



China-Agroforestry Programme

World Agroforestry Centre, Beijing Office

In collaboration with
Chinese Academy of Agricultural Sciences

Centre for Mountain Ecosystem Studies

A joint centre of World Agroforestry Centre, and
Kunming Institute of Botany, Chinese Academy of Sciences

Strategic framework and Medium-term plan 2008 - 2012
World Agroforestry Centre
Transforming lives and landscapes through agroforestry science



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List of acronyms and abbreviations

ASEAN	Association of Southeast Asian Nations
CAS	Chinese Academy of Sciences
CAAS	Chinese Academy of Agricultural Sciences
CG	Consultative Group
CGIAR	Consultative Group on International Agricultural Research
CIFOR	Centre for International Forestry Research
CMES	Centre for Mountain Ecosystem Studies
EU	European Union
ICIMOD	International Centre for Integrated Mountain Development
ICRAF	International Centre for Research in Agroforestry
IHTM	Integrated Himalayan Transect Method
IUCN	International Union for the Conservation of Nature
IWMI	International Water Management Institute
KIB	Kunming Institute of Botany
Masl	metres above sea level
MDG	Millennium Development Goals
MMSEA	Montane Mainland Southeast Asia
NPP	net primary productivity
NTFP	non-timber forest products
PPP	public private partnership
PAES	payment for alpine ecosystem services
RECOFTC	Regional Community Forestry Training Centre (RECOFTC)
RMB	Reminbi (of which there are currently 7.52 to the US dollar)
RRI	Rubber Research Institute
SLCP	Sloped Land Conversion Programme
SP	strategic priorities
TAR	Tibet Autonomous Region

\$ in the text refers to the United States' dollar.

Strategic framework

1. Background

World Agroforestry established a China office, or China-Agroforestry Programme, in August 2002. Registered under the Consultative Group on International Agricultural Research (CGIAR), its establishment is based on an agreement with the Chinese Ministry of Agriculture and the Chinese Academy of Agricultural Sciences (CAAS), and its goal is to bring about a transformation from traditional practices to scientific agroforestry. Currently, the programme has both a liaison office in Beijing and Centre for Mountain Ecosystem Studies (CMES), a joint centre of World Agroforestry Centre (ICRAF) and Kunming Institute of Botany (KIB), Chinese Academy of Sciences (CAS), located in Kunming. It has 18 full-time and a number of part-time staff. During its first five years, the China Agroforestry Programme developed partnerships with national and local research institutes, government, and non-government organizations.

The Beijing office endeavours to link science to policy-making processes in natural resource management together with policy-makers, scientists, and other consultative group (CG) centres, The Kunming office translates science into field practices to improve the multifunctional aspects of agriculture together with farmers and technicians. A broad range of programme activities is carried out, and the programme receives support from a diverse group of donors. In the past, the main activities of the China Agroforestry Programme were based on the following three thematic principles.

- *Resources, technology and information* – In the short term, the behaviour of farmers and their communities is unlikely to change without the technology and information necessary to procure the incremental costs and risks of changing land use.
- *Training, education, and facilitation* – In the medium term, without adequate training, government agencies are unlikely to make the transition from being ‘command and control’ regulators to becoming effective service providers; village communities are unlikely to champion

environmental protection without visual evidence of the economic benefits of conservation investments; and the gap in interests between farmers and government agencies is unlikely to close without training, education, and facilitation.

- *Governance, administration, and policy* – In the long term, effective natural resource management on a regional scale is unlikely without increased autonomy for village communities in natural resource management and effective coordination and monitoring from higher levels of government.

The China-Agroforestry team and its partners have developed this strategic framework and medium-term action plan for the period from 2008-2012 by drawing on an informal review of its past activities. The strategic framework and medium-term plan are based on consultations with China Agroforestry Programme's staff and national stakeholders, as well as on interactions with national, regional, and international partners.

2. China's socioecological transformation

China's rapid development is influencing local, regional, and global patterns of land use, resource production, consumption, and conservation. A dense population and a high rate of sustained economic growth have triggered unprecedented changes. Rural China is currently undergoing fundamental socioeconomic and environmental transformations. Market-oriented rural reforms have resulted in a more than five-fold increase in real incomes since 1980. The benefits, however, are uneven and many parts of rural China, particularly mountainous areas in the western region, remain below the World Bank's threshold for extreme poverty. In many villages in and surrounding the China-Agroforestry project areas, annual per capita incomes are less than 1,500 Reminbi (RMB) (\$200) because of a scarcity of resources, and forest, water, and land endowments per capita that are far below the global average.

Western China — the Tibetan-Qinghai Plateau (called the 'roof of the world'); the Yun-Gui Plateau (the watershed of mainland Southeast Asia); and the Kunlun, Himalayan, and Hengduan Mountains — is the source of the headwaters of eleven large Asian river systems. This region provides water, ecosystem services, and

livelihoods to a population of around 150 million people in the mountain region and downstream areas which include mega-cities such as Beijing, Shanghai, Hong Kong, Guangzhou, Hanoi, Ho Chi Minh, Dhaka, and New Delhi. The river basins provide water for 1.5 billion people — a fifth of the world's population — living throughout the coastal areas of China and in other parts of East Asia, Southeast Asia, and South Asia. The Tibetan Plateau and Yunnan Province in Southwest China play crucial ecological roles that have an impact on Asia as a whole.

Mountains are places where adaptation and resilience are hallmarks of the inhabitants and of the landscape. Chinese farmers from diverse ethnic groups manage forests, food security, and biocultural diversity within their own traditional parameters. Mountain ranges have provided trading routes between Southwest China and South Asia across the Himalayas and the Tibetan Plateau for millennia. Trade in forest and mountain 'niche' products and exchange of cultural beliefs, social values, and technical practices were sources of wealth and diversity for cultural landscapes, the prosperity of mountain towns, and cultural heritage sites throughout the region. Today Asian highways linking China with 'Montane Mainland Southeast Asia' (MMSEA) facilitate regionalization in the greater-Mekong sub-region and Pan-Asian region.

In recent decades, population dynamics, economic growth, and climate change have changed rapidly and the capacity of traditional and balanced mechanisms to adapt to environmental changes and maintain competitiveness in the market economy has decreased. Mountain people are marginalized increasingly from market access, public services, and policy-making processes, affecting both livelihoods and mountain ecosystems adversely. They face dire economic poverty, land degradation, desertification, and vulnerability to climate change. These processes will have impacts beyond the mountain areas, because the Tibetan Plateau is a crucial repository for the water supplies of one third of the earth's population and is of regional importance as an ecological mediating zone between western and eastern coastal areas of China, between India and China, as well as between China and mainland Southeast Asian countries. Needless to say, little is known about the impacts of climate change on the Tibetan Plateau and its surroundings.

China-Agroforestry's goal is to ensure the diversity, exchange, and wealth of Western China (including Yunnan, Guizhou, Tibet, Sichuan, Qinghai, Gansu and Xinjiang) are maintained by raising awareness about the unique role this mountain

system plays for its people. WorldAgroforestry will endeavour to safeguard the substantial legacy of the Tibetan Plateau and mountain ecosystems in Western China. This requires an adequate knowledge base and an institutional capacity for research, communication, and influence that highlights and promotes the region's unique potential for mitigation and strengthens adaptation mechanisms.

3. WorldAgroforestry in China

WorldAgroforestry promotes and carries out integrated approaches to agriculture and forestry, livelihoods, and the environment. Its agenda is similar to China's national strategic plans and those of its many Chinese partners: it aims to attain the millennium development goals (MDG) for poverty reduction and promote environmental conservation and economic development. During the last five years, WorldAgroforestry has given technical support for and training in growing multifunctional trees in agricultural systems in two areas of Northwest Yunnan — Baoshan Municipality and Nujiang Prefecture — and has worked with policy makers and researchers from Yunnan and Beijing to scale up its activities. Activities carried out by China-Agroforestry can be clustered into three overarching categories: policy research, technical support and capacity building, and facilitation.

Building on these activities, and in response to China's efforts to achieve a 'Harmonized Society' and socioecological transformation, China-Agroforestry promotes the use of working trees in working landscapes in fragile ecosystems, for example, in a) tree-based montane ecosystems (forest and agroforest vegetation between 300 to 3000 masl); b) alpine ecosystems (grass and woody vegetation above 3000 masl); and c) dryland ecosystems (grass and oasis vegetation at various altitudes) in West China. These important ecosystems are China's most fragile and are subject to overexploitation and land degradation. Multifunctional attributes of agroforestry can transform society and landscapes for economic growth (trade and markets), ecological sustainability (decrease in land degradation and biodiversity loss), social justice (equity and access to social services), and human well-being (poverty and human health). WorldAgroforestry, as an international centre, is well placed to produce relevant state-of-the-art knowledge on the multifunctional role of trees and to match the relevance of agroforestry science to the changing environment and society and make it accessible to decision makers, research professionals, and development

practitioners in China.

China-Agroforestry programme is a co-learning and enabling centre for linkages between science and field practices and between science and policy in the context of mountain ecosystems and societies. We aim to become an open house for knowledge and innovations that can create conservation and development pathways for poor farmers and land managers, so that they can diversify their farms and rangelands, secure livelihoods and ecosystem services, and improve the quality of their lives. The ultimate goal of our applied research is the upscaling and outscaling of results for the benefit of national and international partners. China-Agroforestry will build the capacity of key research institutes through collaborative research and share best practices at the operational, executive, and policy levels. It will promote the introduction of applied research into local university curricula and graduate education, research fellowships, consultancies, and publications.

4. Overall goal and mid-term objectives

To support the vision of ‘Agroforestry Transformation’, the World Agroforestry Centre formulated the following mission statement which encapsulates its overall direction in China.

‘WorldAgroforestry uses science to generate knowledge about the complex role of trees in agricultural systems and their effects on livelihoods and the environment and fosters the use of knowledge to influence decisions and practices that impact the poor.’

The overall goal is to generate knowledge and innovative options that support ecosystem services and livelihoods in the mountain areas of West China which benefit both local people and other populations living downstream in Southeast and South Asia and inland and coastal China.

The mid-term objectives can be stated as follows.

1. *Generate knowledge about mountain ecosystems* focusing on interdisciplinary and participatory research. It is essential to have a proper understanding of environmental change, major drivers of change,

socioeconomic and ecological trends and thresholds, and local and institutional responses to manage these ecosystems. It is also necessary to find conservation and development pathways for different agro-ecological zones to enable mountain people to emerge from the vicious cycle of poverty and degradation.

2. *Conservation and development support* to strengthen agroforestry science by linking knowledge to action, support integrated conservation and development, and improve the capacity to adapt to the changing environment in the coupled human-environment system. Integrated conservation and development options, such as trees in multifunctional landscapes, will be tested on pilot sites in different ecological zones and socioeconomic conditions with the active participation of local communities, land users, and managers.
3. *Support policy research* in order to understand the impact of past and current policies on land use and livelihoods and explore alternative policies and institutional arrangements with the active engagement of government agencies. The communities' existing institutional arrangements for managing common pool natural resources will be evaluated and innovative arrangements tested. This research will involve ex post and ex ante research and community and stakeholder consultations; the analysis of trade-offs between competing interests and promising scenarios with different options; and, finally, will communicate credible, salient, and legitimate knowledge for policy makers and identify good practices that can be upscaled and outscaled.
4. *Develop partnerships* to expand strategic regional and global partnerships and to cooperate with national and regional centres of excellence to contribute to the management of globally important resources through joint research and co-learning, networking, and the exchange of information, knowledge, and experience.

China-Agroforestry will use a 'Knowledge and Innovations to Action' framework to bridge knowledge gaps between science and policy and between science and field practices in the actual mountain environment. Agroforestry science will be integrated into a single system perspective that places research and development linkages within socioecological systems.

5. What WorldAgroforestry does in China?

Within the broad-based goals of WorldAgroforestry, China-Agroforestry Programme's work has three strategic priorities (SP).

- 1) Livelihoods and trade
- 2) tree-based ecosystem services, and
- 3) climate change and adaptation, all of which are interdependent and interlinked.

Rapid economic growth and land-use transitions in China have great impacts, not only on household economics and the environment but also potentially on the regional and global environment. WorldAgroforestry's interpretation of livelihood has multiple scales and facets, encompassing features that are interlinked with environment and trade in forest and agricultural products: virtual water flows at local, regional, and global level included. In this context, WorldAgroforestry's mission is to help communities to develop livelihood options to cope with the challenges of globalization and climate change, to make the most of new technological developments and market opportunities, and to adapt to environmental consequences. China-Agroforestry helps mountain people to identify production 'niches' in mountain ecosystems as well as market 'niches' for 'niche' products, focusing, in particular, on their promotion through certification of products and areas for European and other premium markets.

The different perceptions of tree-land-water links need to be reconciled before we are in a position to develop financing mechanisms for reforestation and conservation. With joining characteristics, tree-based agroforestry systems play dominant roles in land-water interactions, hydrological processes and water cycling, livelihood security, and landscape aesthetics in montane forest ecosystems. China-Agroforestry and its partners are committed to generating knowledge, innovations, and practices through which 'appropriate' selection of trees and species on the basis of 'right trees or species for the right place' in mountain landscapes: such species will have displayed adequate adaptations to environmental changes, in general, and climate changes in particular. We are committed also to seeing that ecosystem services are sustainable and improved for the benefit of mountain people and for the region as a whole. The productivity and sustainability of tree-based landscapes are associated intrinsically with water

resources and climate conditions. A land-use decision is often a water decision. There are two types of land-use activities that have a fundamental impact on livelihoods.

- a) Land use dependent on limitations imposed by water on society, biomass production, and flood protection. This type of land use is 'water-dependent' land use, and many montane agricultural systems are like this.
- b) Forest conservation and alpine rangeland management have significant water impacts, and promote land use which has an impact on rainwater partitioning through soil and vegetation or impacts related to the function of water as a carrier of solutes and silt in the landscape. This type of land use is 'water-impacting' land use.

Thus management of the three resources, biomass, land, and water, should be integrated, and 'agroforestry models' developed to transform both 'water-dependent' and 'water-impacting' land uses. The best results can be obtained by managing both resources simultaneously within a landscape framework. The aim is to develop an understanding of biomass, land, and water interactions and to develop integrated agroforestry science as a means of bridging scales and epistemologies to contribute to the sustainable management and use of biomass, tree cover, land, and water for livelihoods, landscape and ecosystem, disaster risk reduction, human health, and well-being in Southwest China.

Regional challenges and local impacts of climate change on alpine and dryland ecosystems and livelihoods are profound. The Tibetan Plateau constitutes a climatic and environmental buffer for the region and the world, but there is a growing consciousness that environmental change in alpine as well as dryland ecosystems in Western China affects not only local livelihoods but also the downstream inhabitants of watersheds, river basins, and the region beyond because of regional hydrology. Climate change exacerbates mountain poverty, alpine degradation, and risks to and vulnerability of people. Silvi-agropastoral systems in the mountains are considerably more vulnerable to environmental and economic change than those in the plains. Ultimately, changes occurring in the headwaters impact the availability of ecosystem services downstream: in this context, mountain people are guardians of resources and ecosystem services.

WorldAgroforestry will investigate and highlight the consequences of climate change and promote research efforts to support adaptation and mitigation. It will see that these services are managed sustainably and their benefits shared equitably among mountain farmers and herders and that the value of these services receives widespread recognition.

China-Agroforestry’s strategic priorities (SP) of livelihoods and trade, tree-based ecosystem services, and climate change, mitigation, and adaptation (figure 1) jointly uphold its Vision of ‘transforming lives and landscapes’ and Mission to ‘use science to generate knowledge on the complex role of trees in livelihoods and landscapes and foster use of this knowledge to improve decisions and practices impacting the poor’.

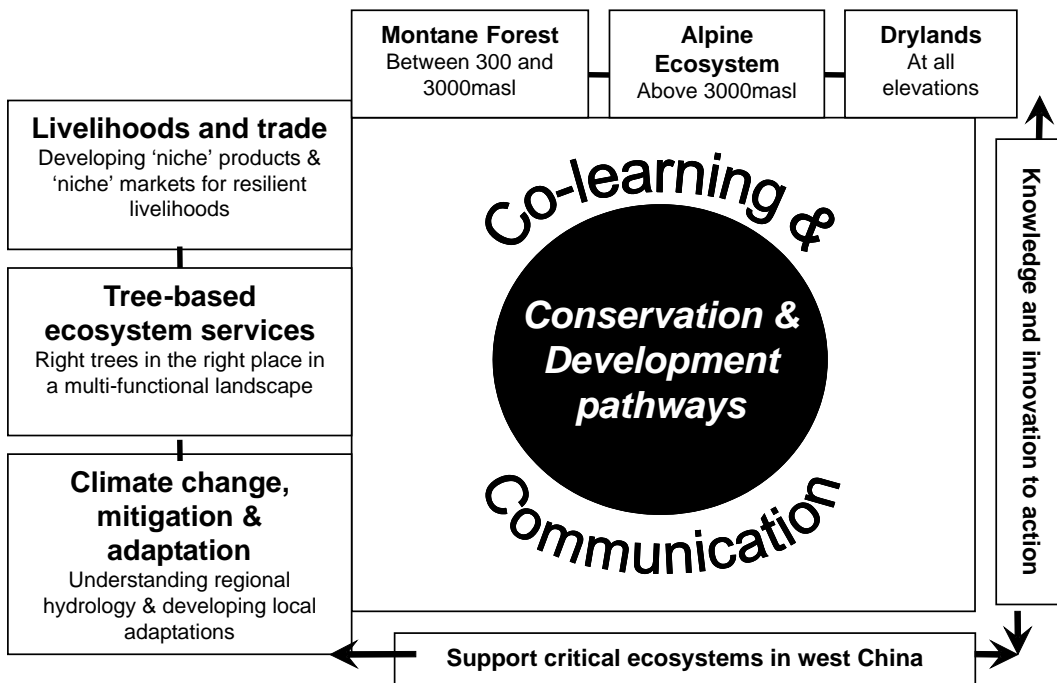


Figure1: China-Agroforestry’s Strategic Framework

6. What is new for China-Agroforestry?

China-Agroforestry's field work, experiences, and analysis of the changing natural and socioeconomic environment during the past five years have prompted it to change its working modalities and reposition itself in the region. It will consolidate existing forestry project sites in Yunnan and, in light of climate change, expand research sites on the Tibetan Plateau into new thematic areas of alpine and dryland ecosystems. These changes are based on the following priorities.

Integrating knowledge systems

The three strategic priorities (SP) discussed above are both complementary and closely interlinked, in many cases dealing with different aspects of a similar physical or social reality through different sources of knowledge. Research teams from complementary disciplines have to work beyond the limits of their own discipline to generate new analytical frameworks, methods, and knowledge about the changing environment and society (that is, a transdisciplinary approach): appropriate expertise is needed all the dimensions of research problems in the context of ecosystem and livelihoods.

An integrated ecosystem approach: from montane forest to alpine and dryland ecosystems

China-Agroforestry will expand its work on montane ecosystems and introduce work on alpine and dryland ecosystems at the headwaters of the major rivers on the Tibetan Plateau. Participatory knowledge development methods, within the context of the strategic priorities and outside, will be assessed and applied with the involvement of key national partners in forest and grassland ecosystems and water-related services —which are the national priorities of Chinese decision-makers and scientists.

Enhanced alignment to regional and global priorities

Interactions with regional partners in the MMSEA and Himalayan region will be increased to improve understanding of the challenges to the region of climatic, environmental, and societal change. China-Agroforestry will support regional networks in academia and civil society and seek the cooperation and support of headquarters and other CG centres in order to increase its core competencies and improve the services it provides to regional and international stakeholders

Why China-Agroforestry? The complementary advantages

At the invitation of both Chinese Academy of Sciences (CAS) and Chinese Academy of Agricultural Sciences (CAAS), China-Agroforestry worked closely with partners to learn about the complexities of the mountain ecosystem: this enabled it to work directly with farmers and local communities in Yunnan during the first five years. China-Agroforestry has gained expertise in the role of trees in multiscale and multifunctional landscapes through successful demonstrations of an integrated approach to agroforestry research for development in Yunnan Province. It has provided the support of its interdisciplinary, policy research team to different levels of decision makers, particularly at CMES in Kunming. To provide a platform for learning and enabling it will facilitate the following initiatives.

- *Linking field practices to science and policies* – Linking research to field action at selected sites by ensuring that research results and lessons learned are relevant to development and policy practices at different levels by synthesizing new insights in scientific knowledge; documenting local knowledge; engaging local farmers, resource managers, and other partners in participatory action research; and promoting intercultural communication between different knowledge systems, among local communities, and among different stakeholders and policy makers — tools will be developed to facilitate linkages between science and field practices and between field practices and policies.
- *Policy dialogue and recommendation* – China-Agroforestry will collaborate closely with decision makers to document good practices in both ‘trade-off’ and ‘win-win’ scenarios and lessons learned in conservation and development; strive to provide credible, useful, and legitimate knowledge for policy development; and promote the availability of credible information to Chinese civil society to foster their abilities to engage responsibly in policy dialogue. China-Agroforestry’s ‘negotiation support’ approach will encourage policy dialogue and good governance by facilitating processes of negotiation among different stakeholders.
- *Public-private partnerships (PPP)* – Economic and institutional incentives for improved practices and behaviour in local communities

and among resource managers for secure (and even increased) ecosystem goods and services (such as community revolving funds and long-term tenure arrangements) will be explored. The potentials of the private sector to operate businesses or support ecosystem services through partnerships with local communities will be explored.

7. Partnership: national ownership and global solidarity

Strengthening national ownership

Partnerships with the Chinese Academy of Sciences (CAS), particularly those with its key research institutions in Yunnan, the Tibet Autonomous Region (TAR), Sichuan, Qinghai, Gansu, and Xinjiang will be strengthened. The Centre for Mountain Ecosystem Studies (CMES) will be assisted through joint programme and project development. China-Agroforestry will seek close collaboration with the Ministry of Agriculture and Chinese Academy of Agricultural Sciences (CAAS) on dryland and rangeland issues. WorldAgroforestry's partnerships with them will create synergies to increase mutual capacities for field research, data analysis, and knowledge synthesis.

Regional collaboration with strategic partners

Collaboration will be fostered with strategic regional partners on transboundary issues such as water, trade and climate change: partners include the International Centre for Integrated Mountain Development (ICIMOD), International Union for the Conservation of Nature (IUCN), Regional Community Forestry Training Centre (RECOFTC), Centre for International Forestry Research (CIFOR), International Water Management Institute (IWMI), and other CG centres who are interested in China, as well as civil society networks in the region.

Global solidarity

China-Agroforestry will participate and contribute to global initiatives at headquarters and other CG centres. World class expertise will be sought from elsewhere if it is not available in the national programme. Long-term partnerships will be promoted with international centres of excellence to acquire the specific knowhow in scientific research and technical practices.

8. Financial strategy

Substantial additional funding will be needed to implement China-Agroforestry's programme strategy. The amount needed is estimated to be more than 1 million \$US by 2012.

Table 1 shows the budget estimate: the breakdown will be as follows.

Core – Originally, core funding accounted for over 50% of China-Agroforestry's budget. This amount decreased steadily to 20% of the total. Core covers mainly the essential functions in China. Ford Foundation has been the principal core donor in the past.

Programme – China-Agroforestry will encourage basket funding from key financial partners who share its strategic objectives, programme activities, and methodologies for dryland (alpine) - rangeland ecosystems and climate change.

Upscaling and outscaling – China-Agroforestry and its strategic partners will identify efficient ways of upscaling and outscaling good practices. Possibilities for funding from the Chinese government will be explored. Public-private partnerships (PPP) are another mechanism we will use for scaling up and generating funding from the private sector.

9. Monitoring and evaluation

During the second five-year action plan, well-established monitoring and evaluation systems will be introduced to measure the success and lessons learned at the programme and activity levels. These systems will focus on the following factors.

- A system to monitor China-Agroforestry's performance in its strategic role as a centre for learning and enabling by focusing on how well the knowledge generated was integrated into its work and disseminated during the action research and development cycle.
- A tool for strategic monitoring to track and measure China-Agroforestry's relevance in terms of scaling up its work at regional and global levels.

- National ownership indicators to track the evolution of contributions by national partners and indicate the extent to which they are taking on ownership of projects that China-Agroforestry has been instrumental in demonstrating in the field, documenting good practices, and scaling up success stories.

Medium-term plan

1. Livelihoods and trade

Goal

The goal is to ensure small-scale mountain farmers benefit from trade that is fair and ecologically friendly and supports livelihood options—part of this includes ensuring that downstream populations enjoy mountain ‘niche’ products and ecosystem services through upstream-downstream linkages and good local and regional governance.

Objectives

The objectives of the programme are as follows.

- Improved understanding of livelihood and land-use dynamics and drivers of transition to market economies regionally and globally
- Assessment of the impacts of livelihood and land-use transition on ecosystems and economies locally and regionally through market chain analysis
- Promotion of fair and ecologically friendly trade and incentives for small-scale farmers and entrepreneurs to derive benefits from agroforestry landscapes and ecosystem services
- Bridging the trade-environment divide through public-private partnerships and sharing of costs and benefits.

Action initiatives

The action areas of this integrated programme fall into three major interlinking themes.

- a) *Livelihood and land-use transition* – During the past thirty years, Chinese farmers have experienced dramatic livelihood and land-use transitions from rural economic reform to allocation of forests and from food productivity to environmental conservation. Farmers are engaging increasingly in off-farm jobs. All transitions have local and global environmental and economic impacts. Managing such transitions can

help to reduce poverty and conserve nature and will be addressed through interdisciplinary research.

- b) *Trade in environmental resources* – (This Includes trade of food (virtual water), carbon, and biodiversity in different land-use systems.) China-Agroforestry’s action-oriented eco-certification project will explore access to ecological and social premium markets for non-timber forest products (NTFP) or ‘niche’ products and measures to ensure fair and ethical trade for the poor.
- c) *Regional resource governance* – Good regional governance can be achieved by improving decision making and the access to information about trade, the environment, and natural resource management on a regional scale. We will work in partnership with regional research institutes and centres to provide policy makers with timely information relevant for policies about sustainable and equitable trade of carbon, forest, and agricultural products. We will also work with local and regional partners to improve access to information, markets, and natural resources to ensure environmental sustainability and social justice.

Problem diagnoses

Global ecological sustainability and local livelihoods and land use are connected through market trade and consumption patterns. China is often seen as an environmentally destructive nation and a rapacious consumer of forest and food products. China, however, could be one of the beneficiaries in carbon trade in global markets because it has the largest tree plantations in the world. Livelihood and land-use transition activities in China have significant impacts on the global environment and economy. We need to facilitate trade that gives adequate protection to the environment, promotes sustainability, and encourages other sociocultural values. Trade causes specialization in production that drives specialization in ecosystems and their associated biodiversity, causing significant decline in local and global biodiversity.

Research in Montane Mainland Southeast Asia (MMSEA) and elsewhere suggests that land-use dynamics and transitions in the tropical uplands should be analyzed in the broader context of political and regional economies. Livelihood and land-use transitions are pervasive on a variety of spatial and temporal scales; they affect ecosystem services, and thus livelihoods, economics, and trade policies significantly. Land use at high altitude on the Tibetan Plateau has great impacts on

ecosystem services downstream in Yunnan and even in Southeast Asia. Building of dams and roads, tourism development, and conservation have local and regional economic and ecological implications. To understand current changes and predict future ones, it is essential to adopt a long-term view of land-use history and ecological forecasting. For these reasons it is necessary to consider the mechanisms of transitions, both environmental and economic, and promote good governance with broad participation and representation of different actors in decision-making processes.

Opportunities

Current or secured projects include the following.

- European Union(EU) : Rural Energy Production from Bio-energy (research project)
- Rubber Research Institute (RRI): China's rural forestry reform (policy research project)

Potential projects include the following.

- Promoting rubber cultivation through agroforestry in multifunctional landscapes in the MMSEA (participatory action research project)
- Trade of timber and non-timber forest products (policy research project)
- Land-use transition and environmental services in Southeast Asia (research project)
- Certification of mountain 'niche' products (action development project)
- Regional environmental governance in the Greater Mekong Sub-region (policy research project)

2. Tree-based ecosystem services

Goal

To promote integrated approaches to the evaluation of ecosystem services and the impacts of land-use dynamics or changes on watershed functions, water resources, biodiversity, carbon stocks, and economic productivity in the mountain ecosystem by local resource managers and people living in tree-based agroforestry landscapes.

Objectives

- To understand the role of tree cover in land-water linkages and hydrological processes in the interface of forest and agriculture at watershed and catchment levels
- To test and synthesize process-based models of ecological and economic trade-offs between ‘goods’ (for subsistence and markets) and ‘services’ (water, carbon stocks, and biodiversity) obtained from multifunctional landscapes with trees (compared to those without)
- To support multiple ways of learning from landscape-scale experiments with onfarm tree biomass cover and institutional and financial incentives to enhance the role of multifunctional agroforestry systems
- To develop decision-making systems for integrated biomass, land, and water management at watershed and landscape level.

Action initiatives

The action areas for this integrated programme have three major interlinking themes.

- a) *Agroforestry landscapes* – Agroforestry makes a significant contribution to the generation of multiple benefits in mountain landscapes: biodiversity conservation, carbon sequestration, and watershed management being among them. China-Agroforestry will document good practices in the traditional agroforestry system (such as *Alnus cardamon*) and test different methods and models for assessing the impacts of agroforestry on hydrological processes and other services on different spatial scales. We will carry out participatory research on the effectiveness and efficiency of tree plantation in various agro-ecological zones— including in the Sloped Land Conversion Programme (SLCP) areas designated by the government and in oasis, desert, and alpine landscapes on the Tibetan Plateau.
- b) *Integrated watershed management* – From our pilot site in Yangliu, Baoshan, we will continue to strengthen the capacities of local partners (particularly the Forestry Bureau) in watershed management, understanding of resource dynamics, development of local livelihoods, and strengthening of good governance at watershed level through our action research and development methods: we will assess the impacts of the state-supported SLCP and natural forest regeneration.

- c) *Domestication of trees* – China has one of the world’s eight plant domestication centres. Yunnan has great potential for using multipurpose timber and non-timber species for livelihoods and ecosystem services. Medicinal plants and other non-timber products from Southwest China enjoy a substantial share of the trade in local and regional markets which flourish on China’s borders with neighbouring countries. Together with local technicians and farmers we will develop technologies and strategies for species’ selection, domestication, multiplication and dissemination, and improved management of agroforestry tree species in the landscape.

Problem diagnoses

In per capita terms, China is one of the poorest countries in the world in terms of water, forest cover, and land. It is, however, one of the countries enjoying forest transition or forest regrowth — there was an increase of more than 4 million hectares in tree cover per year from 2000-2005 — mainly through plantation. China’s SLCP is the largest afforestation programme globally and has more funds than any other programme of its kind. Forest transition in China contributes to global carbon sequestration, biodiversity conservation, and improvement of the local and regional environment. The process and rate of forest transition are mostly determined by a combination of factors such as socioeconomic dynamics, livelihood alternatives, and enforcement of forest laws. China has a long history of managing agroforestry in multi-functional landscapes. Small-scale farmers have innovative ways of incorporating tree species into multifunctional landscapes in contrast to the monocultural plantations driven by state afforestation programmes. Understanding agroforestry transformation and its influence on ecosystems and the economy in China can render valuable contributions to the global environment. China-Agroforestry can contribute to the integrated assessment of environmental services (such as water, biodiversity, and carbon sequestration) associated with different types of tree cover. Given the potential of environmental transformations for slowing soil erosion, improving water quality and quantity, and slowing climate change through carbon sequestration, can decision makers and forest managers accelerate these transitions or, once they have begun, ensure that these transitions continue? By establishing economic incentives and alternative livelihoods that encourage conservation, Chinese policy practices might provide a political and economic impetus for forestation in the region.

WorldAgroforestry has developed a negotiation support approach to reduce conflict in multi-use landscapes. The approach aims to bridge the gaps in perception between stakeholders; increase recognition and respect for multiple knowledge systems; provide quantification of trade-offs between economic and environmental impacts on a landscape scale; and allow for joint analysis of plausible scenarios. Building on the achievements of participatory rural appraisal, we can now add quantitative strengths with the 'toolbox for trade-off analysis'.

Opportunities

Current or secured projects include the following.

- Darwin project on forest ecosystem restoration (action development project)
- Misereor Project: Facilitating community-driven sustainable development (action development project)
- Sino-German Centre: Multipurpose forest (participatory action research project)

Potential projects include the following.

- Trees in multi-use landscapes in Southeast Asia (research project)
- Ecosystem restoration and integrated watershed management in Baoshan, Salween River Watershed (action development project)

3. Climate change and adaptation

Goal

Agropastoralists develop integrated agroforestry with multifunctional trees, shrubs, and grass that can adapt to a changing climate, environment, and society in order to secure alpine and dryland ecosystem services locally and downstream.

Objectives

- To understand alpine (including dryland) ecosystems and livelihood dynamics
- To assess the impacts of climate change on alpine ecosystems and local livelihoods and the potential contributions of alpine and dryland landscapes to climate mitigation and carbon sequestration;
- To support the adaptation of local communities to climate change

- To support the adaptation of local communities to dynamic market economies

Action initiatives

The action areas of this integrated programme have three major interlinking themes.

- a) *Climate impact assessments in alpine and dryland ecosystems* – Timely and efficient monitoring of alpine and dryland ecosystems and changes in them based on scientific and local indicators will provide early warnings about and forecasting on the health of headwater ecosystems in the Tibetan Plateau and Western China. Site assessments will be linked to a greater Himalayan transect in order to understand environmental change, impacts on ecosystem services arising from climate change, and assessment of critical alpine ecosystems such as rangelands and high altitude wetlands.
- b) *Adaptive management* – Options for adapting to climate change in the headwater areas of major river basins will be identified and tested through participatory action research at selected sites and co-management of rangelands and an ecosystem approach to animal and human (herders) health will be developed for adaptation to climate change.
- c) *Rewards for alpine ecosystem services* – Results of applied research into conserving crucial ecosystem services will be packaged and demonstration of integrated management approaches will be applied, scaled up, and communicated to decision makers. Appropriate technologies for conservation and for sharing benefits will be downscaled for pilot sites; and these will include community-based payment for alpine ecosystem services (PAEs), carbon trading, and sharing of access to and benefits from water, biodiversity, and services related to climate change and ecosystems. Adaptation and mitigation and downscaling of technology related to these will be areas of regional and global cooperation for the benefit of downstream populations.

Problem diagnoses

China has one of the largest alpine rangelands in the world, covering about 40% of the country's land area. The Tibetan rangelands, consisting of about 140 million ha on the Tibetan plateau, are the largest in China. There is significant uncertainty

about the effects of global warming on vegetation and animal productivity in alpine rangelands: uncertainties about melting glaciers, movement of the tree line to higher altitudes, desertification, and changing wetlands are also significant. Although alpine rangelands might enjoy increases in net primary productivity (NPP) locally, the greatest confidence is in predicting implications for vegetation production, with less confidence in the implications for vegetation composition, animal production, and adaptation options. Satellite observations suggest that some rangelands might be suffering from processes of degradation due to trends that are warmer and drier than usual. Degraded rangelands already account for over 40% of the grasslands on the Tibetan Plateau. The driving forces are climate warming and overgrazing, as well as the mutual influence of human activities and climate change. Increases in evaporation, reduction in snow cover, and fluctuations in precipitation are key factors contributing to the degradation of dryland ecosystems. In addition, degradation of grasslands through overgrazing has the potential to increase the evapotranspiration level, thereby promoting climate warming and the process of degradation.

The grasslands encompass vast, continuous areas of Western China and can be classified as a) drylands and deserts in arid climates; b) grasslands in semi-arid climates; and c) alpine ecosystems or disjunct areas in the warm temperate zone. Many rangelands in Inner Mongolia, in parts of Gansu, and in Xinjiang are characterized by drought, wind, low annual rainfall, cold temperatures, and a short growing season. Most of the pastoral area on the Tibetan Plateau above 3500 m is semi-arid and, with a severe continental climate, is one of the harshest rangeland environments used for livestock production on earth. Alpine mosaic rangelands are found in high altitude areas of Yunnan and Sichuan.

Several of China's rangeland ecosystems are now recognized as global priority eco-regions for conserving biodiversity, ecohydrological processes, and evolutionary phenomena. Chinese rangeland ecosystems play a very important role in global climate change. Recent studies (Bala et al. 2007) indicate that rangelands might be responsible for a substantial proportion of total terrestrial carbon production and that grassland biomes could constitute a significant sink of global carbon. If poorly managed and if degradation occurs, the alpine rangelands, including peat bogs, can become a carbon source. The vast area and wide distribution of Chinese grasslands suggests that they could have widespread effects on regional climate and global carbon cycles.

Opportunities

Potential projects include the following.

- Oasis and dryland restoration in Xinjiang, Northwest China (participatory action)
- Pastoralist adaptation to climate change on the Tibetan Plateau (action and development)
- Greater Himalayan transect for understanding environmental and climate changes (regional research project)

Linking with the MMSEA and SE Asia

Introduction

The Montane Mainland Southeast Asia (MMSEA) eco-region covers areas between 300 to 3000 masl lying within the basins of the Yangtze, Salween, Irrawaddy, Mekong, Black, Red, and Pearl Rivers. This region constitutes approximately half of the land area of Cambodia, Laos, Myanmar, Thailand, Vietnam, and the Yunnan Province of China (figure 2). Nation states have a strong interest in the political and environmental security of the 'roof' of Southwest China and Mainland Southeast Asia. During the past two decades, the Yangtze, Red, Mekong, Tonle Sap, and Chao Phaya rivers have flooded frequently, causing some of the worst devastation in recorded history. In addition, development of massive tourism hubs and establishment of infrastructure for communication and transportation along the Mekong and other river systems have great impacts on land use, livelihoods, and ecosystem services. These developments, to a certain extent, encourage mountain communities to take advantage of mountain ecologies to produce and process specialized or 'niche' products for sale in lowland markets, as well as to develop joint management plans, eco-tourism and/or on-farm tourism, and benefit-sharing schemes for good land-use practices, biodiversity, and watershed conservation. At the same time, some mountain communities have been drawing on their traditional,



Figure 2: The Montane Mainland Southeast Asian (MMSEA) eco-region is comprised of those areas between 300 to 3000 masl, lying within the basins of the Yangtze, Salween, Irrawaddy, Mekong, Black, Red, and Pearl Rivers. This region covers approximately half of the land area of Cambodia, Laos, Myanmar, Thailand, Vietnam, and Yunnan Province of China.

ecological knowledge and their natural and cultural resources to enter and compete in the lowland and urban markets through technology innovations and revived social institutions, and this demonstrates their dynamism, their resilience, and their capability to adapt to change in response to globalization and environmental and climate changes.

Depending upon the perspective, mountain watersheds have two different faces: negative and positive. The negative face or hazards includes floods, soil erosion, mudflows, and landslides. The positive face is that water from the mountains provides environmental services (water, biodiversity, climate modulation, and carbon storage) and useful products (food, medicine, non-timber forest products, and rock- building materials) locally and downstream. Mountain watersheds also represent pathways for migration and trade. Therefore, the key feature of mountain watersheds is dynamic multifunctionality, which places the multiple functions of mountain ecosystems and the people who live in them in a broad, regional setting. Historically upland-lowland linkages were shaped by political ideologies centred on lowland urban areas and mountain areas were perceived as sources of strategic resources for lowland development.

The China-Agroforestry research team will apply political ecology and political economy approaches for analyzing the impacts of development discourse on livelihood and land-use transition and the consequences to environmental services and multifunctional landscapes. There is a wide range and diversity of research issues related to upland watersheds in the Mekong region, and these vary in scope and scale from upland cultivation systems, floods and forest hydrology, land and property tenure arrangements, ethnic community rights to resources, and discrimination against ethnic groups.. The four potential topics are relevant to mountain watershed discourse.

Key issues

1. Land-use transition and hydrological processes
MMSEA has experienced widespread livelihood and land-use transition. Agricultural expansion and intensification, cross-border trade, development of infrastructure, migration and urbanization, and forest restoration have taken place as a result of changing government policies and regional integration. Land-use transitions impact biotic diversity worldwide directly; contribute to local and

regional climate change as well as to global climate warming; are the primary source of soil degradation; and, by altering ecosystem services, affect the ability of biological systems and hydrological processes to supply the water and other natural resources that people need. Past research has revealed a strong link between watershed deterioration and land-cover changes over time. Oversimplification of the relationship between land use and water resources, however, is predominant in land-use planning and watershed conservation. Discussions with institutions and individuals revealed a lack of data and scientific understanding, especially of the spatial and temporal dynamics, land use, and hydrological processes in the Upper Mekong and Salween watersheds.

2. Regional governance

Lessons learned from development pathways in the region indicate that most states in MMSEA have made transitions from a command control to a market economy and from centralized planning to decentralized decision making, requiring new laws, policies, and institutional arrangements. Good governance for conflict management among different stakeholders— and this includes between upland and lowland communities over resource rights— and a guarantee of equity in the distribution of land, forest, and water resources are essential for sustainable development in the region. One particular example of reform and transition is the introduction of a process in which village committees have the responsibility of managing local natural resources and protecting local environments in China. The legal framework has laid the foundation for the China-Agroforestry team to examine the issues from four major aspects – decentralization process, political participation, customary institutions, and livelihood opportunities, as well as the interrelationships among these elements in watersheds and river basins in the MMSEA.

3. Marketing mountain ‘niche’ products

Livelihood and land practices in mountain watersheds are driven by market demands and access. People are easily persuaded to replace traditional subsistence crops with cash crops such as rubber, tea, and sugar cane that command better prices in the market. Smallholders face competition from lowland and commercial-scale operations that have the advantage of better infrastructure than mountain areas and can take advantage of the emerging free trade in agricultural products. Such changes have also created off-farm employment for mountain farmers and marketing opportunities for mountain ‘niche’ products and eco-tourism potentials in the mountains. The ‘China Factor’ not only means the emerging big consumers in

global markets but also large-scale producers of 'niche' products for premium markets regionally and globally. Yunnan, for example, exports large amounts of medicinal plants and mushrooms to international markets and provides cut flowers and off-season vegetables to domestic markets.

Potential actions

1. Joint seminars
 - a) Support to the forthcoming 5th MMSEA Conference
 - b) Support for regional networking and workshops
2. Joint research projects
 - a) Land-use transition and ecosystem services in mainland and Pacific Southeast Asia
 - b) Promoting rubber agroforestry in Southeast Asia
 - c) Sustainable biofuel feedstock production in the Association of Southeast Asian Nations (ASEAN) and China

Linking the Himalayan region with South Asia, coping with global change and climatic uncertainty

Introduction

The greater Himalayan region, which includes the inner and South Asian mountains, contains the most extensive and rugged high altitude areas on Earth and the most extensive areas covered by glaciers and permafrost outside high latitudes. Rapid reduction in glaciers and snow cover has been reported in parts of the region. Glacial change is not only one of the indicators of the rate of climate change but also has serious implications for water resources, alpine and dryland ecosystems, biodiversity, and local livelihoods and health.

Key issues

1. Water- a key resource from the Tibetan Plateau

Water is life to people and ecosystems. Asia has the densest population in the world, widespread poverty, and increasing demands for water because of increased food production, rapid economic growth, and deteriorating ecosystems. The water resources of the Himalayas are extremely sensitive to changes in climate, and there is a great dependency on these resources from a very large, and often vulnerable, population. It is extremely important that environmental changes affecting the water resources are carefully monitored and understood; that effects and impacts from these changes are mitigated; and that adaptation processes are supported.

2. Environmental change and its consequences for ecosystem services

Climate change, land-use change, and population dynamics are the key drivers of environmental and socioeconomic transformation on the Tibetan Plateau. These drivers have significant impacts on local livelihoods and the vulnerabilities of people and places in alpine and dryland ecosystems. During the last few decades, human activities have dramatically altered natural ecosystems as a result of increasing demands for food, fresh water, energy, and other resources. Activities such as clearance of vegetation, over-grazing, infrastructure development, mining,

and increasing human migration have serious impacts on ecosystems. Research shows that environmental and land-use change have significant impacts on ecosystems, livelihoods, and human health locally, downstream, and even globally. Social and environmental changes have been rapid in West China, particularly on the Tibetan Plateau, during the past 50 years and have accelerated in the past 10. Such changes have both positive (improved infrastructure and social services) and negative impacts (resource depletion, pollution, natural hazards, and diseases) on the society and ecosystem.

3. Climate change: its risks and opportunities

China and India are becoming part of the economic powerhouse of the world and their demands for water, land, and other natural resources have increased accordingly. With climate warming the resource base is changing; the quality and quantity of water are being altered; timing and reliability of rainfall patterns are shifting; and land-use practices and productivity are changing. The Tibetan Plateau and its surroundings have global significance in terms of carbon storage in the soils, wetlands, and peat bogs of rangeland and alpine areas. Global warming is currently not only affecting the water balance and regional hydrology but also the carbon cycle and carbon storage in the Himalayan region. Given the significant role of the Himalayan region, it is necessary to conduct investigations into the total hydrological system and carbon dynamics and to monitor changes in the alpine and dryland systems. Research networks are vital for understanding water towers, land-use dynamics, ecosystems, and livelihood activities in the context of climate change and local people's learning networks are needed to help them adapt to climate change. The mutual commitment of the leaders of China and India on climate change, mitigation, and adaptation serves as a regional forum for dialogue and cooperation in improved management of land, carbon, water resources, and their services. By fostering regional collaboration on climate issues, sustainable economic development will be triggered, benefiting the region as a whole.

Potential actions

1. A transect for learning about vulnerability and adaptation in the Greater Himalayas

Himalayan transects can become an effective platform for studies of environmental and climate change. Four transects along the major climatic and socioecological gradients of precipitation and land uses in the Himalayas have been established for

research into how the availability of water contributes to land-use practices and production and how land use, water availability, and local economies are influenced by climate change. As part of a multiscale socioecological characterization methodology, the Integrated Himalayan Transect Method (IHTM) will generate both qualitative and quantitative data and bridge gaps between disciplines, scales, and socioecological zones. The method is illustrated by using meteorological stations, literature, remote sensing, and rapid field assessments. 'Himalayan climatic and socioecological diagrams' will facilitate easy presentation of information collected about the variation and complexity of the Himalayan environment and its adaptation to climate change. Additionally, various quantified land-use and ecological characteristics will be used to scale up data from the level of the belt transect (50km width) to large climatic zones in the region. For example, the Dhaka-Almaty transect covers all the climatic zones of the world and is hence a perfect laboratory (figure 3).

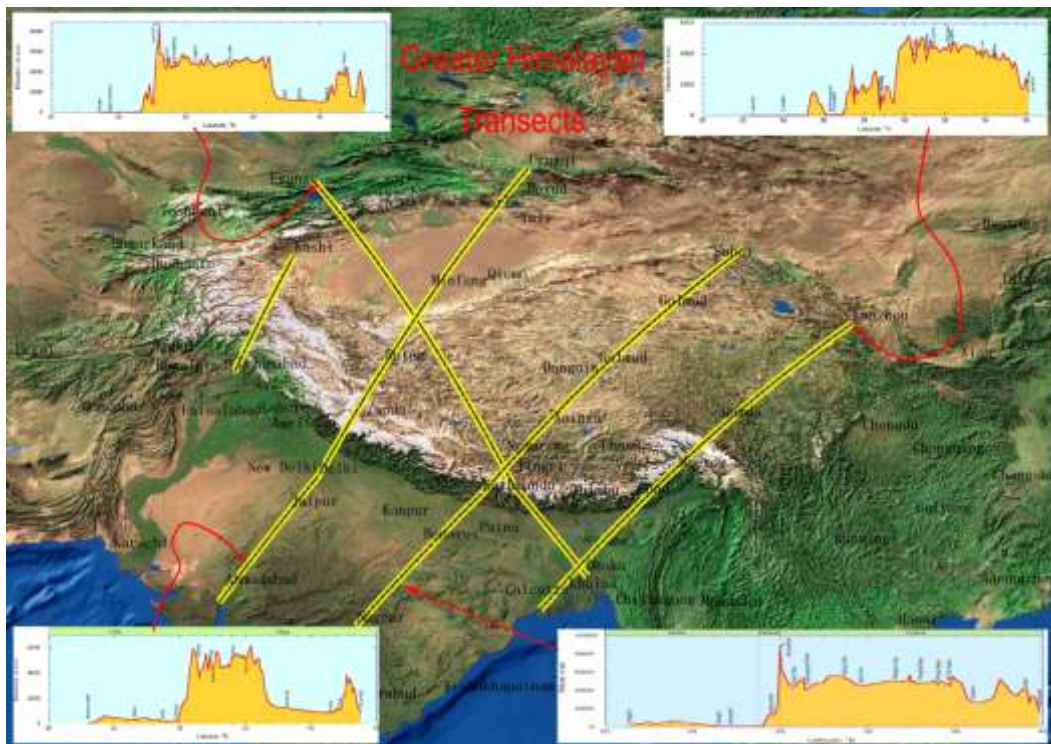


Figure 3: The proposed study transect areas (arid zone of the Urumqi-Delhi transect, transitional zone of Golmul-Kathmandu, humid area of the Calcutta-Lanzhou transect, and cross transect of Almaty-Dhaka) in the Greater Himalayan Region

2. Sino-Indian climate change dialogue on mitigation and adaptation

China and India are promoting sustainable growth, improving resource efficiency, and reducing greenhouse gas emissions through scientific and technological innovations. Together, they have a population of more than 2.5 billion people to sustain and huge investments in agriculture are necessary to improve food production and cope with climate change. In June 2007, during the G8 meeting in Heiligendamm, Germany, Chinese President, Hu Jintao, and Indian Prime Minister, Man Mohan Singh agreed to improve cooperation on climate change. This proposed research and development project aims to facilitate this commitment with tangible outputs for poor farmers in India and China. The project will carry out scoping studies on the most promising options for mitigation of climate change and adaptation to it, and pilot projects exploring and implementing new project methodologies and carbon finance mechanisms will be established.

Linking with WorldAgroforestry's global projects

Within the framework of agroforestry linkages with livelihoods, landscape, environment, and institutions at local, national, and regional levels, China-Agroforestry has identified key contributions to nine interrelated research priorities to generate global public goods. As China becomes a global player, China-Agroforestry will explore potential linkages between Chinese institutions and African institutions for joint research activities, exchange visits, and training programmes.

China-Agroforestry's contributions to nine strategic research priorities (SRPs) are briefly described in the following passage.

SRP1 - Multi-scale assessment of agroforestry opportunities and impacts

Inventory traditional and innovative agroforestry practices and its related ecosystem services in Chinese landscapes.

SRP2 - Tree genetic resources and domestication

Facilitate cooperation between ICRAF tree gene germplasm and China's National Gene Bank (for wild plant resources) located within Kunming Institute of Botany, exchange of genetic materials, capacity building, and database development, assessment of tree species that have potential to contribute to agroforestry landscape in China and worldwide.

SRP3 - Tree-based diversification and intensification of smallholder agriculture

Document salient examples of tree-based diversification and intensification such as agroforestry, livestock and NTFPs development.

SRP4 - Tree product markets

Conduct market chain analysis, good agricultural practice standard and organic certifications for tree products such as walnut and other non-timber forest products.

SRP5 – Trade-offs and synergies in multifunctional landscapes

Actively test and develop methods and tools to establish multifunctional agroforestry landscapes at watershed and river basin level from the Tibetan Plateau to tropical, from alpine to dryland, and from forestry to tree-covered rangeland ecosystems.

SRP6 - Tree-based rehabilitation of degraded lands

Develop a pilot site for an Oasis dryland development project in the Himalayan region, particularly in Xinjiang, northwest China.

SRP7 - Agroforestry for climate change adaptation and mitigation

Assess impacts of climate change, synthesize current knowledge, develop mechanisms for both mitigation and adaptation to climate change in montane, alpine, and dryland ecosystems of West China.

SRP8 - Policy options and incentive mechanisms to strengthen agroforestry

Evaluate ecosystem services at watershed and river basin levels, focused on water, carbon, and biodiversity; carry out research to support development of policy options; and build public awareness of global significance about the Tibetan Plateau and its relevant ecosystem services...

SRP9 - Strengthen agroforestry institutions and learning tools to link knowledge to action

Support research and education institutions in agroforestry science in China and contribute good practices worldwide.



China-Agroforestry Programme



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