan	Longan	Nanning	2766.00				Monsoon evergreen broadleaved forest	Provincial Gov	1980.11.	Forestry
17	Longshan	Shanglin	Nanning	10749.00	4549.50	2940.00	3295.50	Monsoon evergreen broadleaved forest	Provincial Gov		Forestry
18	36 Nong-Longjun	Wuming,	Nanning	12822.00	4205.00	4961.60	3655.40	<i>Burretiodendron hsienmu</i>	Provincial Gov		Forestry
19	Encheng	Daxin	Chongzuo	20900.00		20900.00		macaque	Provincial Gov	1982.06.08	Forestry
20	Xialei	Daxin	Chongzuo	7920.00		7920.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
21	Bapen ¹	Fushui	Chongzuo	10483.00	5528.40	834.50	4120.10	<i>Trachypithecus leucocephalus</i> , macaque	Provincial Gov	1982.06.08	Forestry
22	Banli ²	Chongzuo	Chongzuo	24665.00	8176.70	6350.70	10137.60	<i>Trachypithecus leucocephalus</i> , macaque	Provincial Gov	1982.06.08	Forestry
23	Western Damingshan	Fushui, Daxin Chongzuo, Shangsi	Chongzuo	60100.00		60100.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
24	Huashuigou	Babuqu	Hezhou	9929.00	5348.00	2648.00	1933.00	Water conservation forest	Provincial Gov	1982.06.08	Forestry
25	Gupeshan	Babuqu	Hezhou	6550.00				Water conservation forest	Provincial Gov	1982.06.08	Forestry
26	Qichong	Zhaoping	Hezhou	13023.70	4603.90	3488.20	4931.60	Water conservation forest and macaque	Provincial Gov	1982.06.08	Forestry
27	Daguishan	Babuqu	Hezhou	3780.00	1877.00	1903.00		Crocodile-lizard	Provincial Gov		Forestry

¹ Will be combined with Banli and expanded to form the White-headed Black Leaf Monkey National Nature Reserve.

² Will be combined with Bapen and expanded to form the White-headed Black Leaf Monkey National Nature Reserve.

28	Qingshitan	Lingchuan	Guilin	47362.40	12689.80	10013.50	21579.30	Water conservation forest	Provincial Gov	1982.06.08	Forestry
29	Haiyangshan	Lingchuan, Gongcheng, Guanyang, Quanzhou,	Guilin	90400.00				Water conservation forest	Provincial Gov	1982.06.08	Forestry
30	Yinzhulaoshan	Ziyuan	Guilin	28670.00		28670.00		<i>Abies ziyuanensis</i>	Provincial Gov	1982.06.08	Forestry
31	Jiaqiaoling	Yongfu, Lipu Yangshuo	Guilin	67000.00		67000.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
32	Shoucheng	Yongfu, Lingui	Guilin	75900.00		75900.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
33	Wufubaoding	Quanzhou	Guilin	8567.00		8567.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
34	Yindianshan	Gongcheng	Guilin	48000.00		48000.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
35	Jianxin	Longsheng	Guilin	4860.00		4860.00		Immigrant birds	Provincial Gov	1982.06.08	Forestry
36	Longtan	Tiane	Hechi	42848.40	13253.10	14886.20	14709.10	Water conservation forest and macaque	Provincial Gov	1982.06.08	Forestry
37	Three Tigers	Nandan, Tiane	Hechi	3105.10		3105.10		Water conservation forest	Provincial Gov	1982.06.08	Forestry
38	Dawangling	Baise	Baise	81900.00				Water conservation forest	Provincial Gov	1982.06.08	Forestry
39	Jinzhongshan	Longlin	Baise	27300.00		27300.00		Birds	Provincial Gov	1982.06.08	Forestry
40	Sishui River	Lingyun	Baise	20950.00		20950.00		Water conservation forest	Provincial Gov	1987.05	Forestry
41	Diding	Jingxi	Baise	4000.00		4000.00		Water conservation forest	Provincial Gov	2001.07	Forestry
42	Huanglianshan	Debao	Baise	21035.50	7382.70	5480.70	8172.10	Water conservation forest	Provincial Gov	1982.06.08	Forestry
43	Laohutiao	Nape	Baise	27007.50	8942.50	7997.00	10068.00	Water conservation forest	Provincial Gov	1982.06.08	Forestry
44	Wangzishan	Xilin	Baise	32209.00	9219.40	11963.30	11028.30	Birds	Provincial Gov	1982.06.08	Forestry

45	Nazuo cycas	Xilin	Baise	12458.00	5988.70	5151.70	1317.60	Water conservation forest	Provincial Gov	1982.06.08	Forestry
46	Yachang orchids	Tianlin	Baise	22062.00	7595.72	7023.59	7442.69	Orchids			Forestry
47	Dahongbao	Longlin	Baise	2035.00	605.80	886.20	543.00	Karst forest ecosystem			Forestry
48	Weizhou Island	Beihai	Beihai	2600.00				Migratory birds	Provincial Gov	1982.06.08	Forestry
49	Maoweihei mangrove	Qinzhou	Qinzhou	2784.00				Mangrove community ecosystem	Provincial Gov	2005.01.17	Forestry
50	Nalin	Bobai	Yulin	34737.00		34737.00		Water conservation forest	Provincial Gov	1982.05	Forestry
51	Dapingshan	Guiping	Guigang	1867.00		1867.00		Alsophila spinulosa and crocodile-lizard	Provincial Gov	1982.06.08	Forestry
52	Chengbi river	Youjiang	Baise	77000.00		77000.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
53	Baidong river	Youjiang, Tianyang	Baise	41600.00		41600.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
54	Nalan	Rongning	Nanning	346.67				Birds	Provincial Gov	2003	
55	Wanheshan	Fangcheng	Fangcheng-gang	100.00				Birds	Provincial Gov	2004	?
56	Dizhou	Jingxi	Baise	12100.00		12100.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
57	Gulongshan	Jingxi	Baise	29675.00		29675.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
58	Defu	Nape	Baise	12200.00		12200.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
59	Dahongjiang	Pingguo	Baise	28400.00		28400.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
60	Xilingshan	Fuchuan	Hezhou	19327.00		19327.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
61	Chunxiu	Longzhou	Chongzuo	7870.00		7870.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
62	Guxiu	Mongshan	Wuzhou	1900.00		1900.00		Crocodile-lizard and birds	Provincial Gov	1982.06.08	Forestry
63	Shansuo	Rongan	Liuzhou	5000.00		5000.00			Provincial Gov	1982.06.08	Forestry
64	Lagou	Luzhai	Liuzhou	9592.00		9592.00		Birds	Provincial Gov	1982.06.08	Forestry

65	Qinlongshan	Longzhou	Chongzuo	15100.00		15100.00		Water conservation forest	Provincial Gov	1982.06.08	Forestry
66	Guilin Nanbian	Guilin	Guilin	25.04		25.04		Geological profile of Carboniferous-Devonian Period	Ministry of Science and Technology, Ministry of Geology and Mining, provincial Gov	1989	Geology
67	Hengxian Liujiang	Hengxian	Nanning	5.00		5.00		Geological profile of Devonian Period	Provincial Gov	1983	Geology
68	Xiangzhou Dale	Xiangzhou	Laibin	12.00		12.00		Geological profile of Devonian Period	Provincial Gov	1983	Geology
69	Beiliu Dafengmen	Beiliu	Yulin	8.00		8.00		Geological profile of Devonian Period	Provincial Gov	1983	Geology
70	Nandan Luofu	Nandan	Hechi	12.00		12.00		Geological profile of Devonian Period	Provincial Gov	1983	Geology
Total				1,362,891.8	153,279.1	790,590.8	143,880.0				

Annex VI: Species Change in Ground Vegetation in Different Rotations of Eucalypt Plantations in Guangxi

Data provided by Forest Institute of Guangxi University

	Species	Family	Life form	Rotation 1	Rotation 2
1	<i>Apluda mutioa</i>	Gramineae	Herb	x	x
2	<i>Arthraxon hispidus</i>	Gramineae	Herb	x	
3	<i>Arundinella hirta</i>	Gramineae	Herb	x	x
4	<i>Bothriochloa intermedia</i>	Gramineae	Herb	x	
5	<i>Cymbopogon tortilis</i>	Gramineae	Herb	x	x
6	<i>Digitaria adscendens</i>	Gramineae	Herb		x
7	<i>Digitaria ischaemum</i>	Gramineae	Herb		x
8	<i>Eragrostis pilosa</i>	Gramineae	Herb	x	
9	<i>Hyparrhenia bracteana</i>	Gramineae	Herb	x	x
10	<i>Imperata cylindrica</i> var. <i>major</i>	Gramineae	Herb	x	x
11	<i>Isachne albens</i>	Gramineae	Herb	x	x
12	<i>Microstegium vagans</i>	Gramineae	Herb	x	x
13	<i>Miscanthus floxidulus</i>	Gramineae	Herb	x	x
14	<i>Neyraudia reyraudiana</i>	Gramineae	Herb	x	x
15	<i>Paspalum distichum</i>	Gramineae	Herb		x
16	<i>Paspalum scrobiculatum</i>	Gramineae	Herb	x	x
17	<i>Setaria viridis</i>	Gramineae	Herb	x	
18	<i>Sorghum nitidum</i>	Gramineae	Herb	x	x
19	<i>Ageratum conyzoides</i>	Compositae	Herb	x	
20	<i>Artemisia apiacea</i>	Compositae	Herb		x
21	<i>Asteromeaea indica</i>	Compositae	Herb		x
22	<i>Bidens bipinnata</i>	Compositae	Herb		x
23	<i>Elephantopus scaber</i>	Compositae	Herb	x	x
24	<i>Erigeron Canadensis</i>	Compositae	Herb	x	x
25	<i>Erigeron sonchifolia</i>	Compositae	Herb	x	x
26	<i>Eupatorium odoratum</i>	Compositae	Herb	x	x
27	<i>Gynura crepidioides</i>	Compositae	Herb	x	x
28	<i>Senecio scandens</i>	Compositae	Climber	x	x
29	<i>Mallotus philippenensis</i>	Eupobiaceae	Tree	x	
30	<i>Antidesma ghaesembiila</i>	Eupobiaceae	Tree	x	
31	<i>Mallotus barbatus</i>	Eupobiaceae	Tree	x	x
32	<i>Mallotus apelta</i>	Eupobiaceae	Tree	x	
33	<i>Mallotus repantus</i>	Eupobiaceae	Climber	x	
34	<i>Phyllanthus urinaria</i>	Eupobiaceae	Shrub	x	
35	<i>Manihot esculenta</i>	Eupobiaceae	Shrub		x
36	<i>Phyllanthus emblica</i>	Eupobiaceae	Tree	x	x
37	<i>Glochidion puberum</i>	Eupobiaceae	shrub	x	
38	<i>Breynia fruticosa</i>	Eupobiaceae	shrub	x	
39	<i>Fluggea virosa</i>	Eupobiaceae	Shrub	x	
40	<i>Cantharospermum scarabaeoides</i>	Papilionaceae	climber	x	x
41	<i>Crotalaria usaramoensis</i>	Papilionaceae	Shrub		x
42	<i>Desmodium pulchellum</i>	Papilionaceae	shrub	x	
43	<i>Lespedeza bicolor</i>	Papilionaceae	shrub	x	
44	<i>Millettia nitida</i>	Papilionaceae	climber	x	
45	<i>Eucalyptus exserta</i>	Myrtaceae	Tree	x	
46	<i>Eucalyptus urograndis</i>	Myrtaceae	Tree	x	x

47	<i>Rhodomyrtus tomentosa</i>	Myrtaceae	Shrub	x	x
48	<i>Brossonetia kazinoki</i>	Moraceae	Climber	x	
49	<i>Brossonetia papirifera</i>	Moraceae	Tree	x	
	Species	Family	Life form	Rotation 1	Rotation 2
50	<i>Cudrania tricuspidata</i>	Moraceae	Shrub	x	x
51	<i>Ficus hirta</i>	Moraceae	Shrub	x	
52	<i>Ficus sarmentosa</i> var. <i>impressa</i>	Moraceae	Climber	x	x
53	<i>Rhus chinensis</i>	Anacardiaceae	Tree	x	x
54	<i>Cunninghamia lanceolata</i>	Taxodiaceae	Tree	x	
55	<i>Cinnamomum camphora</i>	Lauraceae	Tree	x	x
56	<i>Litsea glutinosa</i>	Lauraceae	Shrub	x	x
57	<i>Cipadessa cinerascens</i>	Meliaceae	Shrub	x	x
58	<i>Melia azedarach</i>	Meliaceae	Tree	x	
59	<i>Trema dielsiana</i>	Ulmaceae	Tree	x	x
60	<i>Grewia oligandra</i>	Tiliaceae	Shrub	x	
61	<i>Markhamia cauda-felina</i>	Bignoniaceae	Tree	x	
62	<i>Symplocos laurina</i>	Symplocaceae	Tree	x	
63	<i>Symplocos racemosa</i>	Symplocaceae	Tree	x	
64	<i>Symplocos chinensis</i>	Symplocaceae	Shrub	x	x
65	<i>Clerodendron cyrtophyllum</i>	Verbenaceae	Shrub	x	x
66	<i>Callicarpa brevipes</i>	Verbenaceae	Shrub	x	
67	<i>Camellia oleifera</i>	Theaceae	Shrub	x	x
68	<i>Evodia lepta</i>	Rutaceae	Shrub	x	
69	<i>Urea lobata</i>	Malvaceae	Shrub	x	x
70	<i>Urea lobata</i> var. <i>sinuata</i>	Malvaceae	Shrub	x	
71	<i>Sida acuta</i>	Malvaceae	Shrub	x	
72	<i>Melastoma candidum</i>	Melastomaceae	Climber	x	
73	<i>Berchemia lineate</i>	Rhamnaceae	Climber	x	
74	<i>Sageretia theezans</i>	Rhamnaceae	Climber	x	
75	<i>Pileostegia viburnoides</i>	Hydrangeaceae	Climber	x	
76	<i>Stephania longa</i>	Menispermaceae	Climber	x	
77	<i>Stephania sinica</i>	Menispermaceae	Climber	x	
78	<i>Rubus parvifolius</i>	Rosaceae	Shrub	x	
79	<i>Embelia laeta</i>	Myrsinaceae	Climber	x	
80	<i>Streptocaulon griffithii</i>	Asclepiadaceae	Climber	x	x
81	<i>Cayatia japonica</i>	Vitaceae	Climber	x	
82	<i>Helicteres angustifolia</i>	Sterculiaceae	Shrub	x	
83	<i>Centella asiatica</i>	Umbelliferae	Climber	x	
84	<i>Brunella vulgaris</i>	Labiatae	Herb	x	
85	<i>Commelina communis</i>	Commelianaceae	Climber	x	
86	<i>Similax glabra</i>	Similacaceae	Climber	x	
87	<i>Asperagus cochinechinensis</i>	Liliaceae	Climber	x	
88	<i>Cyperus rotundus</i>	Cyperaceae	Herb	x	x
89	<i>Scleria terrestris</i>	Cyperaceae	Herb	x	
90	<i>Lygodium japonicum</i>	Lygodiaceae	Climber	x	
91	<i>Pteridium aquilinum</i> var. <i>latiusculum</i>	Pteridaceae	Herb	x	x
92	<i>Pteris nervosa</i>	Pteridaceae	Herb	x	
93	<i>Pteris semipinnata</i>	Pteridaceae	Herb	x	
94	<i>Adiantum flabellulatum</i>	Adiantaceae	Herb	x	
95	<i>Lindsaea cultrate</i>	Lindsaeaceae	Herb	x	

Annex VII: Additional Tables Referred to Social Impact Analysis in the Text

**Table 1. In the coming year, do you plan to work for "the company's" eucalypt project?
(Households in Project Villages)**

survey type A

Response	Respondents	%
Yes	38	15.57
No	49	20.08
Maybe	52	21.31
Don't know	105	43.03

N(A)=244, response rate (A) = 100%

**Table 2. Structure of Income in the Township
(from township data sheets filled out by 12 township governments in project areas)**

Sector or sub-sector	Average income per township (million yuan)	% of sector (i.e. agriculture, industry, or services)
Agriculture:	170	100
of which: crop income (including trees)	75	44.06
animal husbandry	76	44.50
Industry:	145	100
of which: processing	25	17.62
Services	66	100
of which: labor income	20	31.01

Response Rate = 12 out of 12 (100%)

**Table 3. Structure of Income in Village
(from village data sheets filled out by village leaders in 15 villages in project areas)**

Sector of sub-sector	Average income per township (thousand yuan)	% of sector (i.e. agriculture, industry, or services)
Agriculture:	577	100
Of which: crop income (including trees)	346	59.98
Animal husbandry	123	21.35
Industry:	0.6	100
Of which: processing	0.6	100
Services	97	100
Of which: labor income	69	71.03

Response Rate = 15 out of 15 (100%)

Table 4. In 2004, did you or any other member of your household work in other jobs (i.e. other than those related to "the company" eucalyptus planting)?

Where did you work? (survey Type A)

Response	respondents	Percent (%)
Yes	132	54.10
in my own village	24	9.84
Same township, different village	17	6.97
Same county, different township	39	15.98
Same province, different county	11	4.51
Different province	52	21.31
No	112	45.90

N(A)=244, response rate (A) = 100%

Table 5. Main Expenditures in 2004 for Households in Project Villages
(survey Type A)
units: yuan and percent

Expenditure Area	Average expenditure per household (yuan)	Average percent of household expenditures (%)
Food	1208	65.92
Education	340	18.56
Health	152	8.34
Other areas	132	7.18
Total	1833	---

N(A)=244, response rate (A) = 100%

Table 6. Appliances and Other Durables Owned by Households in Project Villages (survey Type A)
units: percent

Item	Percent of Households Owning Item
Television	95.90
Fixed-line telephone	30.74
Mobile telephone	22.54
Gas stove	31.97
Electric rice cooker	26.64
Refrigerator	2.87
Air conditioner	0
Washing machine	9.02
Motor cycle	58.61
Tractor or similar vehicle	20.08
Car or van	4.10
Other durable items/appliances	5.33

N(A)=244, response rate (A) = 100%

Table 7. Land Rented to "the Company" in the Township
survey of 12 township governments

Question asked	Average per township
total in township area rented to company	4,461.27 mu
rental price	24.55 yuan/mu/year
households involved (households)	225.75 households
population involved (persons)	1,893.58 persons
of land rented to company, area that had history of being planted with any crop or tree (i.e. was not bareland) (mu)	3,928.8 mu
Area rented involving middle persons (bosses, contractors, or prosperous farmers)	2,071.6 mu

Note: 11 townships responded to questions for the first two rows, 12 to those for next two rows, and 10 to those for the last two rows.

**Table 8. Land Rented Out in the Township to People Other than Stora Enso
survey of 12 township governments in project areas**

Response	Number of respondents	Percentage of townships
Yes, land rented out to others	11	91.67%
Use	-----	-----
Fruit trees	6	54.5%
Sugarcane	2	18.1%
Timbre plantation	7	63.6%
Grazing land	0	0%
re-rent to third party	1	9.1%
Other	2	18.1%
No, land not rented out to others	1	8.33%

Response rate=100%

**Table 9: Structure of Income on Forest Farms in Project Areas
from survey of management of 23 forest farm or sub-farms**

Sector or sub-sector	average per farm (thousand yuan)	percent of sector
Agriculture	4,460	100
Of which: income from crops and trees	4,370	97.92
Income from animal husbandry	22	0.51
Industry	91	100
Of which, income from processing	91	100
Services	980	100
Of which, labor income	85	8.62

Response rate=100%

Table 10. In 2004, did you or one of your household members do any other informal jobs (aside from those on "the company's" eucalypt plantations)? (state farm staff in project areas)

Survey Types C and E

Response	C: has worked on Stora Enso land		E: has not worked on Stora Enso land	
	Respondents	%	Respondents	%
Yes	49	27.07	63	44.06
work: my forest farm (or same township)	19	10.50	38	26.57
Different township, same county	5	2.76	7	4.90
Different county, same province	11	6.08	11	7.69
Outside province	18	9.94	15	10.49
No	132	72.93	80	55.94

N (C) =181, response rate (C) = 100%, N (E) =143, response rate (E) = 100%

Table 11. Main consumption expenditures in 2004
(Staff of State Forest Farms in Project Areas)
Survey Types C and E

Expenditure Category	C: Have Worked on Project Land		E: Have Not Worked on Project Land	
	Average Expenditure (yuan)	% of total average expenditure	Average Expenditure (yuan)	% of total average expenditure
Food	1,866	58.32	1,962	59.32
Education	539	16.86	408	12.32
Health	324	10.11	243	7.34
Others	471	14.71	695	21.02
Total	3,200	100	3,309	100

N (C) =181, response rate = 100%, N (E) =143, response rate (E) = 100%

Table 12. Appliances and Durable Items Your Household Has in Use
(Staff of State Forest Farms in Project Areas)
Survey Types C and E

Appliance/Durable Item	C: Have worked project land	E: Have not worked projected land
Television	91.71	95.8
Set telephone	62.43	82.52
Mobile telephone	62.98	60.84
Gas stove	70.17	79.02
Rice cooker	68.51	79.02
Refrigerator	13.26	48.25
Air conditioner	2.76	8.39
Washing machine	25.41	50.35
Motor cycle	86.19	69.93
Tractor or such like vehicle	2.76	8.39
Car or van	2.21	2.10
Others	8.29	3.5

N (C) =181, response rate (C)=100%, N (E) =143, response rate (E) = 100%

Table 13. In 2004, did you or any other member of your household work in other informal jobs (i.e. other than those related to "the company" eucalypt plantations)? (Local Village Households with Member Working on Stora Enso Land on State Forest Farm)

Survey Type D

response	respondents	percent (%)
Yes	53	38.97
Working place: in the same township or forest farm	24	17.65
in another township but same county	2	1.47
Outside county, but same province	27	19.85
Outside province	15	11.03
No	83	61.03

N (D) =136, response rate (D)= 100%

Table 14. Main consumption expenditures in 2004 (Local Village Households with Member Working on Stora Enso Land on State Forest Farm)

Survey Type D

Expenditure Type	Average expenditure per household	Percent of average total expenditures
Food	1,640	60.2

Education	290	10.7
Health	195	7.2
Others	598	22.0
Total	2,723	100

N (D) =136, response rate (D) = 136

Table 15. Appliances and durable items your household has in use (Local Village Households with Member Working on Stora Enso Land on State Forest Farm)

Survey Type D

Appliance or durable item	Percent of households
Television	88.24
Fixed line telephone	36.03
Mobile telephone	32.35
Gas stove	43.38
Rice cooker	47.79
Refrigerator	5.88
Air conditioner	2.94
Washing machine	11.03
Motorcycle	68.38
Tractor or similar like vehicle	8.09
Car or van	2.21
Other	0

N (D) =136, response rate (D) = 100%

Table 16 Place of Origin of Migrants working on Stora Enso Plantation survey of 50 migrants

	Total	Yunnan	Northwestern Guangxi				
			Subtotal of Guangxi	Longlin	Tianlin	Leye	Fengshan
Number of Interviewees	50	15	35	8	11	6	10
%	100	30	70	16	22	12	20

N = 50, response rate = 100%

Table 17. Basic Facts on Group of Interviewees survey of 50 migrant workers

Item	average or percent
Average Age	30.42 years old
% of Female	22%
% of Ethnic Minority	52%
% Miao Ethnic Minority	30%
% Zhuang Ethnic Minority	20%
% Yao Ethnic Minority	2%
Family Size (average)	4.34 persons/household
Laborers per Family	3.02 laborers/family
Years of Education	3.32 years

N = 50, response rate = 100%

Table 18. Household Consumptive Expenditure of Migrant Workers in 2004
Survey of 50 migrant workers

Expenditure Item	Expenditure (yuan)	percent (%)
Food	3,206.1	70.87
Education	356.8	7.89
Medical care	576	12.73
Other (clothes, etc.)	385.2	8.51
Total	4,524.1	100

N=50, response rate = 100%

Table 19. Appliances Migrant Workers Have at Their Homes
Survey of 50 migrant workers

Appliance	percent of households with the appliance
TV Set	48
Telephone	8
Mobile Phone	18
Gas Stove	12
Electric Rice Cooker	12
Refrigerator	4
Air Conditioner	2
Washing Machine	12
Motorcycle	8
Tractor or other farming machine	6
Truck	0
Others	14

N = 50, response rate = 100%

Table 20. Land Use in Townships in Project Areas
Survey of 12 Township Governments in Project Areas, in units of mu

	Agricultural land	Of which, paddy	Of which, dryland	Land suitable to forest	Of which, forested land	Of which, bare land
Total for all townships	563,974	313,695	241,171	901,418	695,427	205,991
Average (per township)	46,998	26,141	20,098	75,118	57,952	17,166

Response rate=100%

Table 21. Land Use on Forest Farms in Project Areas
Survey of 23 State Farm Management Teams, in units of mu

	Agricultural land	Of which, paddy	Of which, dryland	Land suitable to forest	Of which, forested land	Of which, bare land
Total for all forest farms	39,596	446	39,050	1,201,624	1,047,946	153,678
Average (per forest farm)	1,722	19	1,698	52,245	45,563	6,682

Response rate=100%

**Table 22. Land Rented by Forest Farm to "the Company" for Plantation Development
Survey of 23 Forest Farm Management Teams in Project Areas, in units of mu**

	Total for All Surveyed Forest Farms	Average per Forest Farm
Area Rented to Stora Enso	228,188	9,921
Of which, area planted (with any crop or tree) prior to rental	101,981	4,435

Response rate=100%

**Table 23. Land Rented by Village Households and Collectives to "the Company" for Plantation Development
Survey of 12 Township Governments in Project Areas, in units of mu**

	Total for All Surveyed Townships	Average per Township
Area Rented to Stora Enso	49,074	4,090
Of which, area planted (with any crop or tree) prior to rental	39,288	3,274

Response rate=100%

**Table 24. Forestland and bare land rented to the company by individual households in village project areas
Survey Type A**

	Units	Total for all respondent s	mean
Area	mu	5,976.55	24.49 mu/household
Length of lease	years	6,060	24.83 years
	Units	Number of respondent s	proportion of total respondents
Number of households receiving payments on time and in full	percent of households	135	55.33%
Number of households who expect the rental value of their land to increase in the future	percent of households	96	39.34%

N(A)=244, response rate (A) = 100%

**Table 25. What is the area of private ("geren chengbao") forestland and bare land that you have not yet rented to out to others? (Households Renting Private Land in Village Project Areas)
Survey Type A, in units of mu**

	Total area for all respondents	Average area per household
Total	3,613.2	14.8
Of which: forestland	3,245.3	13.3
Bare land	367.7	1.5

N(A)=244, response rate (A) = 100%

Table 26. Land Rented by Your Collective to "the Company" (Households in Village Project Areas)

Survey Type A, in units of mu

	Total are for all respondents	Average area
Area	15,205.2	62.3
Of which: forestland	13,336.2	54.7
Bareland	255.7	1.1
Other	--	--

N(A)=244, response rate (A) = 100%

Note: Areas in the last column can be thought of as typical areas rented per collective, as derived by averaging across household responses to this question.

Table 27. The area of forestland and bare land that your collective has not rented out to others. (Households in Village Project Areas)

Survey Type A, in units of mu

	Total area for all respondents	Average area
Total	7,942	32.6
Of which: forestland	7,574.3	31.0
Bare land	367.7	1.5

N(A)=244, response rate (A) = 100%

Note: Areas in the last column can be thought as typical areas of land not yet rented out per collective, as derived by averaging across household responses to this question.

Table 28. Of the group/village's land suitable to forest, what is the area of collective versus private land? (Small group survey in project villages)

15 Small Groups in Project Villages, in units of mu and percent

	Total area of forest suitable land	Run collectively	Private Use Rights
Total for all groups (mu)	129,752	54,289	75,463
Percent of total area	100 %	41.84 %	58.16 %

Response rate=100%

Table 29. What are the main negative impacts of land rental to Stora Enso for plantation development?

(Check all that apply and rank in importance, with "1" as most important)

Survey of 15 Small Groups in Project Villages

Negative Impact	Number of respondents	percent of respondents (%)	Average ranking
Degradation in soil fertility	12	80	1
Dehydration of soil	6	40	6
Reduction in nearby water resources	10	66.67	2
Deterioration of air and water quality	2	13.33	11
Decrease in productivity of cropland	9	60	3
No more grazing land	8	53.33	4
Nowhere to collect fuel	5	33.33	9
Nowhere to gather construction timber	2	13.33	11
Nowhere to bury people	3	20	10
Harm to both human and animal health	6	40	5

Timber transport damages/pollutes roads	5	33.33	7
Reduction of the chances to work	2	13.33	13
Others	5	33.33	8

N=15, response rate = 100%

Table 30. What are the main negative impacts of renting land to "the company" for plantation development? (Check all that apply)

Survey of 12 Township Governments

Negative Impact	Number of respondents	percent of respondents (%)
Degradation in soil fertility	10	83.33
Dehydration of soil	10	83.33
Reduction in nearby water resources	10	83.33
Deterioration of air and water quality	9	75
Decrease in productivity of cropland	10	83.33
No more grazing land	10	83.33
Nowhere to collect fuel	10	83.33
Nowhere to gather construction timber	9	75
Nowhere to bury people	9	75
Harm to both human and animal health	9	75
Timber transport damages/pollutes roads	9	75
Others	1	8.33

N=12, response rate = 100%

Table 31. Main negative impacts of land rental to Stora Enso for plantation development (please indicate all that apply and rank, with "1" as most important). (State Forest Farm Households in Project Areas that Have Worked on Stora Enso Land)

Survey Type C

Negative Impacts of Project	Respondents	Percent of those responding (%)	Percent of total survey group (%)	Average ranking
Degradation in soil fertility	56	80.00	30.93	2
Dehydration of soil	54	77.14	29.83	4
Reduction in nearby water resources	51	72.86	28.18	1
Deterioration of air and water quality	44	62.86	24.31	3
Decrease in productivity of cropland	39	55.71	21.55	5
No more grazing land	22	31.43	12.15	10
Nowhere to collect fuel	25	35.71	13.81	8
Nowhere to gather construction timber	22	31.43	12.15	11
Nowhere to bury people	22	31.43	12.15	12
Harm to both human and animal health	34	48.57	18.78	6
Timber transport damages/pollutes roads	22	31.43	12.15	9
Other	14	20.00	7.73	7

N(C)=181, response rate (C)=38.67% (70 respondents)

Table 32. What are the main negative impacts of land rental to Stora Enso for plantation development? (Check all that apply and rank in importance, with "1" as most important)

Survey of 20 Small Groups of Project Area State Forest Farm Staff

Negative Impact	Number of respondents	percent of respondents (%)
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Degradation in soil fertility	5	25
Dehydration of soil	3	15
Reduction in nearby water resources	6	30
Deterioration of air and water quality	0	0
Decrease in productivity of cropland	0	0
No more grazing land	1	5
Nowhere to collect fuel	0	0
Nowhere to gather construction timber	0	0
Nowhere to bury people	0	0
Harm to both human and animal health	0	0
Timber transport damages/pollutes roads	0	0
Reduction of the chances to work	7	35
Others	14	70

N=20, response rate = 100%

**Table 33. Willingness of households to rent out private land
Survey of 12 Project Area Township Governments**

Question/Response	Respondents	Percent of Respondents (%)
Generally speaking, do households want to rent out their individually contracted forestland?	---	----
Yes	4	33.3
Why? (open-ended)	Increase income: Because land is not cultivable, rental can in turn produce money.	
No	5	41.67
Why not? (open-ended)	More profitable to plant sugarcane; rental is modest and it's difficult to get cash soon; too many people, too little land.	
Not sure	3	25
Question	Respondents	Average Proportion Given/ Percent of Respondents
Proportion of households that want to rent out their individual forestland	---	34 (average of 7 responses)
Unable to make estimate	5	41.67 (percent of respondents)

N=12, Response Rate (N) = 100%

**Table 34. Reasons you did not agree initially to rent out private your land to Stora Enso
(Households in Project Area Villages)
Survey Type A**

Response	Number respondents	Percent of those responding to question (%)
I want to continue current land use	39	43.33
I want to develop land in a new way myself	25	27.77
I don't want to be locked in for such a long time	24	26.66
Other reason	2	2.22
Total	90	100.00

N(A)=244, response rate (A) = 36.89%

Note: All or almost all of Type A households sooner or later rented private land to Stora Enso.

**Table 35. Willingness of collectives to rent out collective land
Survey of 12 Project Area Township Governments**

Question/Response	Respondents	Percent of Respondents (%)
Generally speaking, do collectives want to rent out their forestland?	---	----
Yes	5	41.67
Why? (open-ended)	Income of both the collective and individuals will increase; certain individuals use the collective land as their own; rental will increase the collective's economic strength.	
No	4	33.33
Why not? (open-ended)	Reasons given vary. Examples include: rental rate too low; rental period too long.	
Not sure	3	25
Question	Respondents	Average Proportion Given/ Percent of Respondents
Proportion of collectives that want to rent out their forestland	---	52.5 (average of 7 responses)
Unable to make estimate	5	41.67 (percent of respondents)

N=12, response rate = 100%

**Table 36: People's Attitude towards Renting out Village's Forestland to Stora Enso for
Plantation Development
Survey of 15 Small Groups in Project Villages**

	Strongly support	Support	Do not support	Strongly object	Don't know
Responses	2	6	3	3	1
Percent	13.33	40	20	20	6.67

N=15, response rate = 100%

Table 37. If forest farm land has been rented to "the company" are the regular workers aware of it?

Survey of 12 Project Area State Farm Management Teams

Response	Respondents	Percent of those responding
Yes	8	36.4
If yes, do they know the area rented?	5 ("yes")	(23)
If yes, do they know the rental price?	5 ("yes")	(23)
They don't know	4	18.2
Some know, some don't	10	45.4

N= 23, response rate = 96% (22 responded)

**Table 38. If collective rental monies are used for projects or goods for the collective, what sorts of collective purposes do you think this money should be spent on? (check all that apply, ranking in order of importance)
(Villagers in Project Areas)**

Survey Type A

Response	Respondents	%	Average importance ranking (1-5)
Roads	177	72.54	1
Healthcare	159	65.16	2
Schools	145	59.43	3
Other	37	15.16	4

N(A)=244, response rate (A) = 100%

Note: When respondents did not include a ranking for an item, that item was given a ranking of "5".

Table 39. How is forestland and bare land of your collective that is not being rented out being used at present? (Households in Project Villages)

Survey Type A

Response	Respondents	%
Bareland	30	20.68
Eucalypt	15	10.34
Pine	38	26.2
Acacia	30	20.69
Fruit trees	3	2.07
Sugarcane	0	0
Grazing	29	0.20
Other	0	0

N(A)=244, response rate (A) = 59.43%

**Table 40. Your family's sources of fuel (select all that apply)
(Village Households in Project Areas)**

Survey Type A

Fuel Source	respondents	%
Coal	3	1.23
Gas	80	32.79
Fuel wood	182	74.59
Agricultural residues	207	84.84
Forest plantation residues	141	57.79
Other	12	4.92

N(A)=244, response rate (A) = 100%

**Table 41. Views on Forest Farm Rental Contract with the Company
Survey of 23 Project Area State Farm Management Teams**

View	Number of Respondents	Percent of Respondents
Contract is perfect/complete	5	21.74
Contract is relatively perfect/complete	4	17.39
Not as expected/ Not ideal	11	47.83
Don't know	3	13.04

N=23, response rate = 100%

**Table 42. What kind of work have you been involved in on the company's eucalypt plantations?
Survey Types C, D, and H**

Type of Work	C: State Farm Workers Working on Stora Enso Land		D: Local Villagers Working on Stora Enso State Farm Land		H: Migrant Workers Working on Stora Enso Land in Villages or on State Farms	
	Number of Workers	Percent	Number of Workers	Percent	Number of workers	Percent
Land clearing	60	33.2	54	39.7	38	76.0
Seedling production	37	20.4	26	19.1	21	42.0
Site preparation (e.g. digging)	75	41.4	70	51.5	49	98.0

Planting	88	48.6	97	71.3	50	100.0
Fertilizer application	87	48.1	107	78.7	49	98.0
Weeding and other maintenance	69	38.1	101	74.3	39	78.0
Harvesting	11	6.1	19	14.0	1	2.0
Others	19	10.5	9	6.6	0	0.0

N(C) = 181, N(D) = 136, N(H) = 50 (response rates for all three groups 100%)

Table 43. If you anticipate accepting work on "the company" plantation project in the future, what kinds of work are you willing to do?
Survey Types A, C, D, and H (Note: C, D, and H have all worked on Stora Enso land in the past; A has rented private land to Stora Enso.)

Response	A: project villager		C: state farm worker		D: villager living near state farm		H: migrant worker	
	Number	%	Number	%	Number	%	Number	%
Land clearing	77	31.6	58	32.0	54	39.7	34	68.0
Seedling production	73	29.9	55	30.4	26	19.1	31	62.0
Site preparation (e.g. digging)	85	34.8	76	42.0	70	51.5	48	96.0
Planting	140	57.4	107	59.1	97	71.3	49	98.0
Fertilizer application	167	68.4	95	52.5	107	78.7	42	84.0
Weeding/ maintenance	150	61.5	85	47.0	101	74.3	34	68.0
Harvesting	49	20.1	32	17.7	19	14.0	4	8.0
Other	6	2.5	19	10.5	9	6.6	0	0.0

N(A) = 244, response rate (A) = 100%, N(C) = 181, response rate (C) = 100%, N(D) = 136, response rate (D) = 100%, N(H) = 50, response rate(H) = 100%

Table 44. Non-Salary Benefits Received by Migrants while Working on Stora Enso Plantations (Select All that Apply)
Survey Type H

Non-Salary Benefits	Number of workers in receipt of subsidy	Percent of respondents
Food	0	0.0
Housing	0	0.0
Healthcare	3	6.0
No non-salary benefits	47	94.0

Note: N = 50, response rate (N) = 50

Table 45. If the forest farm's land was rented and you and your family members no longer had the opportunity to continue working on the forestland, what would the impact on your household's annual cash income?
Survey Types C, D, and H (all of whom have worked on Stora Enso land)

Impact on annual income	C: Forest Farm Staff			D: Villager Near Forest Farm			H: Migrant Worker		
	Count	%	Average increase/Decrease (yuan/year)	Count	%	Average increase/decrease (yuan/year)	Count	%	Average increase/decrease (yuan/year)
Decrease	50	32	-4,855	23	19	-4,345	8	16	2,206
Increase	16	10	+4,743	8	6	+6,676	0	0	---
No effect	92	58	--	93	75	---	42	84	---

N(C)=181, response rate (C)=87.3%, N(D)=136, response rate (D)=91.2%, N(H)=50, response rate (H)=100%

Table 46. If the project work interferes with your need to work your own land, how will you manage it (check all that apply)?

Survey Types A, C, D, and H (Note: C, D, and H have all worked on Stora Enso land in the past; A has rented private land to Stora Enso.)

Method of Managing Time Conflict	A: project villager		C: state farm worker		D: villager living near state farm		H: migrant worker	
	Number	%*	Number	%	Number	%	Number	%
Use more family members	127	52.0	49	27.1	37	27.2	6	12.0
Work harder and longer	159	65.2	110	60.8	93	68.4	17	34.0
Hire laborers	59	24.2	20	16.0	45	33.1	22	44.0
Other	2	0.8	3	1.7	4	2.9	13	26.0

N(A)=244, response rate (A)=100%, N(C) = 181, response rate (C)= 100%, N(D) =136, response rate (D) = 100%, N(H) = 50, response rate (H) = 100%

*"%" indicates percent of respondents (and not percent of responses)

Table 47. Work of You or Your Household Member outside of your Home County in 2004

Survey Types A, C, and D (A: villager renting private land to Stora Enso; C: state farm worker working Stora Enso land; D: villager living near state farm and working on its Stora Enso land.)

Item	A	C	D
Average number of household members (persons/household)	1.7	1.3	2.0
Average overall months per capita (month/person)	9.5	8.2	7.1
Average monthly wages per person (yuan/person/month)	593.8	710.0	656.2

N(A)=244, N(C)=181, N(D)=136; estimated response rates: response rate(A)=26%, response rate (C)=16%; response rate (D)=31%

Table 48. Do you have a contract with "the company" for your work in eucalypt planting? (State Farm Workers Working on Stora Enso Land)

Survey Group C

Response	Respondents	Per cent
Yes	23	18.7
No	100	81.3
Total	123	100.0

N(C)=181, response rate (C)=68.0%

Table 49. Where do you usually go when ill (check all that apply)? (Migrants Working on Stora Enso Land)

Survey Type H

Solution	Count	Percent
Go To A Clinic In The Village	0	0.0
Go To A Clinic In The Neighboring Village	0	0.0
Go To A Town-level Hospital	20	40.0
Go To A County-level Hospital	9	18.0
See A traditional healer In The Village	0	0.0
Take no action And Let It Heal Itself	15	30.0
Other (open response)	15	30.0
Never become Ill (listed in open response)	8	16.0
Buy Medicine at Pharmacies (listed in open response)	7	14.0

N(H)=50, response rate (H)=100%

**Table 50. What is your opinion about the area's local medical services (check all that apply)?
(Migrants Working on Stora Enso Land)
Survey Type H**

Opinion	Count	Percent
Too Costly	6	12.0
Too Far Away	5	10.0
Insufficiency of Drugs And Equipment	0	0.0
Unqualified Doctors	0	0.0
Other (open response)	41	82.0
Have No Idea Since Never See A Doctor While Working Here (from open response)	30	60.0
Good Conditions (from open response)	9	18.0
Fair Conditions (from open response)	1	2.0
Bad Services by Nurses (from open response)	1	2.0

N (H) = 50, response rate (H)=100%

**Table 51. What other requests or suggestions do you have for "the company's" forestry project?
(Migrants Working on Stora Enso Land)
Survey Type H**

Suggestion/Request	Count	Percent
No suggestion or request	34	68.0
Make payments on time	4	8.0
Provide high quality seedlings to prevent necessity of re-planting	5	10.0
Provide better living conditions	1	2.0
Provide better drinking water	1	2.0
Strengthen protection of seedlings in the field to prevent the seedlings from being damaged by local farmers or domestic animals	3	6.0
Lower Work Requirement	5	10.0
Don't Have to Apply Fertilizers Twice	1	2.0
Increase Wages	1	2.0

N(H)=50, response rate(H)=100%

**Table 52. If you have heard that there is an opportunity to rent land to "the company," how did you get this information (check all that apply)?
Survey Type A; units: percent of respondents**

Response	A: villagers renting private land
From company staff	13.9
Government publicity	78.7
Village committee held meeting	67.2
News and mass media	3.3
Neighbor or friends	33.2
Other	0.8
Don't know	2.1

N(A)=244, response rate (A)=100%.

Table 53. If you have heard there is an opportunity to work on the land rented by "the company," how did you first hear about this?

Survey Types A, C, D, and E (all of which live or work in project areas)

Response	A: villagers renting private land	C: state farm staff working project land	D: villagers working project state farm land	E: state farm staff not working project land
From company staff	16.4	40.9	23.5	14.0
Government publicity	40.6	11.6	2.2	16.8
Village committee held meeting	12.7	0	0	0
News and mass media	0.4	0.6	0	2.1
Neighbor or friends	25.8	10.5	25.0	14.7
Other	0.8	22.7	36.0	26.6
Don't know	3.3	13.8	13.2	25.9

N(A)=244, N(C) = 181, N(D) = 136, N(E)=143; Response rate of all was 100%.

Table 54. From what source did you learn that Stora Enso wants to come here to development plantations (Check all that apply)?

15 Village Small Groups and 20 Forest Farm Small Groups

(units: number of groups selecting response)

Response	Village Small Group	Forest Farm Small Group
The company	1	0
Government publicity	8	5
Village committee meeting	1	
Meeting was held		12
News report	0	1
Heard it from friends	0	2
Other	2	6

Estimated response rate (village groups) = 80%; estimated response rate (forest farm groups) = 100%

Table 55. What info. have the people obtained from Stora Enso (Check all that apply)?

15 Village Small Groups and 20 Forest Farm Small Groups

(units: number of groups selecting response)

Response	Village Small Groups	Forest Farm Small Groups
Plantation policies	2	0
Rental policies	3	0
Rental rate/standard	4	0
Decision-making procedure	0	0
Distribution methods	0	0
Other	NA	18

Response rate (village) = NA; response rate (forest farm) = 90%

Table 56. How should Stora Enso strengthen communication with you (Check all that apply)?

15 Village Small Groups and 20 Forest Farm Small Groups (units: number of groups selecting response)

Response	Village Small Groups	Forest Farm Small Groups
Regular meetings between the two sides	10	14

Regular bulletins or brochures	2	4
Community internet website linked with company	0	0
Set up hotline	1	1

Estimated response rate (village) = 87%; estimated response rate (forest farm) = 95%

Table 57: Household Housing Conditions

Survey Types A, C, E, D, I, and J (C and D work on Stora Enso state farm land; E is worker of project area state farm, but does not work on Stora Enso land; I has family member working in project area; J has family member migrating to non-project area.)

Type of Home	A: villagers renting private land	C: state farm worker	E: state farm worker	D: villager near state farm	I: migrant place of origin household	J: migrant place of origin household
Mud with tiled roof					66.7	39.7
Mud with thatched roof					0	0
Stone					0	1.4
Brick walls with tiled roof	32.0	71.8	59.4	55.2	3.7	13.7
Concrete and brick	25.4	16.6	15.4	13.2	0	6.8
Other	42.6	11.6	25.2	31.6	29.6	38.4
Housing Area per Person	20.1	15.8	13.4	18.5		

Note: Shaded options were collapsed into "other" for groups A, C, E, and D; data on housing area was not collected for groups I and J. N(A)=244, N(C)=181, N(E)=143, N(D)=136, N(I)=27, N(J)=73; Response rates for all were 100%.

Table 58: Where do you usually go for treatment when sick (check all that apply)?

Survey Types A, C, E, D, I, and J (C and D work on Stora Enso state farm land; E is worker of project area state farm, but does not work on Stora Enso land; I has family member working in project area; J has family member migrating to non-project area.)

	A: villagers renting private land	C: state farm worker	E: state farm worker	D: villager near state farm	I: migrant place of origin household	J: migrant place of origin household
doctor or clinic in village	78.3	13.3	14.0	52.9	70.4	69.9
doctor or clinic in nearby village	37.0	28.2	20.3	51.7	0	6.9
clinic or hospital in township seat	82.4	87.9	94.4	83.1	37.0	57.5
hospital in county seat	39.3	20.4	55.24	29.4	7.4	23.3
traditional healer in village	0	0	0.7	0	0	0
no treatment	0	4.4	0	0	14.8	1.4
Other	0	0	6.3	0	18.5	12.3

Note: N(A)=244, N(C)=181, N(E)=143, N(D)=136, N(I)=27, N(J)=73; Response rates for all were 100%.

Table 59: What are the most urgent priorities for improving conditions in your community (check all that apply and rank, with "1" as most important)?
(units: number of respondents and average rank)

Survey of 15 Project Area Village Small Groups and 20 Project Area Forest Farm Small Groups

Priority Area	Village Small Groups (number of groups)	Forest Farm Small Groups (number of groups)	Rank	
			village groups	forest farm groups
Road conditions	12	11	1	3
Access to drinking water	9	9	2	4
Telecom, internet access	3	3	6	8
Irrigation, water conservancy	7	3	3	6
Educational conditions	4	7	5	5
Health services	4	12	7	2
Local living environment	7	17	4	1
Produce trade and market conditions	3	3	8	7

Response rates for both groups were 100%.

Table 60: What are the most urgent priorities for improving conditions in your community (check all that apply and rank, with "1" as most important)? (units: number of respondents and average rank)

Survey of 12 Project Area Township Governments and 23 Project Area Forest Farm Management Teams

Priority Area	Township Governments (number)	Forest Farm Management Teams (number)	Rank	
			Township government	Forest farm management
Road conditions	12	23	1	1
Access to drinking water	11	22	6	5
Telecom, internet access	11	22	7	7
Irrigation, water conservancy	11	22	2	8
Educational conditions	11	23	3	4
Health services	11	23	4	2
Local living environment	12	23	5	3
Produce trade and market conditions	11	22	8	6

Response rates for both groups were 100%.

Annex VIII. Employment Generation from Plantation Project

Direct Work Opportunity Generation from the Project (in workday/ha)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Option 1: replant in 2nd rotation															
Site Clearing	15							15							30
Site Preparation	60							60							120
Base Fertilizer	12							12							24
Planting	9							9							18
Watering	9							9							18
Weeding & Coppice Removal	15	15						15	15						60
Follow-up Fertilizer	15	15						15	15						60
Forest Guarding & others	7.5	7.5	7.5	7.5	7.5	7.5		7.5	7.5	7.5	7.5	7.5	7.5		90
Harvesting							60							60	120
Sub-total	142.5	37.5	7.5	7.5	7.5	7.5	60	142.5	37.5	7.5	7.5	7.5	7.5	60	540
Option 2: germination in 2nd rotation															
Site Clearing	15														30
Site Preparation	60														120
Base Fertilizer	12														24
Planting	9														18
Watering	9														18
Weeding & Coppice Removal	15	15						15	15						60
Follow-up Fertilizer	15	15						15	15						60
Forest Guarding & others	7.5	7.5	7.5	7.5	7.5	7.5		7.5	7.5	7.5	7.5	7.5	7.5		90
Harvesting							60							60	120
Sub-total	142.5	37.5	7.5	7.5	7.5	7.5	60	37.5	37.5	7.5	7.5	7.5	7.5	60	435
Annual Labor Opportunity: Option 1: 4,628,571 workdays; Option2: 3728571 workdays															

Annex IX: Main Financial Indicators of the Project as Used in Cost Benefit Analysis

Main Financial Indicators of the Project

Indicator	Unit	Amount
Labor cost	Yuan/Work day	25
Land lease cost	Yuan/ha·year	600
Transport cost	Yuan/ m ³ ·Km	0.45
Average transport distance	Km	20
MAI	m ³ / ha·year	24
Wood Production in calculation period	m ³ /ha	336
Market price	Yuan/m ³	380
Average Turnover in calculation period	Yuan/year	1,094,400,000
Average Tax (10% of Turnover) in calculation period	Yuan/year	109,440,000

Annex X: Operational Costs of the Project as Used in Cost-Benefit Analysis

Operational Cost of the Project (Yuan/ha)

Year/Cost Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Option 1: replant in 2nd rotation															
Land Lease	600	600	600	600	600	600	600	600	600	600	600	600	600	600	8400
Labor Cost	3562.5	937.5	187.5	187.5	187.5	187.5	1500	3562.5	937.5	187.5	187.5	187.5	187.5	1500	13500
Materials Cost	1539	787.5	0	0	0	0	0	1539	787.5	0	0	0	0	0	4653
Transport Cost	0	0	0	0	0	0	1512	0	0	0	0	0	0	1512	3024
Total Operation Cost	14,788.5							14,788.5							29,577
Option 2: germination in 2nd rotation															
Land Lease	600	600	600	600	600	600	600	600	600	600	600	600	600	600	8400
Labor Cost	3562.5	937.5	187.5	187.5	187.5	187.5	1500	937.5	937.5	187.5	187.5	187.5	187.5	1500	10875
Materials Cost	1539	787.5	0	0	0	0	0	1129.5	787.5	0	0	0	0	0	4243.5
Transport Cost	0	0	0	0	0	0	1512	0	0	0	0	0	0	1512	3024
Total Operation Cost	14,788.5							11,754							26,542.5
Average annual cost in calculation period:															
Option 1:a.Land Lease: 72,000,000 Yuan; b. Labor cost: 115,714,285 Yuan; C; Transport Cost: 25,920,000															
Option 2:a.Land Lease: 72,000,000 Yuan; b. Labor cost: 93,214,285 Yuan; C; Transport Cost: 25,920,000															