

# Integrated Ecosystem Assessment for the Coordination of Bio-diversity Conservation and Economic Development in the Upstream Region of Great Rivers, Northwest Yunnan, China

## 1 Introduction

The upstream region of Northwest Yunnan is located in latitudes of 25°30′ - 29°15′ N, and longitudes of 98°05′ - 101°15′, with a total land area of 69 000 km<sup>2</sup>, supporting a population of 3.09 million in 1998. Sitting on the southern end of Mount Himalayas, this region is a transit field between the Tibetan Plateau and the Yunnan Plateau. The geomorphology of this region, which is the major portion of the famous Hengduan Mountains, is characterised with high mountains, deep gorges and huge rivers developed with north to south strike. Within a distance of 200 km, the elevation varies from 6674 m at the highest point to the 720 m at the lowest point, with the drop of level of more than 6000 m, which makes the region the unique high-mountain-deep-gorge area.

In the region of such extreme fluctuations, the high mountains and deep river valleys form the longitudinal passage and latitudinal gathering point for flora and fauna, which makes the region one of the most significant resources of bio-diversity and biological landscapes on the Earth, the cutting point of three of the four bio- and geo- interfaces (i.e. the first three of the humid-temporal, arid, humid-hot and polar interfaces), one of the three origins and differentiation sites of species in China, one of the best preserved primary ecological systems of China and one of the symbolic areas of the temporal ecological systems in the world.

This region forms the upstream portions of the Irrawaddy, the Nu-Salween, the Lancang-Mekong and the Yangtze and has a fragile biological environment. Despite of the rich bio-diversity, the majority of the species have relatively small stocks, many of which are close to distinction. Over 60% of the land is located in medium to high mountain areas, featured with high mountains and steep slopes, low temperature, thin and infertile soil, and slow vegetation recovery and evolution process. Around 15% of the land is dry-hot river valleys, with dry and hot climate, infertile soil, low vegetation coverage and hard vegetation recovery. In river valleys and low to medium mountain areas, the rapidly growing population, long development history and intensive development levels, the extensive resource exploitation and irrational development strategy lead to degraded vegetation cover, decreased bio-diversity, and speeded deterioration of ecological functions. The deterioration of the ecological environment poses direct impacts on the security of 500 million people in downstream areas with a land area of approximate 3 million km<sup>2</sup> in China, Thailand, Burma, Vietnam, Laos and Cambodia.

Of the 15 cities and counties in this region, there are 12 poverty counties; and 75 of the 165 townships are listed as the key poverty alleviation townships. Throughout the project area there are currently 495 000 people, or 16% of the total population, who are short of enough food and clothes. The poverty is not only limited to the poor income and food

supply of the population, but also in terms of the serious lagging behind of social development. There are widespread difficulties in meeting the basic demand of local villagers in terms of drinking water, daily fuels, hygiene and medical services, as well as education demand for their children.

At present, 78% of the households and 79% of the population depend on firewood for daily fuel consumption. The consequent loss of forest is as high as 129 200 ha. On average, 7.34 million m<sup>3</sup> of timber is consumed each year, of which 4.13 m<sup>3</sup> is firewood. Without an urgent substitute fuel energy project for the local people, the primary forest as well as its significant ecological functions will disappear completely in fifty years' time.

## **2 Urgency**

### **2.2 Assessment on the function and ability of nature reserves**

There are 18 nature reserves in the project area, with a total area of 711248 ha, accounting for 10.61% of the territory of NW Yunnan, forming an infant network of nature protection, which contributes to the eco-system conservation to a certain extent. To assess the role that the existing nature reserves play in NW Yunnan will provide reference to the newly planned nature reserves and the establishment of the nature reserve systems.

### **2.3 Assessment on the history, present features and changes of plateau lakes and wetland ecosystems**

The project area is rich in lakes and wetland ecosystems. In these lakes there are some precious endangered birds, fish and flora gene resources. Plateau wetlands have many different ecological functions, they are usually key habitats for some lowly ranked flora. In this sense, they are called "kidneys of the Earth", of which some ecological functions haven't been fully understood. Due to the disturbances such as the surging population, wide-spread of reclamation and water pollution, and the purposed utilisation of species, the area of plateau lakes and wetland systems is decreasing and disappearing, with the species and quantity of flora and fauna decreasing sharply. Therefore, it is urgent to establish an assessment mechanism and institution for the purpose of effective conservation.

### **2.4 Assessment on de-reclamation and reforestation**

Due to the fact that the inadequate arable land resources resulting from the high mountain steep slope landform in the project area, the demand of the increasing population is hard to meet. As a consequence, reclamation of steep slopes is expanding, leading to widespread soil and water loss, and serious destruction of the environment, which further affects the effective conservation of bio-diversity.

Aiming at the ecological security of the middle and downstream regions of great rivers, Chinese government started its effort to implement the project of source area protection of

great rivers in the upstream areas in 1998, one well-known example of which is the Yangtze wind screen protection project. In the upper Yangtze, primary forest protection and de-reclamation/reforestation projects for this purpose require that slopes steeper than 25° to be de-reclaimed and reforested. Many issues arise from the implementation of such a policy: how to de-reclaim, what to recover, how to meet the demand of food of farmers, sustainability of the local development after the cancellation of the de-reclamation subsidies, and communication of commercial goods after the agricultural structure adjustment, etc. The nature of these issues is the integrated assessment of the ecological benefit in the project areas. Only by accurately assessing the comprehensive impact on food, economic and ecological interests of the fresh and old industries, the project can be implemented and the overall goals of environmental protection, poverty alleviation and economic growth be achieved.

## 2.5 Assessment on the impact of transportation infrastructure construction on the environment

To improve the transportation facility should be treated as the foundation to promote regional socio-economic development. In the project area, transportation infrastructure construction is the current focus of the local efforts. However, as a result of the high mountains and unstable steep slopes, highway construction and maintenance is costly, and will cause vegetation destruction and the blocking of ecological corridor, in addition to the frequent landslides and serious soil and water loss which will bring damage to farmland, village settlements and buildings. In this sense, it is necessary to comprehensively assess the benefit of transportation infrastructure construction and environmental impact, to provide reference for decision makers.

## 6 Assessment Capabilities

### 6.1 Implementing agencies

Partners include the *Office of Conservation and Development Action Plan for NW Yunnan* (under the dual leadership and national and provincial Planning Committees), which has regional affiliated offices in the planning committees of the four prefectures and 15 counties and cities, and established a cooperation and coordination network with related national ministries, Yunnan provincial government and academic institutions. Information needed for the proposed project can be obtained through such wide scale cooperations and the research results be tested and applied via this network.

The following maps images of the project area have been made and can be utilised in the assessment:

Electronic maps of 1: 250 000 (showing the township administrative boundaries)

Satellite images of soil erosion, vegetation types

Maps of infrastructure Planning

Planning maps of nature reserves

Electronic maps of 1: 50 000 in key areas

6.2 In the last 15 years, members of the proposed project have undertaken a variety of studies relevant to the key ecological processes. The following are part of them:

- Professor He Daming

1999-2000 *The Yunnan Great Rivers Projects*

funded by Yunnan provincial government and The Nature Conservancy; focuses on the construction of national park and nature reserve system, infrastructure construction, land use and farmland protection, rural fuels, construction of nature reserves and poverty alleviation, harnessing of soil and water loss, landslides and debris flows, and etc.

1998-9 *National park system and human settlements in Northwest Yunnan*

funded by Yunnan provincial government, focuses on rural economy and poverty alleviation, human-nature interaction, land use, indigenous culture, mountain disasters, investigation on soil and land loss.

1997-2000 *Multi-objective development and co-operative management of water resources in international rivers*

Key project in the 9<sup>th</sup> FYP supported by China National Natural Science Foundation and Yunnan Provincial Natural Science Foundation.

1997 *Sustainable social, economic and environmental development in river basins: a comparison between the Lancang and the TVA*

Supported by the Science Institute of the USA and the University of Memphis.

1996 *Investigation on the ecological environment in Northwest Yunnan*

Supported by the Sino-US International Scientific Cooperation Project

1995-6 *Rural poverty alleviation and human resource development in Yunnan, China: a case study of Northwest Yunnan*

Funded by the World Bank.

1993-5 *Integrated development and cooperative management in the Lancang River Basin*

Funded by China National Natural Science Foundation.

1993-6 *Study on the complex human-nature relationship in the high mountain deep gorges frigid area in Northwest Yunnan*

Funded by China National Natural Science Foundation.

1990-2 *Socio-economic investigation, assessment and sustainable development of rural social economies of Dulong nationality*

funded by China National Social Science Foundation.

1987-91 *Investigation on resource and environment in the Dulong River (upstream of the Irrawaddy) Basin*

funded by China National Natural Sciences Foundation. Over 20 ore spots and 89 new plant species were discovered.

- Professor Ou Xiaokun
- Dr. Gan Shu

## **7 Policy influence and implementation influence**

Policy influence of the proposed project can be seen in the following aspects.

### 7.1 Influence on international development agendas.

The project area is the upper part of several important international river basins in Southeast Asia, as well as one area with the richest bio-diversity in the world. Only with integrated ecological assessment in the Northwest Yunnan in accordance with international standard via multidisciplinary and multi-sectoral co-operation, the co-operation between academic institutions and the decision-making government agencies in particular, it is possible for the significance of the bio-diversity conservation in the project area be recognised by the international society. This will also contribute to a wider awareness of the impact of ecological construction in upstream regions of international rivers on both international and regional development, which will enforce the transition of regional planning strategies on the protection and maintenance of the tropical and sub-tropical eco-regions.

### 7.2 Influence on national development policy and the investment on the restoration and maintenance of ecosystems

The project area is one of the important regions for exported timber, as well as the potential base of mineral resource exploitation. Through the integrated ecological assessment, the significance of ecological maintenance of the project area at both national and international scale will be fully realised by the national strategic planning agencies, and impose positive impact on the making and implementation of the ongoing national primary forest preservation project, the Jingsha River wind screen project, de-reclamation and forest recovery project, Lanpin lead-zinc mining, nature reserve planning and construction, infrastructure construction, hydro cascade construction, Yunnan Provincial Agenda 21<sup>st</sup> and the Yunnan Great Rivers Project. In the meantime, The assessment will provide policy references for the investment direction change for regional economic construction, and improve the investment on regional environmental protection and ecological construction.

### 7.3 Influence on local development in project area

Being in a long-standing poverty stricken area, local governments and farmers in the project area are bound to take some short term development actions driven by the willing to alleviate poverty and provide enough food for the population. Through this assessment, it is possible to provide the local governments and the local communities with appropriate development models and ideas, and to enforce the transition for the local governments from the current pure economic benefit strategy to one that aims to improve the ecological function of the system and the overall socio-economic development.

### **Implementing influence:**

The ecological assessment on the impacts of soil erosion, de-reclamation of slope lands, food security, rural fuel substitution and ecological landscape evolution on local ecological functions, the positive and negative impacts of infrastructure construction on regional landscapes and bio-diversity will provide guidance to the implementation of the regional conservation and development projects and helps to improve the operation ability of these projects.

## **8 Capacity building**

The assessment results will help to strength the participating capacity of the local communities in local economic development and ecosystem protection, and to improve the management, guidance and enforcement capacity of decision-makers at different levels, as well as the integrated assessment, co-ordination and co-operation capacity in the study of complex systems.

## **9 Information bases**

- 9.1 1998-2000 With the cooperation of Yunnan Provincial government and The Nature Conservancy, USA, a team composed of more than 200 domestic and foreign experts, government officials and over 20 academic institutions undertook an action plan of *The Yunnan Great Rivers Project* including investigation lasting over 18 months. The framework of the project encompasses four fundamental steps: biodiversity, cultural diversity, eco-regional planning and economic development, which covers more than 20 sub-study (?) including flora and fauna, natural forest protection, nature reserve construction, legal construction, infrastructure construction, tourism development, flower planting, agriculture, mining industry, water resources and hydropower, etc. In the process, large amount of social, economic and eco-environmental data were collected for respective databases.
- 9.2 There are large amount of readily available relevant research results to refer to. Some members of the project team undertook over 20 research projects on natural resource and environmental surveys and investigations, detailed surveys of land resources and land use planning, sustainable development of agricultural cultivation system in gorges and river valleys, strategies of regional economic development, harnessing of soil and water loss, investigations on rural economy, wetland changes investigation, bio-diversity investigation, rural poverty alleviation and human resource development.