CHINA

SUSTAINABLE FORESTRY DEVELOPMENT PROJECT

REVISED ENVIRONMENT AND SOCIAL IMPACT MANAGEMENT AND MONITORING PLAN[1]

10 April 2001

[1] Documents revised based on comments from the Bank and findings of Appraisal Mission

Environmental Protection Guidelines for Plantations Management

Pest Management Plan

Resettlement Policy Framework

Sustainable Forestry Development Project (SFDP)

Environmental Protection Guidelines For Plantation Management

World Bank Loan Management Center
State Forestry Administration, China
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Environmental Protection Guidelines for Plantations

I. INTRODUCTION

The purpose of these guidelines is to draw on experience from previous plantation projects (i.e. NAP, FRDPP and FDPA) to ensure that plantations in SFDP are designed to achieve the highest level of productivity and financial viability with the least possible negative impacts on local communities and the natural environment. These guidelines are based on the following:

- PRC laws and regulations, specifically the Environmental Protection Law, Forest Law, Forest Disease and Insect Pest Regulation, Plant Quarantine Regulation, Fire Prevention Regulation, and Soil and Water Conservation Regulation; and

- World Bank Operational Policies, specifically O.P. 4.04 Natural Habitats, O.P. 4.09 Pest Management, O.P. 4.36 Forestry, O.P. 4.11 Cultural Property, and O.P. 4.20 Indigenous Peoples

These guidelines consist of eight sections: Plantation Site Selection; Plantation Design; Plantation Establishment; Plantation Tending; Soil and Watershed Protection; Integrated Pest Control; Fire Prevention and Control; Harvesting; and Monitoring and Evaluation

The most important pre-requisite of a successful plantation project is an explicit statement of management objectives; including expected outcomes for products and production, land rehabilitation, watershed protection, habitat conservation and restoration, and community development and participation. Clear statements of objectives will have a fundamental influence on all aspects of plantation management from site selection, through design and implementation, to monitoring and evaluation. An explicit statement of management objectives, in line with the above guideline, should be contained in the management plan for each plantation project.

II. PLANTATION SITE SELECTION

2.1 Land Use/Land Cover Considerations.

Consistent with the above Chinese Laws and Regulations, no area containing cultural or heritage resources, consisting of natural forest, either intact or capable of rehabilitation (i.e. any area consisting primarily of native tree species of >20% crown closure) or which are located wholly or partly within designated nature reserves can be converted to plantation.

Priority sites for plantation establishment, from an environmental perspective, will be recently-harvested plantation sites or poor-quality plantation sites, agricultural lands where farmers agree to plantation conversion, degraded sites consisting of bare lands and exotic weed species (i.e. *Lantana* and *Eupatorium*), and dis-climax vegetation types (i.e. vegetation types that are atypical of a particular climatic zone).

More problematic in terms of plantation conversion will be communities of native shrubs and open forest. China's native ecosystem diversity is in a critical state. The only "pristine" ecosystems are now confined to mountainous areas. In most lowland areas the last remaining refuges for indigenous plants, birds and mammals are native shrub and open secondary forest communities. The World Bank Policy on Natural Habitats states that such areas shall not be converted unless it can be demonstrated that they are common, and even then if there are no other options for planting sites. The PRC Forest Law (Article 24) requires the preservation of representative natural ecosystems from conversion to other uses at all levels of planning from national to municipal. Relative priorities for preservation are recommended as follows.

Higher Priority: Climax shrub communities; Advanced serial shrub communities of high diversity with native forest tree regeneration; Open forest in drier areas

Lower Priority: Pioneer serial shrub communities of low biodiversity resulting from significant site disturbance; Open forest in moist climates

These decisions can not be made on a case-by-case basis, but rather through a transparent, inter-disciplinary planning process with clear goals, objectives and criteria for decision-making. Such a planning process is in place in many areas of China, preparing master land use plans at the County level. These plans should allow decisions on: 1) which areas will be preserved intact or rehabilitated to natural forest; 2) which areas will be allowed for plantation establishment; and 3) how much of the latter will be retained in natural vegetation for in-plantation biodiversity conservation. That implementation units should refer to such a county plan.

A site screening process will be used during the project implementation which follows a flow chart of a series of questions designed to elicit pertinent information on site characteristics as they relate to natural habitat and cultural heritage values, and to document what decisions were made in light of those characteristics of the sites (see Annex 1). The flow chart, as well as any photos called for by the screening process, would be attached to sub-compartment date cards which Forestry Bureau staff fill out for all sites being considered for inclusion in the program.

2.2 Site Suitability Considerations

No production plantations will be allowed on slopes exceeding 35 degrees for reasons of both slope instability and low productivity. Plantations on slopes between 30 and 35 degrees should have much lower than normal planting densities to limit site disturbance from both planting and harvesting and to retain ground cover.

Special attention must be given to the selection of sites with suitable climate and soil characteristics for the tree species and varieties under consideration.

A special consideration in soil fertility management is the ability of tropical soils (i.e. Hainan), especially acidic red-yellow podzols (oxisols and ultisols) to sustain wood production over several short rotations without serious site nutrient depletion. During selection of plantation sites, the relevant existing scientific findings and information regarding the soil investigations in the project areas should be fully adopted to avoid soil degradation.

2.3 Social Considerations

Special attention must be paid during site selection to community-related aspects. Design teams must refer to the CFAs carried out in relevant sample counties in their province to better understand the options preferred by farmers. Plantation design must address and accommodate the following considerations.

Participation

- Plantation development plans should be developed in consultation with the authorized users or beneficiaries of the land. All townships, villages and households must be adequately informed about the project and there must be a minimum of ten days between the distribution of project information and the receipt of applications to participate.
- Site design should be consistent with the expressed needs of the beneficiaries provided these are consistent with relevant government policies.

- Preference must be given to individual households, household groups and shareholdings as opposed to collective and state forest farms.
- Ethnic minorities and women must have equal opportunity to apply and participate.

Land Use Rights

- Current ownership of the land must be identified and the plantation development should only be undertaken with the prior agreement and participation of the authorized users.
- Selected sites must primarily involve existing long-term contracts to individual households with plantations resulting in no change to these land use rights except with the written agreement of the authorized users.
- In the event that sites selected are currently under collective land rights, participating households must receive individual land use rights for a term of not less than thirty years.
- In the event that any changes in land use rights are identified, the provincial PMO must be informed.

Access to Land and Resources

- The size of the plantation in the village group must be designed to retain adequate grazing land, fuelwood and other resources to meet the needs of local residents.
- Where the plantation involves the conversion of steeply-sloping farmland/wasteland, design should be consider alternatives such as agroforestry and mixtures of trees, shrubs and grass.
- Accommodation of traditional forest uses must be considered in areas set aside for biodiversity conservation.

Production Arrangements

- Priority must be given, in selecting production arrangements, to direct responsibility and management by beneficiary households or groups of households.
- If households or household groups are to participate in a shareholding arrangement with another party, the production arrangement options and their implications must be discussed with the householders in an open and transparent manner. The agreed arrangements should be documented in contract signed by all parties to it and all parties should be provided with a copy of the contract.
- A contract model with standard provisions should be developed by the provincial PMO.

III. PLANTATION DESIGN

Species Selection and Planting

Species shall be selected on the basis of their overall suitability for the site and their appropriateness to the management objectives. To enhance biodiversity conservation, native species are preferred over exotic species for both plantations and watershed restoration programs. Exotic species should be used only if their overall performance is greater than native species. Exotic species shall be monitored to detect unusual mortality, disease or insect attacks and adverse ecological impacts. No new exotic species shall be introduced on a large scale until local trials and experience demonstrate that they are ecologically adapted, non-invasive and have no significant ecological impacts on other ecosystems.

Plantations are not forests, they are much more like farms. Plantation diversity (of genetic materials, species, age classes and spatial structure at the landscape-level) is essential for the ecological stability and resilience that limits the risk of failure and reduces the necessity for artificial inputs and interventions in these simplified ecosystems. All plantations over 50 ha

must consist of several sub-compartments, the size and number of which will depend on the scale of the plantation, comprising wherever possible different tree ages (to promote structural diversity), different species of indigenous and exotic trees, different genotypes within species, and residual indigenous natural vegetation types. Wherever practical given the scale of the plantation, design and layout should promote the protection, restoration and conservation of natural communities by utilizing wildlife corridors, retention of native tree species, stream protection corridors and a mosaic of different age and rotation periods to mimic the landscape patterns of natural forest stands.

No large area of single clonal plantations will be permitted. Not less than ten clones of poplar, Chinese fir, or Eucalyptus will be approved for each county. As a general rule of thumb, 80 % of the area of the project plantations within a county should be planted equally to 5 of the clones and the remaining 20% planted to the remaining five clones.

More emphasis must be placed in all plantations on encouraging indigenous broadleaf species which, though slower growing, are likely to have both a higher conservation value and a higher monetary return at harvest. Any existing natural vegetation including native broadleaf tree species must be retained on any plantation site over 100 ha for biodiversity conservation.

Streamside Protection

Simple standard stream protection setbacks are insufficient to ensure adequate protection in complex landscapes where stream courses are likely to vary considerably in gradient, cross section, flow, stability and ecological importance. A more useful approach is to relate the size of stream protection reserves to a simple stream classification system based on the size and cross-section of the stream, the inherent stability of the stream channel and to the character of the adjacent riparian land. A stream protection reserve would be an area where no clearing or ground disturbance would be allowed during plantation establishment, native vegetation would be retained and no forest harvesting would be allowed. There appear to be two different types of streams that could be impacted by plantations, without adequate protection reserves. The two stream types both have a "gully" configuration, defined as a stream with side slopes of 25 degrees or greater. The two stream types with protection reserve designations is as follows:

1. Entrenched small streams (usually < 5 m in width) with boulder or bedrock substrate.

Recommended protection reserve = 5 m from the top of the entrenchment slope on each side of the stream.

2. Entrenched small streams (usually < 5 m in width) in fine textured channel substrate.

Recommended protection reserve = 15 m from the top of the entrenchment slope on each side of the stream. Stability of these stream courses is often dependent on live vegetation on the gully sidewalls and on large woody debris incorporated in the stream channel. Plantations must be managed to ensure a continuous supply of large woody debris to preserve stream channel stability.

Figure 1 demonstrates the application of protection reserves in these two categories of streams.

Plantation design must look beyond establishment to eventual harvesting. In particular, design must consider how the site will be accessed for product extraction.

FIGURE 1. Application of Stream Protection Reserves

Stream Category 1. Entrenched small streams in bedrock/boulder substrate.

Stream Category 2. Entrenched small streams in fine textured substrate

IV. PLANTATION ESTABLISHMENT

Fire cannot be used as a tool of site clearing and site preparation: sites must be cleared by hand or by using mechanical equipment. Existing vegetation will be retained at the top and bottom of slopes, and in all stream courses - whether permanent or ephemeral. Site preparation may involve planting holes, strip cultivation or full cultivation under the following conditions:

- Full cultivation will be allowed on slopes below 15 degrees and only were absolutely necessary to control weeds. Where full cultivation is undertaken on slopes over 200 m in length, a contour belt of existing vegetation at least 3 m wide must be retained every 100 m.
- Planting holes or contour strip cultivation may be used on slopes between 16 and 25 degrees with existing vegetation retained between contour rows.
- Planting holes only may be used on slopes between 26 and 35 degrees, with the planting holes aligned in a fish-scale configuration.
- Economic tree crops should be established on the site with slop below 25 degrees.

Terracing will be employed only under special circumstances and must be carefully designed. Moisture-retaining terraces (the so called bamboo joint ditches) should be considered only in low rainfall areas with deep free-draining soils. In other areas, terraces should convey surface runoff onto stable ground or to stream courses capable of accepting the increased flow.

Any inter-cropping activities on sloping plantation sites should be carried out along the contour. No inter-cropping will be allowed on slopes over 25 degrees and inter-cropping of root or tuber crops will not be permitted over 15 degrees.

V. PLANTATION TENDING (for timber plantation only)

Weeding should be limited to what is absolutely necessary to establish the plantings. Slashing shall be used wherever possible, so as to maintain ground cover. Spot clean-weeding will be encouraged in tending operation. Vegetation debris from weeding should be left on site as a mulch.

Thinning should be generally guided by operational design, but the actual time of thinning should be determined by regular surveys. One of the keys to insect and disease resistance is a healthy, vigorously-growing plantation stand (see Section 7), which in turn depends on timely thinning. Effective measures should be taken to promote decomposition of thinning debris and to reduce fire risk. Thinning operations should be carefully planned and implemented to avoid damage to residual trees and site disturbance.

VI. SOIL AND WATERSHED PROTECTION

Measures shall be taken to maintain or improve soil structure, fertility and biological activity, using natural measures wherever possible to reduce reliance on inorganic fertilizers. Use of organic fertilizers, green manure and inter-cropping with nitrogen-fixing plants is encouraged wherever practical. The inorganic chemical fertilization will strictly follow the plantation models, in which, the fertilizer applications must be justified by adopting appropriate research results or appropriate test, and the fertilizer application will be adjusted by adopting new research results during the project implementation. During operation, only spot and strip fertilization will be allowed; broadcast application is prohibited.

Economic tree crop plantations will require an assessment of irrigation needs and whether the necessary water can be obtained without impacting other water users, aquatic resources or

waste dilution requirements. Special attention should also be paid to the potential impact of plantation establishment on product processing capacity in the general area (i.e. wood and rubber processing and fruit/bamboo shoot canning, etc) and the potential impacts of any expanded processing (i.e. water requirements and waste generation).

VII INTEGRATED PEST CONTROL

Measure shall be taken to prevent or minimize outbreaks of pests, diseases, fire and invasive plant introductions. Integrated Pest Management (IPM) shall form an essential part of the plantation management plan, with primary reliance on prevention and biological control methods rather than chemical pesticides. Chemical pesticides may be used only where justified within the framework of a comprehensive IPM system and only where the pesticide falls into World Health Organization CLASS II AND CLASS III, is specific to the particular pest, and has low toxicity to non-target organisms. Workers and farmers who are to apply pesticides may only do so after they have received training on the safe handling, storage and use of the chemicals. The applying and handling of the class ii products should be done by trained and equipped pest control specialists of the forestry bureau.

An Integrated Pest Management Plan has been developed for SFDP by the PMC to meet the requirements of the World Bank Operational Directive on pest management (O.P. 4.09).

VIII. FIRE PREVENTION AND CONTROL

Forest fire prevention and control activities must be integrated with the local fire management system at all levels. Each afforestation entity must prepare a forest fire control plan establishing a fire control organization, defining roles and responsibilities, and detailing prevention, public education, patrolling, enforcement and fire response programs.

All plantation blocks over 100 ha shall have fire breaks dividing the area into sub-compartments of not more that 80 ha. Fire breaks should be 10-20 m wide and should utilize stream courses and fire resistant native vegetation wherever possible.

IX. PLANTATION HARVESTING

Techniques and rates of harvesting, access construction and road maintenance shall not result in long-term soil degradation or adverse impacts on water quality and watershed hydrology. Any logging operations must be strictly enforced according to provisions of the Forestry Act. For slopes over 15 degrees, logging coupes shall not exceed five ha with at least 50 m between adjacent coupes logged the same year. For slopes less than 15 degrees, logging coupes shall not exceed 20 ha, with at least 100 m between adjacent coupes.

Ground vegetation shall be preserved as far as possible during logging and the site shall be re-planted in the year following logging. Roads and trails must be constructed according to acceptable engineering standards and shall have regular maintenance.

X. MONITORING AND EVALUATION

Appropriate to the scale of operation, plantation monitoring programs shall be of two main types: 1) compliance monitoring to assess the degree to which plantation implementation is consistent with approved design plans and these guidelines; and 2) management monitoring to determine plantation performance and detect on-site and off-site ecological and social impacts.

Compliance Monitoring

Compliance monitoring assesses whether operational implementation has been carried out in a manner consistent with established standards. Guidelines such as these are not usually enforceable because they seek to cover a range of site conditions and operational activities. As the term implies, their function is to guide operational design and implementation. It will be the responsibility of the PMO to ensure that all plantation design plans meet the principles, standards and criteria established in these guidelines. PMC will undertake surveillance of the design process through a regular evaluation of randomly-selected plantation designs. Once a plan has been prepared and approved, the county PMO will be responsible for ensuring, through regular inspections and supervision, that all operations are implemented in a manner that complies with the approved plan. To ensure consistency and continuity in compliance monitoring, standard reporting forms will be used. The provincial PMO will insure the quality of operational monitoring through regular, random "spot-checks". The primary focus of compliance monitoring will be the plan prescriptions on plantation diversity, stream protection, site preparation, tending (weeding and thinning), pest management (use and application of pesticides and worker/farmer safety) and harvesting.

Management monitoring

Management monitoring will be specially designed to assess: 1) the progress of plantation programs; 2) the effectiveness of these guidelines and development plans in protecting and enhancing the environmental; and 3) the contribution of the plantations to local community welfare. This type of monitoring will utilize a limited number of practical monitoring indicators which will be measured at established intervals and regularly evaluated to determine whether management practices require revision. A general management monitoring program has been designed by PMC and will be adapted by PMOs to suit the specific needs of individual provinces and counties. Proposed plantation performance, environmental and social indicators are described in the following sections. These indicators will not be relevant to every area and every situation and must be selected and adapted to specific monitoring programs. These monitoring programs, in turn, must be practical, meaningful and affordable.

Plantation Performance Indicators

- Regularly maintained plantation sub-compartment records and maps showing areas planted annually, with species/varieties, planting density, and all plantation operations (wherever possible)
- Survival rates (%) by year and species and the extent (ha) of beating-up required.
- Extent (ha) of tending operations (weeding, thinning, pruning, fertilization) each year.
- Incidence of insect attack, disease and fire (number and area impacted) and actions taken (method and area of treatment/response).
- Growth or production rates by sub-compartment; recording increment in height and DBH/or cu. m/ha/yr. (based on sample plots) for wood plantations, and annual production in kg/ha for economic tree-crops.

- Harvesting operations for wood plantations (area and yield per ha and site class).

Environmental Indicators

- Area (ha and % of project plantation areas) of set-asides for biodiversity conservation and stream protection reserves for each project plantation 50 ha or larger.
- Annual use (kg/ha) of fertilizers, herbicides and pesticides by species.
- Training of pesticide users/applicators in safety, handling and risks associated with use of pesticides.
- Contour site preparation and planting holes in a fish-scale configuration.

Social Indicators

- Number of participation households;
- Farmer satisfaction (% of target households) for the services provided by the project.

Annex 1 . Environmental Screening Process for Plantation Site Selection

Step 1
Does the site:

1) contain cultural or heritage resources?;
2) contain natural forest, either intact or capable of rehabilitation (i.e. any area consisting primarily of native tree species of >20% crown closure)?; or
3) Is the site located wholly or partly within a designated nature reserve?

If the answer to any of the above is "yes" the plantation development is prohibited and an alternative site must be found.

If the answer to all of the above is "no", proceed to step 2.

Step 2
Is the area of the site less than 35 ha.?

If "yes", it is unlikely that the plantation development will have any adverse effect on habitat values regardless of its location. The screening process ends and the proposed development may proceed.

If "no", proceed to Step 3.

Step 3
Which of the following general ecotype descriptions best describes the proposed development site:

Category 1 – poor quality plantation sites or harvested plantation sites;

Category 2 – land that is being used or has been used for some agricultural production purpose;

Category 3 – waste land or barren land;

Category 4 – other land which may have natural habitat potential (this could include natural forest with canopy cover less than 20%, natural grasslands (e.g. at high altitude), wetlands or swampy areas).

If the land falls into categories 1, 2 or 3, it is unlikely that plantation development will have any adverse impact on natural habitat values (it should be noted that any sites which are located within agricultural production areas and far removed from forest areas would fall into one of these three categories). The screening process ends and the proposed development may proceed.

If the land falls into category 4, proceed to Step 4.

Step 4
Is the ecotype widespread in the general area? (for example, would the proposed plantation area occupy less than 5% of the total area of this ecotype in the general area?).

If **yes**, the proposed development may proceed but a photograph should be taken of the site and filed with the sub-compartment card to record the type of vegetation that is on it.

If **no**, the proposed development should not proceed and an alternative site should be found.

CHINA
SUSTAINABLE FORESTRY DEVELOPMENT PROJECT
PLANTATION ESTABLISHMENT COMPONENT

Pest Management Plan

10 Aprio 2000

Sustainable Forestry Development Project (SFDP)
Pest Management Plan (PMP) for Afforestation

Contents

Foreword

The Pest Management (PMP) for Afforestation was made according to the Rule of Pest and Disease Control in Forestry issued by the State Council, December 18, 1989 and according to the demand of professional policy of World Bank for Pest and Disease Integrated Management (4.09). The pests herein include insect pests, mites, plant nematodes and diseases. The purpose of the plan is to strengthen pest monitoring and controlling in the sites of SFDP.

1. PEST AND DISEASE MANAGEMENT IN CHINA

1.1 Legislation, regulations and policy concerning pest and disease management in forestry

(i) Legislation and regulations

The main legislation and regulations concerning pest and disease management in China are outlined below.

To strengthen pest control and quarantine government has issued the "Forestry Law", "Forestry Pest Control Regulations", " Technological Rules for Forestry Quarantine", "Management Measures for Target Forest Pest Control" and "Regulation of Pesticide Management".

Integrated Pest Management (IPM) is promoted under the "Pesticide Rational Application Guideline" and "Regulation of Pesticide Management".

Manufacture, sale and use of agricultural chemicals. Firstly, any company wishing to manufacture or formulate pesticides must be registered according to the "Regulation of Pesticide Management" and must meet conditions for safety, quality control, environment and pollution control. Secondly, any pesticide shop can sell pesticide only after obtaining the relevant license and may only purchase pesticides from a registered pesticide company. Extremely hazardous and highly hazardous pesticides may not be produced or sold for application in food. Thirdly, it is forbidden to market agricultural products (especially vegetable, fruit and grain crops) with pesticide residues exceeding the pesticide residue standards.

Farmers are required to apply low poison, high effect chemical pesticides only after pests reach a serious level and they can not use the other control methods effectively. Chemical pest control methods are indispensable to farmers when some pests are seriously epidemic

The following agencies are responsible for monitoring and enforcing these regulations at national, provincial, county and local level

- Forestry bureaus at national, provincial, county and township level in relation to forestry pests and diseases;
- Agriculture bureaus (Ministry of Agriculture of China, province, county and township) for grain crops and vegetables;
- Pesticide Inspection Institute of Ministry of Agriculture of China and the Pesticide Inspection Institute of each province is responsible for monitoring pesticide residues of agricultural products (especially vegetable, fruit and grain crops).

(ii) Plant protection policy in China

The Chinese government has thought seriously about pest control in forestry and the policy of "first prevention and then IPM" has been emphasized. Gradual progression to biological control as the main method in the future is proposed. The China Green Food Development Center , Ministry of Agriculture of China has issued "Pesticide Application Guideline for Organic Food Production"to guide the production of "green" food (A Class) and organic food (AA Class)

The objective of government policy is to control pests at low population level, promote the quality of forestry and increase sustainable use of forestry resources. The aim is to protect forestry resources and to conserve ecological environment.

Since 1975 the plant protection policy has emphasized "first prevention, and then IPM". The definition of IPM proposed by Glass (1975), is used in China - " IPM is a system that, in the context of the associated environment and the population dynamics of the pest species, utilizes all suitable techniques and methods in as (ecologically) compatible a manner as possible and maintains pest population levels below those causing economic injury."

Economic Injury Level (EIL) is defined as: "the density at which control measures should be applied to prevent an increasing pest population from reaching the economic injury level".

"Whoever plants must control" is the policy in China. The growers are expected to take responsibility for pest control on economic trees and forest trees, unless extreme pests such as locusts lead to disaster.

Chinese government has attached great importance to food safety. According to the "Regulation of Pesticide Management " (issued by Chinese government), "Pesticide Rational Application Guideline" (issued Ministry of Agriculture of China) and "Standards of Pesticide Safe Application" (issued Ministry of Agriculture of China), any producer must abide above "Guideline"," Regulation" and "Standards" when they make agricultural chemical products. These documents show clearly

- which pesticide can applied for controlling pests in agricultural production (pesticides of extremely hazardous and highly hazardous classification are forbidden).;
- which highly efficacious, low hazardous and low pesticide residues are recommended for application when non-chemical methods can not control pests;
- agricultural products which exceed standards of pesticide residue may not be brought to the market for sale;
- safe application methods for pesticides including: the form of pesticide, method of safe and rational application, common dose and maximum dose, maximum application time within the same year, time from last application of pesticide to harvest etc.

The Regulations of Pesticide Management encourages use of chemical pesticides which are highly effective, low poison and low residue (HLL) and prescribes standards for the sale of pesticides. Some chemical pesticides, like Parathion, Phorate and Monocrotophos are forbidden to use under "Standards of Pesticide Safe Application" and "Regulation of Pesticide Management".

Some provinces have begun making local guidelines for producing safe agricultural products for producing safe food.

The Pesticide Inspection Institute of Ministry of Agriculture of China and the Pesticide Inspection Institute of each province are the institutions responsible for monitoring pesticide residues of agricultural products (especially vegetable, fruit and grain crops).

The rapidly expanding "Green food" market provides price incentives to reduce or eliminate chemical pesticide application.

(ii) Organization

There are strong organizations for forest pest control in China. The Department of Afforestation of the State Forestry Administration (SFA) is responsible for management, guidance and monitoring pest control nationwide. The General Forestry Pest Control Section is responsible for practical tasks.

Every forestry bureau at levels of province, region, city and county has its own Pest and Disease Control organization which is responsible for managing, guiding and supervising of forest pest control within their jurisdiction. A total of 2,400 pest control and quarantine stations have been established at province, region and county levels. Fourteen thousand people are employed; among whom 8,100 are professionally qualified technicians. More than 6,100 monitoring stations were set up nationwide and more than 4300 professional technicians worked for monitoring and predicting.

Each county forestry bureau has a pest and disease control station which is responsible for managing, guiding and supervising pest and disease control for forest and economic crops (including monitoring and predicting). Each level of government prescribes pest control techniques to the next lower level.

Institutes or laboratories for forestry plant protection have been established in forestry organizations at national, province, region and city level. Forestry scientists have researched the life cycles, and biology of the main pests and their control methods. Research results have been applied successfully for forest production with good effect. Some examples are provided in Section 1.2.2 below.

1.2 Recommended Control Methods For Insect Pests And Diseases

(i) Control methods of insect pests and diseases

Five control methods are recommended by SFA and the Ministry of Agriculture.

Quarantine : It is a state method for preventing crop damage by insect pests, diseases and weeds from invading and dispersing with agricultural production areas. Quarantine in China started in 1930's. In 1991, "The Law of Import and Export Plant Quarantine" was implemented in China. There are more than 300 quarantine organizations established at sea, land and air trading ports national-wide to prevent entry and dispersion of pests coming from abroad. These organizations have played an important rule in prevention of pests (eg. Grape root gall aphids). Many pests have been quarantined in these years, such as Mediterranean fly, and America white moth. Quarantine functions in China are divided into two parts, agricultural quarantine (administered by national General Station of Plant Protection of the Ministry of Agriculture) and forestry quarantine (managed by the State Forest Farm And Planting Stock General Station of State Forestry Administration).

Provincial quarantine stations (belonging to the provincial forestry bureau) are responsible for internal quarantine of plant material transported between provinces. County quarantine stations (belonging to the county forestry bureaus) are responsible for

internal quarantine for plant material transported between counties within the same province.

Physical and mechanical methods: These are popular for forest pest control because they are: (1) Cheap – Farmers do not need to buy pesticide for pest control and labor is cheap in China; (2) Efficacious – Physical and mechanical methods are effective for controlling some pests (eg. wrapping sticky plastic sheets around trunks also helps prevent the adults of ruler moths and Giant mealybug climbing up trees); and (3) Safe – there is no pollution, environmental safe, and natural enemy safe.

Such methods include: vibrating trees to capture adults of beetles according to their feature of pretending death; scraping coarse trunks of apple trees is useful for removing over-winter adults of red mites and canker pathogen. Picking up damaged and infested fruits is an easy way to reduce population of larvae. Black light lamps are used to reduce insect pest population (effective for more than 50 species of insect pests in agriculture).

Physical and mechanical methods can reduce a large population of pests, and avoids buildup of resistance to chemical pesticides. The main limitation is that it is time consuming and sometimes special tools are needed. The method is only effective for certain pests. Therefore it is a supplementary control method.

Agricultural method: It is environmental factor based method which uses agricultural technology to reduce crop damage caused by pests. It includes strengthening integrated tree management, enhancing anti-pest and anti-diseases capacity of trees, ploughing soil and exposing pests to extreme climate, sanitation, and stopping pest host succeeding (eg. avoiding a mix of apple and pear trees and inter-planting with peach, plum or cherry trees).

Agricultural pest control methods can significantly reduce or eradicate the population of important pests at relatively low cost. It can control pests for years. It is safe for the environment and natural pest enemies. Limitations are that the method is labor consuming and achieves effectiveness slowly.

Biological method: Biological control is carried out with arthropods or with entomopathogenic microbes (viruses, bacteria, fungi and nematodes) and their metabolites. Biological control is safe for human beings, livestock, vegetation and environment. It can control pest under lower population for many years. Biological control agents are an abundant resource in the world. However biological control is not as rapidly effective as chemical pesticides. Normally, the cost of biological control is higher than use of chemical pesticides so growers prefer chemical pesticides to biological methods. In the recent two or three years growers have increasingly adopted biological pest control methods because of the growing market demand for "Green Food".

Chemical method: is very popular throughout the world. Thousands of pesticides were used, such as zineb, mancozeb, asomate, phosethyl-AL, chorothalonil, fenaminosulf, tuzet, carbendazim, thiophanate-methyl, lime sulphur, bordeaux mixture, DDVP, phoxim, monocrotophos, phosmet, malathion, omethoate, dimethoate, pirimicarb, isocarbophos, fenitrothion, deltamethrin, fenvalerate, cypermethrin, fenpropathrui, cyhalothrin.

Rapid effectiveness is the outstanding advantage of chemical methods. Besides, chemical pesticides can be purchased at any time. There is no seasonal limitation.

However the extreme pollution caused by chemical pesticides has threatened human and livestock health. Pesticides kill many natural enemies of the targeted pest and in time many pests have become resistant to chemicals.

(ii) The experience of IPM and the situation of chemical pesticide application

IPM is the preferred approach recommended by forestry agencies.

Different kinds of pests have their own features which require different control methods, not only chemical method. The principle of pest control is to use integrated control methods as much as possible, not only chemical methods for the production of forests and fruits, especially edible products such as fruits. Their quality, especially their security (no chemical pollution) impacts directly on human health. Since living standards of consumers is increasing and the quantity of different fruits and forest products is increasing in recent decades in China, people now concentrate more on food quality and security. Chemical pesticides are a key factor affecting food security production. Not only because chemical pesticides are very poisonous but also because the poison material kills natural enemies, which make people further dependent on chemical pesticides control pests. Therefore, it is very necessary to adopt integrated pest management (IPM) for pest control. IPM depends on the biology and habits of different pests. Quarantine, physical and mechanical, agricultural and biological control methods should be considered first. Only if the above methods are not successful to control pests, then high effect and low poison chemical pesticides may be used.

There are some successful findings on integrated pest management (IPM), especially on biological control. The *trichogramma* have been reared and released successfully for some pest control. Entomopathogenic nematodes are used for control many kinds of fruit moths, trunk borers on economic trees and forest trees. Some bio-pesticides were studied and produced, such as Abamectin, Flufenoxuron. No poison adipose films were used for against some diseases. The principle of the films is to achieve pathogenic asphyxiation of the pest. At present however, farmers can not control all pests with biological methods. When major pests outbreaks occur in the project sites farmers should apply low poison, high effect chemical pesticides, if they can not use the other control methods effectively. Chemical methods are indispensable to farmers in these circumstances. Pesticide spraying times varies with pest species, crop related factors, areas of sites and tree conditions. For some pests growers can not use pesticides. For example, apricot poxes and apricot-boring wasps do not need chemical pesticides. Effective control can be obtained by cutting damaged shoots and fruits. Eucommia and hickory nuts are seldom damage by pests so there is again no need to use chemical pesticides. Some pests like apple yellow aphids only need chemical pesticides if they seriously infest young trees. Normally pesticides have been used for control of fruit borer pests in pear, peach, apple orchards and vineyards. Chemical pesticides are usually applied from three to ten times per year for economic trees, depending on different regions, species, seasonal condition and age of tree.

The following actions are recommended for successful control of insect pests and diseases and for reducing the risk of insect pest and disease damage for project plantations:

- Implement the State Council rules for Pest and Disease Control in Forestry, the professional policy of World Bank for Pest and Disease Integrated Management and SFDP Pest Management Plan;

- Fully apply successful pest control techniques by adopting Integrated Pest Management (IPM) methods, not only chemical methods, for pest control;
- Plant pest resistant forest species, strictly prohibit planting of seedlings with insect pest or disease, advocate diversified forestry, not a single variety of trees, clean tree planting areas to reducing pest occurrence;
- Strengthen management of pesticide purchasing and application;
- Strengthen training for pesticide management;

(iii) Main Pests and Chemical Control Methods

Table 1 lists the main pests which occur in forest species and the pesticides applied in project provinces. The type of pests and degree of damage degree will vary in different sites.

Table 1. Main Pests Occurring And Pesticides Used In Timber Plantaions Areas Of SFDP Provinces

Species	Pests and diseases	Pesticides
Masson pine	Pine caterpillar (*Dendrolimus punotatus ;D. Kikchil*); Pine tussock moth (*Dasychira axutha*); Pine seedling stem rot (*Rhizoctonia solani*); Pine needle rust (*Coleosporium salidaginis*)	Chorothalonil; Zineb; Bordeaux mixture; Thiophanate-methyl; Malathion; Deltamethrin; Omethoate
Chinese fire	*Polychrosis cunninghamiacola*; Anthracnos (*Glomerella cingulata*); *Cercospora pinidensiflorae*	Tuzet; Carbendazim; Omethoate; Phoxim; Monocrotophos、
Loblolly pine	Tortricids; Brown spot; Pine tussock moth (*Dasychira axutha*)	Chorothalonil; Omethoate; Deltamethrin; Fenvalerate
Larch	Larger pine shoot borer; Leaf-cast	Carbendazim; Fenaminosulf、Zineb; Chorothalonil; Deltamethrin; Omethoate
Slash pine	Tortricids; Brown spot; Pine seedling stem rot (*Rhizoctonia solani*); Pine needle rust (*Coleosporium salidaginis*); Pine tussock moth (*Dasychira axutha*)	Chorothalonil; Thiophanate-methyl; Zineb; Bordeaux mixture; Deltamethrin; Omethoate; Phosphamidon
Chinese white poplar	Poplar clear wing moth (*paranthrene tabaniformis*); *Clostera anachorta*; *Cryptorrhynchus lapathi*; *Apocheima cinerarius*; Mulberry longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*	White corpse bacterium▸; Omethoate;Zine phospide; Fenitrothion; Phosphamidon; Entomopathogenic nematode▸
	Cryptorrhynchus lapathi; Mulberry	Carbendazim;

Italian poplar	longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*; Poplar clear wing moth(*paranthrene tabaniformis*); *Clostera anachorta*; *Apocheima cinerarius*; Poplar tree canker (*Valsa sordida*); Poplar tree Botryosphaeria canker (*Botryosphaeria ribis*)	Thiophanate-methyl; Asomate; Tuzet; Bordeaux mixture ; White corpse bacterium▸、Fenitrothion; Omethoate; Phosphamidon; Bacillus thuringiensis▸;Entomopathogenic nematode▸
Simonii	*Cryptorrhynchus lapathi*; Poplar clear wing moth (*paranthrene tabaniformis*); *Clostera anachorta*; *Apocheima cinerarius*; Mulberry longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*; Poplar tree canker (*Valsa sordida*)	Thiophanate-methyl; Carbendazim; Phosphamidon; Bacillus thuringiensis▸ ; Phosmet; White corpse bacterium▸、Omethoate ; Entomopathogenic nematode▸
Paulownia	Oriental moth (*Cnidocampa flavescens*); *Crytothelea variegata*; Witch's broom(MLO)	Monocrotophos; Trichlorphon; Phosmet
Acacia (*Acacia mangium*)	Powdery mildew(*Oidium* sp.); *Lymantria xylin;* Geometrid (*Buzura suppressaria*)	Carbendazim; Tuzet; Bordeaux mixture; Omethoate, White corpse bacterium▸、Trichlorphon; Thiophanate-methyl
Horsetail beefwood	*Lymantria xylina;* Horsetail beefwood bacterial wilt; Curculio	Chorothalonil; Tuzet; Trichlorpho; Omethoate
Beautiful sweetgum	Oriental moth (*Cnidocampa flavescens*); Tent caterpillar (*Malacosoma neustria testacea*)	White corpse bacterium▸、Phosmet; Deltamethrin; Fenvalerate
Black locust	Oriental moth (*Cnidocampa flavescens*); Geometrid; *Crytothelea variegata*; Botryosphaeria canker (*Botryosphaeria ribis*)	Carbendazim; Chorothalonil; Thiophanate-methyl; White corpse bacterium▸、Methamidophos; Dimethoate; Phoxim
Maoso bamboo	*Ceracris kiangsu*; *Algedonia coclesalis*; *Pantana sinica*; *Cyrtorachelus buqueti*; *Sterostram corticioides*; *Balansia take* ; *Vstilagosh iraiana*	Zineb; Carbendazim; Thiophanate-methyl; Deltamethrin; Fenvalerate; Methamidophos; Trichlorphon、
Rubber tree	Canker; Powdery mildew; Anthracnos; Bark beetles	Zineb; Tuzet; Lime-Sulphur; Bordeaux mixture; Carbendazim;

		Chorothalonil; Phoxim; Deltamethrin; Fenvalerate; Malathion
Red shell bamboo	*Ceracris kiangsu*; *Algedonia coclesalis*; *Pantana sinica*; *Loudont dispar*; *Sterostram corticioides*	Bordeaux mixture; Carbendazim; Chorothalonil; Deltamethrin; Fenvalerate; Methamidophos

Notes : Pesticides marked with " *" are bio-pesticides

Source: Statistics from project provinces

Based on the statistics from project provinces, the main pests occurring and pesticides usually applied for economic tree crops in project province are listed in Table 2 below.

Table 2. Main Pests Occurring and Pesticides Used for Economic Tree Crops in Project Provinces

Species	Insect pests and diseases	Pesticides
Walnut	Walnut bacterial blight; Walnut melanconis disease ; Walnut cytcospora canker ; Walnut anthracnose	Thiophanate-methyl; Zineb; Lime-Sulphur; Bordeaux mixture
	walnut sun moth (*Attrijuglans hetaohei*); White-striped longicorn (*Batoccera horsfieldi*); Giant mealybug (*Drosicha corpulenta*)	Prothiofos; Monocrotophos; Phosmet; Deltamethrin; Fenvalerate
Chestnut	Chestnut gall wasp (*Dryocosmus kuriphilus*); Large chestnut aphid (*Lachnus tropicalis*); Peach pyralid moth (*Dichocrocis punctiferalis*); *Paratetranychus* sp.; Chestnut clear wing moth (*Aegeria molybdoceps*)	Dimethoate; Omethoate; Phosmet; Trichlorphon; Deltamethrin; Fenvalerate
Apricot	Apricot pox	Lime-Sulphur; Bordeaux mixture
	Apricot boring wasp (*Eurytoma samsonovi*);Plum fruit moth (*Grapholitha funebrana*); Peach longicorn beetle (*Aromia bungii*); White peach scale (*Pseudaulacaspis pentagona*)	Phoxim; Deltamethrin; Fenvalerate; Malathion; Fenitrothion ; Entomopathogenic nematode▸
Gingko	Rhizome rot	Bordeaux mixture; Thiophanate-methyl
	(*Dictyoploca japonica*); (*Clania varieguta*); Tea brown chafer	Deltamethrin; Malathion; Fenitrothion; Diflubenzuron▸
Chinese date	Jujube witche's broom (MLO) ; Jujube rust	Triadimefon; Lime-Sulphur; Bordeaux mixture
	Peach fruit borer (*Carposina niponensis*); Bud-eating weevil (*Scythropus yasumatsui*); Tortoise wax scale (*Ceroplastes japonicus*); Jujube midge (*Contarinia* sp.)	Fenitrothion; Phoxim; Phosmet; Fenvalerate ; Malathion ; Deltamethrin
	Pear scab; Pear perennial canker; Pear rust; Pear tree dieback; Pear brown spot	Thiophanate-methyl; Tuzet; Carbendazim; Lime-Sulphur ; Bordeaux mixture

Pear	Peach fruit borer (*Carposina niponensis*); Oriental fruit moth (*Grapholitha molesta*); Yellow-brown stinkbug (*Halyomorpha picus*); Pear fruit sawfly (*Hoplocampa pyricola*) ; Pear jumping plant lice (*Psylla pyri*); Pear curcuclio (*Rhynchites foveipennis*)	Phosmet; Fenitrothion; Trichlorphon; Phoxim; Deltamethrin; Fenvalerate; Malathion; Imidacloprid▶
Whinghac-kberry	Leaf spot disease	Carbendazim; Zineb ; Lime-Sulphur; Bordeaux mixture
Chinese prickly ash	Gummosis; Rust ; Twig blight、	Tuzet; Zineb ; Lime-Sulphur; Bordeaux mixture
	Aphid	Dimethoate; Pirimicarb
Eucommia	Cercospora leaf spot; Brown spot	Bordeaux mixture; Carbendazim; Tuzet
	Tussock moth; Eucommia mengni armyworm	Phoxim; Deltamethrin; Bacillus thuringiensis▶; Fenvalerate
Tea	Anthracnos (*Glomerella cingulata*), white star disease, tea pan cake disease	Carbendazim; Chorothalonil; Thiophanate-methyl; Tuzet
	Geometrid (*Buzura suppressaria*; *Biston marginata*); Tussock moth (*Euproctis pseudocnspersa*)	Phoxim; Deltamethrin; Fenvalerate; Malathion
Peach	Peach tree leaf curl; Peach bacterial shot hole; Peach cercospora shot hole; Peach clasterosporium shot hole、	Thiophanate-methyl ; Tuzet; Lime-Sulphur; Bordeaux mixture
	Peach fruit borer (*Carposina niponensis*); Peach pyralid moth (*Dichocrocis punctiferalis*); Plum fruit moth (*Grapholitha funebrana*); Green peach aphid (*Myzus persicae*); Apple tree borer (*Conopia hector*); White peach scale (*Pseudaulacaspis pentagona*)	White corpse bacterium▶, Malathion; Fenitrothion; Deltamethrin; Bacillus thuringiensis▶; Lime-Sulphur ; Cypermethrin; Fenpropathri
	Pomegranate tree dieback (*Zythia versoniana*); Brown spot (*Cercospora punicae*)、	Carbendazim; Zineb; Lime-Sulphur ; Asomate

Pomegranate	Peach pyralid moth (*Dichocrocis punctiferalis*); Peach fruit borer (*Carposina niponensis*); Tortoise wax scale (*Ceroplastes japonicus*); *(Eriococcus)lageros troemiae*	Malathion; Fenitrothion; Deltamethrin ; Cypermethrin; Fenpropathri
Rubber tree	Powdery mildew; Anthracnose; Canker	Zineb; Tuzet; Lime-Sulphur; Bordeaux mixture
	Bark beetle	Phoxim; Deltamethrin; Fenvalerate; Malathion
Apple	Apple alternaria leaf spot; Apple of canker (*Valsa mail*); Apple alternaria leaf spot; Apple tree of dieback; Apple heart rot; Apple rust	Zineb; Tuzet; Lime-Sulphur; Asomate; Iprodione; Bordeaux mixture
	Apple leaf curing aphid (*Myzus malisuctus*); Green peach aphid (*Myzus persicae*); Smaller apple leaf roller (*Adoxophyes orana*); Peach fruit borer (*Carposina niponensis*); European red mite (*Panonychus ulmi*); Hawthorn spider mite (*Tetranychus viennensis*)	Lime-Sulphur; Fenitrothion; Trichlorphon; Imidacloprid▶; Deltamethrin; Fenvalerate; Dimethoate; Pirimicarb
Chinese yew	Spot disease	Bordeaux mixture; Zineb; Tuzet
	Borer moth	Malathion; Fenvalerate; Fenitrothion; Trichlorphon
Tea-oil tree	Anthracnose、tea sooty mold disease	Carbendazim; Tuzet
	Geometrid (*Buzura suppressaria*; *Biston marginata*); *Lcerya purchasi*	Deltamethrin; Trichlorphon; Malathion; Fenitrothion
Citrus	Citrus scab; Citrus canker; Citrus phoma rot	Lime-Sulphur; Bordeaux mixture; Thiophanate-methyl; Tuzet
	Citrus rust mite (*Phyllocoptruta oleivora*); Broad mite (*Polyphagotarsonemus latus*); Citrus red mite (*Panonychus citri*); Cottony cushion scale (*Icerya purchasi*); Arrowhead scale (*Unaspis yanonensis*); Mulberry white-spotted longicorn (*Anoplophora chinensis*); *Zadezhdilla cantori*	White corpse bacterium▶, Lime-Sulphur; Fenitrothion; Deltamethrin; Trichlorphon; Malathion; Fenvalerate; Trichlorphon

Hickory nut	Canker; Walnut melanconis disease	Lime-Sulphur; Bordeaux mixture; Thiophanate-methyl; Tuzet
	White-striped longicorn (*Batoccera horsfieldi*)	Deltamethrin; Trichlorphon
Willow	Black velvety chafer (*Serica orientalis*) ; *Proagopertha lucidula*	Fenitrothion; Phosphamidon

Notes : Pesticides with " *" mark are bio-pesticides

Source: statistics from project provinces

The damage caused by pests directly influences quality and quantity of economic tree products. Different pests cause various degree damages in different years and areas. Some pests can cause damage to 50-80% of plants if appropriate pest control is not applied. Some pests (such as walnut sun moth, fruit moth of apricots and plums, pear scab) can cause 95% damage if pest control methods were not implemented correctly. Pest control is particularly important for economic trees.

1.4 Current practice in project provinces

The recommended practice on government forestry bureaus and forest farms is to use integrated control methods as much as possible, not only chemical methods. Utilizing all suitable techniques and methods in as (ecologically) compatible a manner as possible will maintains pest population levels below those causing Economic Injury Level. Recommended IPM methods include quarantine; physical and mechanical method; agricultural method; biological method and chemical method.

The pest control situation depends on species of pest and degree of damage. Now, chemical method still the main method. Meantime quarantine; physical and mechanical method; agricultural method; biological method are also were applied to control pests. The main control methods depends on the type of pest (e.g, apricot poxes and apricot-boring wasps do not require chemical pesticides. Cutting damages shoots can provide effective control. But, up to now in China, the Green peach aphid (*Myzus persicae*) requires chemical control methods.

Farmers current knowledge of IPM and use of pesticides is obtained mainly from TV programs concerning agricultural knowledge (eg.CCTV-8), books about pesticide application techniques or pesticide handbooks. Some training courses are provided by government agencies and advice from technicians usually from county or township level. Some technical handbook and textbooks for plant protection provide information on IPM methods, but these do not deal with all project tree crops in a standard or simple manner. The China Green Food Development Center has issued "Rules of operation for the production of green food of fruit trees (economic crops)".

For health protection, some farmers wear protective clothes, caps, masks and gloves while they sprayed pesticides. Most farmers have bought hand-sprayers. A few farmers have mobile-sprayers. Farmers may lend sprayers to each other. Some farmers buy special work clothes and others wear old work clothes while spraying pesticides.

Farmers will use which ever pest and disease control methods provide them with the best income. Chemical methods are generally effective and quick acting. But farmers will abandon using chemical methods if they can get a better net income using non-chemical methods. It is very convenient for farmers to buy pesticides in China. Almost every township has a pesticide shop. For this reason farmers normally buy pesticides only when they are about to use them. They buy the amount of pesticides according to their need and generally use up the pesticide they have bought. Remaining pesticides are kept by farmers in their own storage. To enable them to make informed choices, it is important that farmers have good information about the range of methods available to them and the advantages and disadvantages of each.

Improved training, and more intensive managing, guiding and supervising by the responsible pest and disease control units is necessary to improve adoption of an IPM approach. Further training is needed to ensure that farmers understand how to handle and apply pesticides safely and efficiently.

Township hospitals can deal with farmers' accidental poisoning problem caused by pesticide application. Farmers with serious pesticide poisoning can be sent to county level hospitals. Staff at both levels are trained in treatment of cases of chemical poisoning.

2. PEST AND DISEASE MANAGEMENT FOR SFDP

2.1 Recommended Methods

The plant protection policy of " First prevention, and then IPM" should be implemented in project sites. The methods of quarantine, physical and mechanic control, agricultural control, biological control and chemical control should be adopted in the project sites for pest management. Biological control, especially using bio-pesticides, should be emphasized for pest control. At the same time attention will be paid to increasing yield and quality of forestry in the project areas, reducing pollution and protecting environment.

This project policy will be implemented by:

- Development of IPM recommendations for project plantation species;
- Development of training materials and programs for IPM and safe pesticide use;
- Training project staff at county and township level and project farmers in IPM methods and safe methods of use of pesticides;
- Effective monitoring and prediction of pests and diseases for project plantation species;
- Screening, purchase and distribution to project sites of only approved pesticides

This document by PMC will fuction as general IPM principles and methods and tree crop specific recommendations for all project tree crops. These general guidelines will be refined by provincial PMO to ensure recommendations are relevant for conditions prevailing each project province.

The project will arrange training of county and township technical staff and participating farmers in methods relevant to the particular species being planted at each site. Details

of training courses are provided in section 2.6. Training courses will emphasize the importance and potential benefits of non-chemical methods be optimized and indicate under what circumstances chemical methods can be used to supplement the non-chemical methods

Monitoring and forecasting of pests and diseases is the responsibility of the Pest and Disease Control Station at each level of government. Their role will be critical in effective IPM.

Similar to the World Bank it is also the policy of the Chinese government to emphasize the use of agronomic, biological and other non-chemical methods plus pest monitoring and application of pesticides only when other methods have failed and pest monitoring indicates that pest levels are exceeding economic thresholds

2.2 Approved Pesticide List

The following pesticides are recommended as being in accordance with the above IPM approach and have been screened to be consistent with the World Bank's procurement guidelines for pesticides (OP 4.09). Additional chemicals may be identified during project implementation and the Bank will be provided with the same details prior to them being added to the purchase inventory.

Table 3 Approved Pesticide List

Species	Pests and diseases	Pesticides	Classification of pesticide (WHO)
Masson pine	Pine seedling stem rot (*Rhizoctonia solani*), Pine needle rust (*Coleosporium salidaginis*)	Metalaxyl Chlorothalonil, Mancozeb, Carbendazim、 Zineb Triadimefon、 Bordeaux mixture,	Class III Class U Class U Class U Class U Class III
	Pine caterpillar (*Dendrolimus punotatus ;D. Kikchil*), Pine tussock moth (*Dasychira axutha*)、	Deltamethrin, Cypermethrin、 Fenvalerate、 Bacillus thuringiensis▸ , Muscarding Beauveria bassiana▸	Class II Class II Class II Class III

Chinese fire	Anthracnos(*Glomerella cingulata*), *Cercospora pinidensiflorae*	Tuzet、 Carbendazim、 Bordeaux mixture,	Class II Class U
	Polychrosis cunninghamiacola,	Phoxim Fenitrothion Malathion	Class II Class II Class III
Loblolly pine	Brown spot,	Chorothalonil Carbendazim Mancozeb	Class U Class U Class U
	Tortricids, Pine tussock moth (*Dasychira axutha*)	Deltamethrin、 Fenvalerate Fenitrothion、 Malathion	Class II Class II Class II Class III
Larch	Leaf-cast	Carbendazim Zineb、 Chorothalonil Tuzet、	Class U Class U Class U Class II
	Larger pine shoot borer;	Fenitrothion、 Phoxim Trichlorphon	Class II Class II Class III
Slash pine	Brown spot; Pine seedling stem rot (*Rhizoctonia solani*); Pine needle rust (*Coleosporium salidaginis*);	Chorothalonil Thiophanate-methyl、 Zineb、 Carbendazim、 Mancozeb, Triadimefon Bordeaux mixture	Class U Class U Class U Class U Class U Class III

	Tortricids; Pine tussock moth (*Dasychira axutha*)	Deltamethrin Fenvalerate Fenitrothion、 Cypermethrin Malathion、	Class II Class II Class II Class II Class III
Chinese white poplar	Poplar clear wing moth (*paranthrene tabaniformis*); *Clostera anachorta*; *Cryptorrhynchus lapathi*; *Apocheima cinerarius*; Mulberry longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*	Muscarding Beauveria bassiana▸ Fenthion、 prothiofos Fenitrothion, Deltamethrin, Trichlorphon Phosmet	Class II Class II Class II Class II Class III Class II
Italian poplar	Poplar tree Botryosphaeria canker (*Botryosphaeria ribis*) Poplar tree canker (*Valsa sordida*)、	Thiophanate-methyl、 Carbendazim、 Mancozeb, Asomate、 Thiophanate Bordeaux mixture Lime-Sulphur	Class U Class U Class U Class II **Class II**
	Cryptorrhynchus lapathi、 Mulberry longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*; Poplar clear wing moth (*paranthrene tabaniformis*)、 *Clostera anachorta*、 *Apocheima cinerarius* ; Mulberry longicorn (*Apriona germari*);	Fenthion、 prothiofos Fenitrothion, Deltamethrin, Trichlorphon Phosmet Muscarding Beauveria bassiana▸	Class II Class II Class II Class II Class III Class II
Simonii	Poplar tree canker (*Valsa sordida*)	Thiophanate-methyl、 Carbendazim Asomate、	Class U Class U Class II

	Cryptorrhynchus lapathi、 Poplar clear wing moth (*paranthrene tabaniformis*)、 *Clostera anachorta*; *Apocheima cinerarius*、 Mulberry longicorn (*Apriona germari*); *Saperda populnea* ; *Anoplophora nobilis*;	Fenthion、 prothiofos Fenitrothion, Deltamethrin, Trichlorphon Phosmet Chlorfluazuron▸、 Tebufenozide▸ Muscarding Beauveria bassiana▸	Class II Class II Class II Class II Class III Class II Class U Class III
Paulownia	Witch's broom(MLO)	Terramycin	
	Oriental moth (*Cnidocampa flavescens*)、 *Crytothelea variegata*	Trichlorphon Phosmet Fenitrothion,	Class III Class II Class II
Acacia (*Acacia mangium*)	Powdery mildew (*Oidium* sp.)	Carbendazim Thiophanate-methyl Triadimefon、	Class U Class U Class III
	Lymantria xylin; Geometrid (*Buzura suppressaria*)	Trichlorphon Deltamethrin, Cypermethrin、 Fenvalerate、 Bacillus thuringiensis▸, Muscarding Beauveria bassiana▸	Class III Class II Class II Class II Class III
Horsetail beefwood	Horsetail beefwood bacterial wilt;	Chorothalonil Carbendazim、 Mancozeb, Bordeaux mixture	Class U Class U Class U
	Curculio , *Lymantria xylina*、	Trichlorphon Phosmet Fenitrothion,Fenpropathri Cyhalothrin	Class III Class II Class II Class II Class II
Beautiful sweetgum	Oriental moth (*Cnidocampa flavescens*)、	Phosmet、 Deltamethrin	Class II Class II Class II

	Tent caterpillar (*Malacosoma neustria testacea*)	Fenvalerate Muscarding Beauveria bassiana▸	
Black locust	Botryosphaeria canker (*Botryosphaeria ribis*)	Thiophanate-methyl、 Carbendazim、 Mancozeb, Bordeaux mixture Lime-Sulphur	Class U Class U Class U
	Oriental moth (*Cnidocampa flavescens*)、 Geometrid; *Crytothelea variegata*;	Deltamethrin、 Fenvalerate Fenitrothion、 Cypermethrin Malathion、	Class II Class II Class II Class II Class III
Maoso bamboo	*Sterostram corticioides*; *Balansia take* ; *Vstilagosh iraiana*	Carbendazim Thiophanate-methyl、 Triadimefon , Bordeaux mixture、	Class U Class U Class III
	Ceracris kiangsu; *Algedonia coclesalis*; *Pantana sinica*; *Cyrtorachelus buqueti*;	Trichlorphon Phosmet Fenitrothion, Fenpropathri Cyhalothrin (active ingredient concentration in excess of 70%) Muscarding Beauveria bassiana▸	Class III Class II Class II Class II Class II
Rubber tree	Canker Powdery mildew Anthracnos、	Zineb、 Tuzet Carbendazim Chorothalonil Triadimefon , Lime-Sulphur Bordeaux mixture	Class U Class II Class U Class U Class III

	Bark beetles	Deltamethrin Fenvalerate Fenitrothion、 Malathion Muscarding Beauveria bassiana▸	Class II Class II Class II Class III
Camellia sinensis Kuntze	*Sterostram corticioides*	Chorothalonil Triadimefon , Kerosene ,	Class U Class III
	Ceracris kiangsu、 *Algedonia coclesalis*; *Pantana sinica*; *Loudont dispar*;	Trichlorphon Phosmet Fenitrothion, Fenpropathri Cyhalothrin (active ingredient concentration in excess of 70%) Muscarding Beauveria bassiana▸	Class III Class II Class II Class II Class II
Walnut	Walnut bacterial blight; Walnut melanconis disease ; Walnut cytcospora canker ; Walnut anthracnose	Thiophanate-methyl、 Zineb、 Lime-Sulphur、 Bordeaux mixture	Class U Class U
Chestnut	walnut sun moth(*Attrijuglans hetaohei*)、 White-striped longicorn (*Batoccera horsfieldi*); Giant mealybug (*Drosicha corpulenta*)	Prothiofos; Phosmet; Deltamethrin、 Fenvalerate Dimethoate MTMC Muscarding Beauveria bassiana▸ Petroleum oil	Class II Class II Class II Class II Class II Class II
	Chestnut gall wasp (*Dryocosmus kuriphilus*)、 Large chestnut aphid (*Lachnus tropicalis*); Peach pyralid moth (*Dichocrocis punctiferalis*); *Paratetranychus* sp.; Chestnut clear wing moth (*Aegeria molybdoceps*)	Dimethoate、 Phosmet、 Trichlorphon; Deltamethrin、 Fenvalerate MTMC Flurenoxuron▸ Pirimicarb Matrine▸	Class II Class II Class III Class II Class II Class II Class II Class III Class II Class III

Apricot	Apricot pox	Lime-Sulphur Bordeaux mixture	
Gingko	Apricot boring wasp (*Eurytoma samsonovi*)、 Plum fruit moth (*Grapholitha funebrana*)、 Peach longicorn beetle (*Aromia bungii*)、 White peach scale (*Pseudaulacaspis pentagona*)	Phoxim、 Deltamethrin、 Fenvalerate、 MTMC Muscarding Beauveria bassiana▸ Petroleum oil	Class II Class II Class II Class II
	Macrophomina phaseoli	Bordeaux mixture、 Thiophanate-methyl	Class U
Chinese date	(*Dictyoploca japonica*)、 (*Clania varieguta*)、 Tea brown chafer	Deltamethrin、 Diflubenzuron▸ Flurenoxuron▸	Class II Class III Class III
	Jujube witche's broom(MLO) ; Jujube rust	Triadimefon、 Lime-Sulphur、 Bordeaux mixture Hcl-Tetracycline	Class III
Pear	Peach fruit borer (*Carposina niponensis*)、 Bud-eating weevil (*Scythropus yasumatsui*)、 Tortoise wax scale (*Ceroplastes japonicus*); Jujube midge (*Contarinia* sp.)	Fenitrothion、 Phoxim、 Phosmet、 Fenvalerate Deltamethrin, Cypermethrin、 Fenvalerate、 Bacillus thuringiensis▸ , Chlorpyrifos	Class II Class II Class II Class II Class II Class II Class II Class III Class II
	Pear scab; Pear perennial canker; Pear rust; Pear tree dieback; Pear brown spot	Thiophanate-methyl、 Tuzet、 Carbendazim、 Imibenconazole、 Polyoxin▸ Diniconazole、 Lime-Sulphur	Class U Class II Class U Class U Class III Class III

Whinghac-kberry	Peach fruit borer (*Carposina niponensis*) ; Oriental fruit moth (*Grapholitha molesta*); Yellow-brown stinkbug (*Halyomorpha picus*); Pear fruit sawfly (*Hoplocampa pyricola*); Pear jumping plant lice (*Psylla pyri*); Pear curcuclio (*Rhynchites foveipennis*)	Phosmet、 Fenitrothion、 Trichlorphon、 Phoxim、 Deltamethrin、 Fenvalerate、 Malathion、 ethofenprox Imidacloprid▸ Diflubenzuron▸	Class II Class II Class III Class II Class II Class II Class II Class III Class II Class U
	Leaf spot disease	Carbendazim、 Lime-Sulphur、 Bordeaux mixture	Class U
Chinese pricklyash	Gummosis、 Rust、 Twig blight、	Tuzet、 Carbendazim、 Triadimefon、 Lime-Sulphur、 Bordeaux mixture	Class II Class U Class III
Eucommia	Aphids	Dimethoate、 Deltamethrin Pirimicarb	Class II Class II Class II
	Cercospora leaf spot; Brown spot	Bordeaux mixture、 CarbendazimTuzet	Class U Class II
Tea	Tussock moth、 Eucommia mengni armyworm	Phoxim、 Deltamethrin Fenvalerate Bacillus thuringiensis▸	Class II Class II Class II Class III
	Anthracnos (*Glomerella cingulata*), White star disease Tea pan cake disease	Carbendazim、 Chorothalonil、 Thiophanate-methyl、 Tuzet Mancozeb	Class U Class U Class U Class II Class U

peach	Geometrid (*Buzura suppressaria*; *Biston marginata*)、 Tussock moth (*Euproctis pseudocnspersa*)	Phoxim、 Malathion Trichlorphon ethofenprox Diflubenzuron▸ Imidacloprid▸ Chlorfluazuron▸、 Tebufenozide▸	Class II Class III Class III Class III Class U Class II Class U Class III
	Peach tree leaf curl; Peach bacterial shot hole; Peach cercospora shot hole; Peach clasterosporium shot hole、	Thiophanate-methyl、 Tuzet、 Lime-Sulphur、 Bordeaux mixture	Class U Class II
Pomegranate	Peach fruit borer (*Carposina niponensis*); Peach pyralid moth (*Dichocrocis punctiferalis*); Plum fruit moth (*Grapholitha funebrana*); Green peach aphid (*Myzus persicae*); Apple tree borer (*Conopia hector*); White peach scale (*Pseudaulacaspis pentagona*)	Malathion、 Fenitrothion、 Deltamethrin、 Bacillus thuringiensis▸、 MTMC Diflubenzuron▸ Lime-Sulphur Petroleum oil Muscarding Beauveria bassiana▸	Class III Class II Class II Class III Class II Class U
	Pomegranate tree dieback (*Zythia versoniana*); Brown spot(*Cercospora punicae*)、	Carbendazim、 Zineb、 Asomate Lime-Sulphur	Class U Class U Class II
Rubber tree	Peach pyralid moth (*Dichocrocis punctiferalis*); Peach fruit borer (*Carposina niponensis*); Tortoise wax scale (*Ceroplastes japonicus*); *(Eriococcus)lageros troemiae*	Malathion、 Fenitrothion、 Deltamethrin、 Bacillus thuringiensis▸、 MTMC Diflubenzuron▸ Lime-Sulphur Petroleum oil Muscarding Beauveria bassiana▸	Class III Class II Class II Class III Class II Class U

Apple	Powdery mildew、 Anthracnose、 Canker	Zineb、 Tuzet、 Triadimefon Imibenconazole、 Polyoxin▸ Lime-Sulphur、 Bordeaux mixture	Class U Class II Class III Class U Class III
	Bark beetle	Phoxim、 Deltamethrin Fenvalerate、 Malathion MTMC	Class II Class II Class II Class III Class II
	Apple alternaria leaf spot Apple of canker (*Valsa mail*) Apple alternaria leaf spot、 Apple tree of dieback;、 Apple heart rot ; Apple rust	Zineb、 Tuzet Asomate; Iprodione; Triadimefon Diniconazole、 Bordeaux mixture、 Lime-Sulphur、	Class U Class II Class II Class U Class III Class III
Chinese yew	Apple leaf curing aphid (*Myzus malisuctus*); Green peach aphid (*Myzus persicae*); Smaller apple leaf roller (*Adoxophyes orana*); Peach fruit borer (*Carposina niponensis*); European red mite (*Panonychus ulmi*);Hawthorn spider mite (*Tetranychus viennensis*)	Fenitrothion、 Trichlorphon、 Imidacloprid▸、 Deltamethrin、 Fenvalerate、Dimethoate、 Pirimicarb Permethrin ethofenprox ▸ Diflubenzuron▸ Lime-Sulphur、	Class II Class III Class II Class II Class II Class II Class II Class II Class III Class U
	Spot disease	Zineb、 Tuzet Bordeaux mixture、	Class U Class II

Tea-oil tree	Borer moth	Malathion、 Fenvalerate Fenitrothion Trichlorphon	Class III Class II Class II Class III
	Anthracnose、 *Meliola camelliae*	Carbendazim、 Chorothalonil、 Thiophanate-methyl; Tuzet	Class U Class U Class U Class II
Citrus	Geometrid (*Buzura suppressaria*; *Biston marginata*)、 *Lcerya purchasi*	Deltamethrin、 Trichlorphon、 Malathion; Fenitrothion MTMC	Class II Class III Class III Class II Class II
	Citrus scab、 Citrus canker、 Citrus phoma rot	Thiophanate-methyl; Tuzet Lime-Sulphur; Bordeaux mixture	Class U Class II
Hickory nut	Citrus rust mite (*Phyllocoptruta oleivora*); Broad mite (*Polyphagotarsonemus latus*); Citrus red mite (*Panonychus citri*); Cottony cushion scale (*Icerya purchasi*); Arrowhead scale (*Unaspis yanonensis*); Mulberry white-spotted longicorn (*Anoplophora chinensis*); *Zadezhdilla cantori*	Fenitrothion、 Deltamethrin、 Trichlorphon、 Malathion、 Fenvalerate MTMC Esfenvalerate Chlorfluazuron▸、 Tebufenozide▸ Muscarding Beauveria bassiana▸; Lime-Sulphur	Class II Class II Class III Class III Class II Class II Class II Class U Class III
	Canker、 Walnut melanconis disease	Thiophanate-methyl Tuzet Lime-Sulphur、 Bordeaux mixture	Class U Class II
Willow	White-striped longicorn (*Batoccera horsfieldi*)	Deltamethrin、 Trichlorphon	Class II Class III
	Black velvety chafer (*Serica orientalis*) ; *Proagopertha lucidula*	Fenitrothion Imidacloprid▸ Fenvalerate、 MTMC	Class II Class II Class II Class II

Notes : (1) Pesticides marked with " *" are bio-pesticides

(2) Beside pesticide included in Table3, other pesticide may be applied in project sites if new pests appear which pesticides included in Table3 may not be available to control

2.3 Organization and Management

(i) Institutional Arrangements

PMC at national level, and PMO at province and county levels will be responsible for implementing the PMP. Implementation responsibilities include supervising the project units in following IPM methods, arranging training for forestry bureau staff at each level and participating farmers, and monitoring training and the application of IPM methods.

PMC, in consultation with World Bank, will approve the Approved Pesticide List and project funds will be used to buy only those pesticides included on the List. PMO at each level will maintain records in sufficient detail to enable procurement to be monitored.

Provincial PMO will amend the Approved Pesticide List to include the product names of pesticides sold within the province. This list will provide the basis to prepare pesticide management training programs by the PMOs at different levels for county and township technicians and farmers. Provincial PMO will monitor training and application of IPM methods by project county PMOs.

Project county PMOs will be responsible for implementation of training programs for forestry staff (county and township) and farmers, and for field monitoring of application of IPM methods.

The general IPM principles and methods and tree crop specific recommendations for all project tree crops contained in this document by PMC , will be refined by provincial PMOs to ensure recommendations are relevant for conditions prevailing each project province and presented in a manner suitable for use in training courses for lower level technicians and farmers.

(ii) Pesticide management

PMC will establish a policy for pesticide examination and approval for project purchases. Procurement of pesticides will be carried out by provincial PMOs according to the project policy.

Each afforestation entity should, in accordance with the propose according to pest prediction, the names, dosages and quantity of pesticides required and report to county PMOs,. County PMOs will report thereafter to provincial PMOs, who together with PMC will consolidate project requirements for bulk purchase and arrange purchase according to project guidelines.

Technical staff will be assigned to escort pesticide transportation to ensure that the pesticides are be delivered safely to destinations, and in timely manner. In the event that pesticide containers are accidentally damaged, effective remedies must be adopted to

prevent environmental pollution. Transportation and delivery records will be maintained by the county PMO

Forestry bureaus in project counties will maintain storage facilities for project pesticides according to regulations. Project units and retail stores serving afforestation entities will also maintain approved storage facilities.

Technical staff of the county forestry bureau and township t forestry stations will diagnose pests and diseases and advise growers on the application of IPM methods and use of approved pesticides. These technical staff will in turn consult relevant provincial level experts or institutions as required. These agencies include: staff of the provincial Forest Pest and Disease Control Station, Department of Plant Protection at the relevant Agricultural University or Forestry University; or the appropriate Institute/experts of Economic Crops, Forestry or Plant Protection.

(iii) Safe usage of pesticides

The following steps are proposed:

(1) Growers will be advised on the basis of pest forecast reports from county monitoring stations to apply pesticide scientifically through specific training programs prepared according to the tree species for each planting plot.

(2) Growers requiring larger quantities of pesticides will submit procurement plan to the county PMO; for smaller quantities farmers will purchase from the township pesticide shop which will be supplied with approved chemicals by the county PMO.

(3) To ensure control efficiency, different spraying methods should be applied according to the biology of different pests, injury areas and damage position on the trees. Staff of the county Forestry Pest & Disease Control Station will recommend appropriate pesticides and spraying routines for the tree and economic crop species infected by pests;

(4) Provincial PMO will ensure that relevant experts are consulted to formulate appropriate location specific recommendations. The experts may include staff of the national or provincial Pest and Disease Control Station, Department of Plant Protection at provincial Agricultural or Forestry Universities or the national or provincial Institute of Economical Crop, Institute of Forestry or Institute of Plant Protection;

(5) Regular pesticide rotation will be considered to reduce pest resistance to pesticides and decrease plant injury cause by pesticides. Provincial PMO will ensure that relevant experts are consulted to make appropriate recommendations. These recommendations will be incorporated into training programs, technical recommendations for each site and the pesticide procurement program;

(6) Farmers or afforestation entities in every project site will undergo project sponsored training concerning pesticide safety use and the appropriate means of pesticide application;

(7) Training programs will stress the importance of protective clothing when they apply pesticides. This will include suitable work clothes, protective cap, mask, gloves and shoes. Surplus pesticides should be properly stored or safely disposed of;

(8) Training programs will also emphasize the need to strictly follow pesticide application procedure and avoid polluting residential areas, water resources and grazing lands;

(9) Surplus pesticides of each afforestation entity will be returned to designated storehouses. Empty pesticide containers will also be returned to designated storehouses for reuse or disposal (by deep burying) according to relevant laws and regulations;

(10) County PMOs and township technical staff will emphases the important of effective procedures for pesticide management.

(iv) Pesticide purchase

The afforestation entities will report to county PMOs, according to pest prediction, the names, dosages and quantity of pesticides required. County PMOs will report county requirements to provincial PMOs, who together with PMC will consolidate project requirements for bulk purchase and arrange purchase according to project guidelines.

Purchase of pesticides should follow the regulation of "management method for project material and facilities purchase" applicable for World Bank projects. Provincial PMOs will organize the purchase. PMC will establish a policy for pesticide examination and approval for project purchases to ensure that project funds are used only for purchases of pesticides on the Approved Pesticide List.

2.4 Training

The project will arrange training of county and township technical staff and participating farmers in methods relevant to the particular species being planted at each site. The training will be based on the IPM methods and safe use of pesticides recommended for each tree crop species in each project province.

PMC will revise these general project guidelines for IPM and safe use of pesticides according to the provincial specifics and the project implemetnaion situation. Provincial PMOs based on this manaagemetn plan, will arrange for preparation of training materials and training programs based on the general project guidelines for provincial level training programs for PMO and key technical staff from provincial and county level. Provincial PMOs will also arrange for training materials and training programs to be prepared for county level training of township technicians. Counties will be responsible for preparation of training materials for use in farmer training and demonstrations.

(i) Content of training

Law and regulation training : Training courses will include relevant information from "Forestry Law", "Environment Protection Law", "Regulation of Forest Pest Control" and "Integrated Pest Management", and requirements of the professional policy of World Bank (4.09). The level of detail will be adjusted according to the target audience.

Technical knowledge training : Pest identification, life cycles, biology of pests, techniques of control, basic knowledge of pesticides, pesticide management and safe application will be included in the training courses. The level of detail will be adjusted according to the target audience.

Field practice : Field demonstration to farmers for properly and safely pesticide application.

(ii) Training method

In general training will be organized as follows:

- Provincial PMOs will be responsible for the provincial level training courses or the conduciotn of the ; or the provincial Institutes of Economic Crops, Forestry or Plant Protection. Provincial level training will be supervised by staff from PMC.
- Training courses at county level for township and county technical staff will be provided by staff from county or provincial Forestry bureau (mainly from the Forestry Pest and Disease Control station).
- Farmers and forestry farm staff will be trained on-site by township level technicians using basic educational materials and practical demonstration. Training courses for farmers and field technicians will be run mostly in orchards or fields.

The PMOs of province and county levels should plan and arrange the yearly training courses according to the IPM requirements and the problems existing in the project sites. The training arrangement at each level should provide records to PMO at the next highest level for monitoring purposes.

(iii) Training Plan and budget

An overall training plan and budget for the duration of the project will be prepared for each province showing: number of training courses by year for each type of tree crop, number of participants, location of training, details of the training program and training materials. A detailed training plan will be approved in advance for each year by PMC. The budget will show costs for preparation of training materials and unit costs for training (per person per day). Payments for training activities will be based on (i) production of training materials and (ii) monitorable evidence of training courses held (records of participants, trainers and duration).

The following indicative budget will be revised based the overall training plan and detailed annual budget to be prepared by provincial PMOs.

Table 4: Indicative training budget

Content of training	Number of training course	Number of participants	Estimated Cost (RMB '0,000)
Total	**558**	**8495**	**218.7**
1、National level	**1**	**30**	**5.4**
(1) Pesticide safe use and management	1	30	5.4
(2) Techniques of forest and fruit pest control (not chemical method)			
2、Province level	**22**	**440**	**52.8**
(1) Pest control and pesticide safe use	11	220	26.4
(2) Techniques of forest and fruit pest control (not chemical method)	11	220	26.4
3、county level	**535**	**8025**	**160.5**
(1) once training course (on pest control and pesticide safe use) a year in each project site	535	8025	160.5

Note: an overall training plan and detailed annual training plan and budget will be prepared by each provincial PMO.

2.5 Monitoring

Monitoring is required for the following elements of the PMP:

- Development of training materials and programs for IPM and safe pesticide use;
- Training project staff at county and township level and project farmers in IPM methods and safe methods of use of pesticides;
- Effective monitoring and prediction of pests and diseases for project plantation species;
- Screening, purchase, distribution to project sites, and use of only approved pesticides

Preparation of training materials for provincial and county level and farmer training by provincial PMOs will be monitored by PMC.

Implementation of provincial and county training programs will be monitored by PMC, and implementation of township and farmer training by provincial PMO on the basis of training reports prepared by county PMOs..

Effective prediction of pest and disease incidence, provision of regular guidance to field staff and response to pest and disease outbreaks by Pest and Disease Control stations should be monitored by the next higher technical level of the responsible agency, and also by PMOs to ensure project farmers receive an adequate level of service.

Screening and purchase of approved pesticides should be monitored by PMC on the basis of procurement reports. Distribution and use of pesticides should be monitored by provincial and county PMOs on the basis of information provided by the Pest and Disease Control stations at the respective levels. Appropriate storage and handling of project agro-chemicals should also be monitored by the Pest and Disease Control stations at the respective levels.

China: Sustainable Forestry Development Project

Policy Framework for Resettlement and Land Acquisition

10 April 2001

A. Introduction

1. The proposed Sustainable Forestry Development Project promotes innovative approaches to improve management of forest resources and to protect the natural environment. A key aspect in project design is provision of incentives so as to enlist the voluntary participation in resource management. Neither project agencies nor other governmental units are expected to undertake civil works or otherwise identify or undertake activities requiring taking of land. Accordingly, neither land acquisition nor involuntary relocation is expected to occur in any of the three project components:

> The Protected Area Management component supports conservation and improved forest management. Because this component involves existing forest reserve areas, land acquisition will not occur. Effective management, however, may require additional restrictions on forest use. The project views community co-management of forest reserves as essential to sustainable management. This means that communities now relying on access to forest resources will participate in allocation of resource use and in design of remedial measures for lost resource access, if any. (Potential impacts resulting from restriction of access to nature reserves are covered in a separate "Process Framework.")
>
> The Plantation Establishment component promotes increased production of wood to meet growing consumer demand and to provide sources of employment and income for persons already affected by logging bans and other restrictions on use. Participants receive various forms of support to develop wood or tree-crop production. Most recipients are likely to be individual or collective plantation owners, selected from among voluntary applicants meeting specified eligibility criteria. This may involve voluntary conversion of participants' existing land to plantation purposes, but no involuntary land acquisition or other resettlement-related issues are likely to arise. It is possible that township governments may be among recipients, but eligibility criteria require that any government recipients utilize existing government land for eligible activities, or obtain additional land through voluntary negotiations with present land owners or users.
>
> The Natural Forest Management component supports development and testing of new management techniques of potential use in the government's Natural Forest Protection Program. Among various activities in this component, the European Union would provide small grants or credits in rural villages already affected by logging ban. Villages meeting counterpart funding requirements would be eligible for small village improvement grants. These small-scale activities would be identified through community planning processes. Some may involve physical improvements (e.g., road widening or construction of sheds or other facilities), but it expected that all such improvements would be sited within the village itself. Because land is collectively owned within villages, there is very little likelihood of land acquisition or resettlement-related impacts. Use of unallocated collective land for community improvements identified by the community itself is not considered land acquisition. Use of land allotted to individual households on a

lease basis by the collective would be covered by this framework unless obtained through voluntary negotiations with the leaseholder.

2. As part of project agreements, the Borrower will attest that no activities requiring involuntary taking of land will be undertaken in this project without prior acceptance by the Bank of appropriate planning remedies. The European Union, as the source of grant support, also will attest that it will not provide support for any activities requiring involuntary taking of land, or activities imposed by government agencies on villages receiving grant support.

3. At the time of project preparation and appraisal, no land acquisition or other resettlement-related impacts could be identified. However, since the siting of small-scale infrastructure that may be undertaken in the plantation establishment and the natural forest management components is not yet known, resettlement-related impacts cannot be ruled out completely. This policy framework has been prepared for the purpose of establishing principles and procedures to be applied in the event that involuntary loss of land or other fixed assets would arise as a result of project implementation. The policy framework has been developed based on World Bank Operational Directive 4.30 on involuntary resettlement and relevant Chinese laws and regulations, and will form the basis for resettlement planning.

B. General Principles

4. Basic principles guiding any necessary actions related to involuntary loss of land or other assets are as follows:

(a) Taking of land or other assets, as well as other resettlement-related impacts, should be avoided or minimized;

(b) Project activities causing any such losses will not be approved for financing until remedial measures have been prepared and found by the Bank to be consistent with this framework;

(c) As relevant, remedial measures should provide project-affected persons with: (i) compensation for land or other lost assets at full replacement cost without depreciation, (ii) compensation for damaged crops at full market value, (iii) provision of an alternative house plot (as necessary); and/or (iv) land redistribution, alternative employment or other measures necessary to improve, or at least restore, incomes following loss of land or other productive assets;

(d) Absence of legal title to, or formal ownership of, affected assets is not a barrier to compensation or other forms of assistance;

(e) Adequate supervision and monitoring should be in place to identify any issues associated with involuntary losses in a timely manner;

(f) Institutional responsibilities to implement the rehabilitation measures need to be clearly delineated.

(g) For the purposes of this framework, "affected persons" are defined as persons who, as a result of works carried out or to be carried out under the Project, would incur involuntary loss, temporarily or permanently, of land, shelter, productive assets or access to productive assets, or of income or means of livelihood and, as a consequence, have their living standards or production levels adversely affected.

(h) No grant assistance will be provided for any activities requiring involuntary relocation of residence.

C. Identification of Impacts and Planning Procedures

5. As stated above, project design emphasizes voluntary participation, including selection of activities by villagers themselves. If involuntary taking of land or other assets (including involuntary taking by collectives of land leased to collective members) arises during project implementation, remedial plans are to be prepared in keeping with the general principles listed above. As regarding compensation for lost assets, and conversion of agricultural land for other purposes, remedial plans also will be consistent with the Law of the PRC on Land Management (1999), the Implementation Regulations of the Law of the PRC on Land Management, and related provincial laws and regulations.

6. Given the nature of the proposed project components, any activity that may cause taking of land or other assets is likely to affect relatively few people (e.g., less than 200 people), and impacts are likely to be relatively minor (e.g., not requiring changes in occupation or relocation of residence). Under such circumstances, a relatively brief remedial plan can be prepared. Even under these circumstances, however, the remedial plan should briefly review: (i)description of the project activity necessitating land acquisition; (ii) basic legal or regulatory provisions regarding land acquisition and compensation; (iii) basic data enumerating and identifying impacts and the persons to be affected by them; (iv) compensation rates; (v) timetable; (vi) organizational and financial arrangements; and (vii) consultative arrangements (including grievance procedures).

7. In the unlikely event that any project activity is to affect more than 200 persons, more detailed presentation of planning elements is required. In the event that any project activity would result in the necessity for arrangements to promote the economic rehabilitation of any affected persons, detailed review of arrangements (e.g., land redistribution, provision of employment, or other alternative measures to restore incomes) must be provided prior to Bank acceptance.

D. Management Organizations and Responsibilities

8. At the time that the necessity of land acquisition (or taking of other assets) is recognized, the provincial Project Management Office should assign responsibility for consultations with project-affected persons, preparation of remedial plans, and resettlement implementation. Specific responsibilities to be assigned include, at a minimum:

(a) identification of impacts and project-affected persons;
(b) establishment of remedial measures consistent with the general principles stated above;
(c) consultations with project-affected persons, and dissemination of relevant information to them in a timely manner;
(d) prior consultations with the Bank (or other donor agencies, as relevant) in selection of activities necessitating land acquisition or resettlement, and in formulation of remedial plans;
(e) coordination with any local government units sharing responsibility for any aspects of resettlement preparation or implementation;
(f) timely payment of compensation, and provision for delivery of any other forms of assistance;
(g) monitoring of effectiveness of resettlement implementation;
(h) responding to grievances presented by project-affected persons.

E. Consultation and Grievance Procedures

9. The taking of land or other assets, and the preparation of remedial plans require consultation with project-affected persons. Prior to taking of land or other assets, the responsible governmental unit will visit affected villages or households to discuss the location and quantity of assets to be acquired, and compensation rates and any other rehabilitation measures to be provided. Following consultations, any remedial plans will be disseminated to the project-affected persons in a manner accessible to them. Information disseminated to the project-affected persons will include: (i) compensation rates for all categories of affected assets; (ii) eligibility criteria for all other forms of assistance that may be provided; and (iii) grievance procedures (including specific contact information for initiating, or following up on, grievances).

10. If project-affected persons are not satisfied with proposed resettlement arrangements, or if they are dissatisfied with actual resettlement implementation, they can first seek satisfaction through village councils (or other local leaders). If this does not result in resolution of issues, project-affected persons can also make grievance verbally or in written form to authorities as specified in the remedial plan. Specified authorities should record receipt of grievances and reply to the project-affected person or persons within ten days after receiving the grievances. If the grievances or disputes cannot be resolved through administrative action, the project-affected person can initiate legal proceedings, in accordance with provincial and national law.

China: Sustainable Forestry Development Project

Process Framework for Mitigating Potential Adverse Livelihood Impacts

10 April 2001

1. **Project Description.** The Sustainable Forest Development Project (SFDP) proposes the development and implementation of innovative management approaches in selected natural forests, nature reserves and forest plantations to relieve pressures on China's remaining natural forest resources, as well as to protect selected important forest ecosystems and associated biodiversity. The SFDP has three components: (a) Natural Forest Management (NFM); (b) Protected Areas Management (PAM); and (c) Plantation Establishment (PE).

2. **PAM Component Description.** The SFDP's PAM Component would support more effective *in situ* protection of threatened and globally important forest ecosystems and habitats, and associated rare and endemic species in selected Nature Reserves (NR) in China. China's NRs face increasing pressure from the human communities inside or in close proximity to them. These local communities, many of which are impoverished, are typically forest-dependent in that they derive substantial portions of their income from the use of non-timber forest products (NTFPs), rely on firewood as a major energy source (annual fuelwood consumption can be as high as 10 tons/household in the Western Sichuan mountains), and use forest areas for other subsistence and economic activities such as farming staple grains, grazing livestock, and medicinal herb production. In some areas these activities increasingly exceed sustainable levels, undermining already meager livelihoods. Moreover, coupled with widespread wildlife hunting and illegal extraction of timber products, excessive levels of forest-resource use adversely affect the biological integrity and sustainability of the NRs.

3. The significant forest dependence of the local communities presents a three-fold challenge to protecting the China's NRs from overuse and other threats. The first facet of the challenge is how to engage local people in NR management, during the project and over the long-term. The second is what are appropriate encouragement and incentives for local people to use nature reserve resources sustainably. And, the third is what types of alternatives could be developed to forest-resource-dependent activities which would both support more sustainable livelihoods and maintain the integrity of the nature reserves. The PAM component takes a multi-pronged approach to addressing these challenges through three sub-components and key activities: (a) Nature Reserves Planning and Management including (i) revision of initial management plans, (ii) preparation of ecological baseline maps, (iii) implementation of wildlife damage control demonstration, (iv) strengthen field management, research, and monitoring, and (v) improvement of reserve infrastructure; (b) Community-Based Nature Conservation including (i) preparation and implementation of co-management demonstration activities, (ii) community conservation education/public awareness, (iii) energy conservation demonstrations, and (iv) technical extension and community training on sustainable livelihood activities; (c) Training and Capacity Building with emphasis on provincial and nature reserve levels; and (d) Monitoring and Evaluation.

4. **Policy Trigger.** This Process Framework will be implemented in accordance with World Bank policy on involuntary resettlement. It covers restrictions of access to legally designated parks and protected areas which result in adverse impacts on livelihoods of the affected persons. Good practice has demonstrated that the objectives of the policy can be better achieved through a participatory process and rehabilitation interventions along the lines outlined in this Process Framework. To determine the appropriate coverage of the Process Framework, a review was undertaken of the PAM component design and the results of the Social Assessment (SA) to confirm if any involuntary restrictions of resource access are anticipated, as well as to evaluate the potential impacts on peoples' livelihoods of any restriction of access likely to be imposed as a result of the PAM component.

5. In general logging, grazing, hunting, fishing, herbal plant collection, mining, burning of grasses or other vegetation, and farming of crops are all forbidden by law within NRs in China,

with some exceptions for limited subsistence uses. China's NRs are typically sub-divided in to a core zone, where no use for any purpose other than approved research is allowed, and an experimental zone, where subsistence and income generating uses are allowed on a limited level as long as the uses do not conflict with the operation of the nature reserve. The imposition of China's "logging ban" in 1998, effectively extended the prohibition of logging, collection of forest products and other extractive uses of forest resources to all natural forests.

6. In order to enhance the management systems of NRs, the PAM component would support, *inter alia*, development and implementation of management plans for selected NR, which would focus on key management activities to enhance conservation, such as habitat restoration, increased monitoring and working with forest-dependent households and communities to develop and implement regulations and other measures to ensure sustainable utilization of natural resources. The PAM component design would not require involuntary physical displacement or relocation of people. Furthermore, to the extent feasible, the NR management plans would avoid including new restrictions or stricter enforcement of current restrictions of use of NR resources by local communities which would adversely affect their livelihoods, beyond those needed to ensure the sustainability of the NRs.

7. Nonetheless, new or increased restrictions of access to natural resources in the NRs, such as changes in zoning between experimental and core zone, or introduction of a new, buffer zone with increased restrictions from the experimental zone, may be needed to ensure sustainability of the NRs. In some cases, changes in zoning may adversely impact livelihoods. In other cases, zoning changes may actually increase opportunities for communities, as in the case of some of the NR in Hunan Province, where re-zoning of the core zone may actually open up more collective forests for sustainable use of fuelwood and selective collection of NTFPs. However, increased restriction of access cannot be ruled out until the management plans for the NR are developed during implementation, at which time the nature of any proposed restrictions, as well as the type of measures necessary to mitigate adverse impacts of those restrictions, would be determined in consultation with the project-affected groups.

8. **Process Framework.** This Process Framework outlines the criteria and procedures which will be followed as part of the project, in cases where project-induced involuntary restriction of access to NR resources results in adverse livelihood impacts, to ensure that eligible, affected persons are assisted in their efforts to restore or improve their livelihoods in a manner which maintains the environmental sustainability of the nature reserve in question. More specifically, it describes the participatory process by which: (a) specific components of the project were prepared and will be implemented; (b) the criteria for eligibility of affected persons will be determined; (c) measures to assist the affected persons in their efforts to improve or restore, in real terms, to pre-displacement levels, their livelihoods (e.g., as appropriate, alternative grazing areas, cultivation of unique non-timber forest products such as mushrooms, or other crops, or investments in community infrastructure) while maintaining the sustainability of the park or protected area will be identified; and (d) potential conflicts involving affected persons will be resolved. It also provides a description of the arrangements for implementing and monitoring the process.

9. Process Followed During Preparation. A full SA process was conducted during component preparation by provincial teams guided by provincial, national and international experts. A representative sample of rural village households in selected "critical" communities in and adjacent to the 13 nature reserves included under the project were interviewed. The objective of the SA was to: (a) assess the existing social conditions; (b) determine the potential negative impacts of the component project, if any; (c) serve as a vehicle for community consultations on the component; and (d) inform the ongoing component design.

10. The SA found that the likely overall impact of the proposed PAM component would be positive since participation of local communities in preparation and management of nature reserves would be increased, alternative methods for reducing crop damage from wildlife would be introduced, awareness of potential nature reserve benefits on local economies would be enhanced, and alternative livelihood and energy efficiency activities would be supported. The results of the SA were used to refine the design of the PAM component, enhancing positive impacts and mitigating likely adverse effects. Nonetheless, it is possible that some component activities could inadvertently affect adversely the livelihoods of persons living in or adjacent to the NRs.

11. Preparation or revision of management plans (MPs) for the NRs would follow a participatory approach, in which the roles of local communities in the management of NRs would be strengthened, and appropriate measures would be identified with local communities to enhance the sustainability of NR resource-based livelihood activities and manage pressures on the NRs. In addition, a community-based nature conservation sub-component would assist the 13 NRs participating in the project develop their community-based approach to conservation through support to: (a) the establishment of county-level organizational structures, as well as strengthening of village institutions, for the development and implementation of co-management activities in the NRs; (b) decreasing the threats from overuse of forest resources for energy through targeted demonstrations of appropriate, practical, and cost-effective energy conservation approaches; and (c) providing training and technical assistance for the identification and demonstration of alternative income generating techniques as alternatives to the use of critical forest resources.

12. Process to be Followed During Implementation. The process to be followed during project implementation would consist of the following seven key steps: (a) conduct participatory rural assessment (PRA) surveys to determine community use of natural resources and critical threats, conflicts and community issues; (b) establish and train leading groups; (c) select co-management demonstration sites; (d) establish Management Forum in communities; (e) prepare Community Resource Management Plans; (f) establish and implement Community Conservation Fund; and (g) monitor and evaluate implementation.

13. *Participatory Rural Assessments*. Following-up on the SAs conducted during preparation, additional work on social assessment through Participatory Rural Assessment (PRA) surveys would lead off the implementation of the component. The PRAs would focus on developing a more in-depth understand of: (a) the social and geographic setting of the communities in the component areas, including their economic and social problems; (b) the types and extent of community use of natural resources, and the existing *de jure* and *de facto* rules and institutions for the use and management of natural resources; (c) the communities' threats to and impacts on the NRs; (d) the potential livelihood impacts of new or more strictly enforced restrictions on use of resources in the NRs; (e) communities' suggestions and/or view on possible mitigation measures; and (f) potential conflicts over the use of natural resources, and methods for solving potential conflicts. The results of the PRAs will be an input to the development or revision of the MPs under the nature reserves planning and management sub-component, as well as to the development of the Community Resource Management Plans (CRMPs) under the community based conservation sub-component.

14. *Leading Groups*. Leading groups for each of the NRs, comprised of officials from local county government, staff from the nature reserves, and representatives of the local communities participating in the co-management activities will be formed under the component. The leading groups will be charged with overseeing the co-management process, with key tasks and

responsibilities including: (a) preparing selection criteria for the co-management demonstration sites; (b) coordinating technical advice, programs and cooperation among various local government departments; (c) reviewing and approving CRMPs and community contracts; and (d) resolving conflicts arising out of the co-management process.

15. *Determination of criteria for eligibility of affected persons, and identification of measures to assist affected persons.* Selection of the villages to participate in the Community-Based Conservation sub-component would not be made until the first year of project implementation, and would be based on the results of the participatory rural assessments (PRAs) as well as the threats analysis, to identify the sources of the major threats to the nature reserves, conducted as part of the nature reserve management planning process. Participating villages would be identified based on their level of dependency on the forest resources inside the nature reserve, the degree of threat that these uses pose to the NR, and the anticipated severity of adverse impact to livelihoods from imposition of any proposed use restrictions. The results of the PRA and the threats analysis will be used to ensure that the project provides benefits to eligible forest-dependent household in the project areas adversely affected by the project, and to help define project activities that will assist them in improving their livelihoods, both by enhancing and improving the sustainability of the natural resource base and by identifying alternative sources of income (e.g., skills training, small grants, technical extension, etc.).

16. Based on the results of the PRA surveys and the threats analysis, the Leading Groups will determine the eligibility of villages as well as confirm the eligibility of households in the eligible villages, and select co-management sites in or around each of the NRs on the basis of severity of impacts. Critical communities (i.e., those which are dependent on the nature reserve, pose a threat to the nature reserve, and would be adversely affected by proposed use restriction), as identified in the management planning process, will get priority for project activities under the Community Resource Management Plans (see paras 18 - 20). Other communities, either less impacted or exerting less pressure on nature reserve natural resources, may not be able to participate. A minimum of twenty-six villages (two per NR) will be selected to participate in co-management activities, including alternative livelihood measures. For NRs in which project activities would adversely affect the livelihoods of local people in more than two villages, the other villages would be deemed eligible and would be included, and an increased level of local government counterpart funding would be in place to cover the costs of the additional villages. Another 39 villages will be selected to participate in fuelwood management and/or technical training activities. In addition, 7 villages will be supported in community-based wildlife management demonstrations.

17. *Management Forum.* A Management Forum (MF) for the co-management process would be comprised of representatives are the various stakeholders groups, including the village committee, village groups, special groups, and nature reserve staff. The exact composition of the MF would be determined by the results of the PRA, which would clarify the traditional power structures and their relationship to the official power structures. Where appropriate, the MF would include religious and/or traditional leaders (e.g., monks, ethnic minority leaders). The MFs would lead the preparation of Community Resource Management Plans (CRMPs) as well as manage the Community Conservation Fund (CCF). In addition, the MF would approve community conservation and development project supported by the CCF, enforce rules and regulations of the CRMP, and adjudicate potential conflicts.

18. *Community Resource Management Plans and Community Conservation Funds.* As an incentive for local communities to participate in the development and implementation of the MPs for the NRs, the Project will help the communities to prepare CRMPs, outlining the priority management actions that communities would need to undertake, as well as meeting priority needs

of communities. Thus, the CRMPs would provide management programs, or plans and rules agreed to by the community, the nature reserve and local government, that provide for more sustainable use of critical community resources, such as firewood and wild medicinal plants. In ethnic minority communities these plans would be culturally appropriate.

19. The CRMPs would be developed by the village-level MF, a village stakeholder committee built on the village committee, through participatory mapping exercises and detailed consultations with stakeholders. All people affected by MPs for the NRs would be given the opportunity to participate in planning and implementation of CRMPs. The MFs would be provided technical assistance to outline their respective natural resources management issues, and to develop a plan for solving the most important conflict or threat facing the nature reserve and the community. Each of the CRMPs would comprise a community-based NR resource use and protection program, proposals for economic activities that reduce the overuse of critical NR resources or provide alternative livelihoods for resources lost, and outline the organizational structure and approach for managing the implementation of the CRMPs. As village capacity to develop and manage projects is generally low, village leaders and other members of the MF would receive project management training under the project.

20. Eligible activities in the CRMPs would be financed through the Community Conservation Funds (CCFs), with appropriate counterpart funding from local governments and beneficiaries. Eligible activities for financial assistance include small-scale enterprises, alternative livelihood activities or small-scale conservation and rural development activities, such as installing energy conserving technologies in village households. The CRMPs will also contain negotiated conservation agreements related to the MPs for the NRs, which will outline in detail the conservation activities to be undertaken by the community as part of implementation of the management plan. Funding for the CRMPs will be conditioned on commitment by the community to undertake the agreed conservation measures, as well as on making counterpart contributions and ensuring maintenance of investments, as appropriate.

21. The SFDP would provide funds for the establishment of CCFs. Villages can use the CCF to finance projects identified within the community that solve problems and/or take advantage of opportunities identified in the CRMPs. The project would provide technical assistance and training to MFs regarding the management of the CCFs.

22. *Monitoring and Evaluation Arrangements*. Baseline information on socio-economic conditions of the villages and household, in particular the potential livelihood impacts of new or more strictly enforced restrictions on use of resources in the NRs, will be collected through the PRAs conducted at the initial stage of implementation. These data will be used as the basis for determining the eligibility of villages and households for assistance under the process framework, as well as designing measures to assist the affected persons in their efforts to improve or restore their livelihoods to comprise the CRMPs. Follow-up PRAs, conducted at the mid-term review and the close of project, will update these data for the purpose of monitoring and evaluation of the implementation and impacts of the CRMPs. The specific monitoring indicators will be outlined in the Plan of Action. Possible indicators include: numbers of eligible villages and households; the potential livelihood impacts to these villages and households of new or more strictly enforced restrictions on use of resources in the NRs; livelihood benefits of measures to assist the affected persons; numbers of villages and households participating in CCFs; and funds provided by CCFs to eligible villages and households.

23. Plan of Action. The CRMPs for each of the 13 NRs would together serve as the Plan of Action required by the Bank's policy on involuntary resettlement to be developed and submitted to the Bank during project implementation and prior to enforcement of new restrictions of access

to resources in the NR, describing the specific measures to assist persons to be adversely affected by the proposed restrictions.

24. Conflict Resolution Mechanism. The risk of conflicts arising between communities or among NRs, villages and households during implementation of this process framework are real and must be addressed. A two-fold mechanism, with both proactive and reactive elements for resolution of conflicts, disputes and grievances that might arise, would be put in place

25. *Proactive Approach.* Recognizing that many conflicts arise due to difference in understanding and perceptions, a proactive approach would be adopted to avoid conflicts before they start. This approach would promote a common understanding through a four-pronged approach, including: (a) wide-spread disclosure of project background information; (b) clarification of the criteria of eligibility for assistance under the process framework; (c) clarification of the duties and responsibilities of all stakeholders in the process, and in particular the composition and roles of the leading groups and management forums; (d) community conservation education and public awareness regarding values of the NRs, threats to the NRs, and options for mitigating these threats.

26. *Reactive Approach.* Conflict that do arise would be dealt with through the appropriate leading groups and MFs. The MFs would adjudicate potential conflicts at the village level. If resolution is not possible at the village level, the MF can seek advice from the county-level Leading Group, who are charged with overseeing the co-management process.