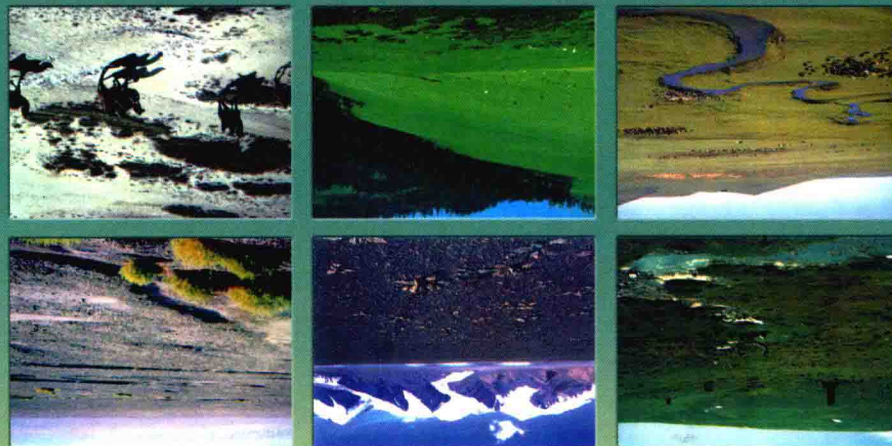


Key Project of International Cooperation for Science and Technology,  
Ministry of Science and Technology of the People's Republic of China  
Sub-Global Assessments of Millennium Ecosystem Assessment



# Integrated Ecosystem Assessment of Western China

Edited by

LIU Jiuyan YUE Tianxiang JU Hongbo WANG Qiao LI Xiubin



China Meteorological Press

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**LIU Jiyuan YUE Tianxiang JU Hongbo WANG Qiao LI Xiubin**

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Edited by

LIU Jiuyan YUE Tianxiang JU Hongbo WANG Qiao LI Xiubin

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# Integrated Ecosystem Assessment of Western China

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## 1. Introduction

Western Development is an important strategy of China Government. The ecological environment in the western region of China is very fragile, and any improper human activity or resource utilization will lead to irrecoverable ecological degradation. Therefore, the integrated ecosystem assessment in the western region of China is of great significance to the Western Development Strategy. This project, Integrated Ecosystem Assessment of Western China (MAWEC), will provide very important scientific foundations for both the central and local governments to make decisions on ecological construction, thus assuring the successful implementation of the Western Development Strategy. Meanwhile, MAWEC as one of the MA sub-global assessments is contributing to strengthen capability in boosting the development of the ecological science, interaction between different subjects, and combination between scientific research and practice, and pushing forward international cooperation in the relevant fields.

### 1.1. *Millennium Ecosystem Assessment*

Millennium Ecosystem Assessment (MA) is a four-year international cooperation project. The purpose of the project is to meet the demands of the decision makers for scientific information about interrelation between ecosystem services and human well-being (<http://www.millenniumassessment.org>). UN Secretary-General Kofi Anan announced the commencement of MA in June 2001, and the major assessment reports were and will be published successively in 2003-2005.

MA focuses on the linkages between ecosystems and human well-being and, in particular, on “ecosystem services.” In terms of MA, an ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit. The MA deals with the full range of ecosystems—from those relatively undisturbed, such as natural forests, to landscapes with mixed patterns of human use, to ecosystems intensively managed and modified by humans, such as agricultural land and urban areas. Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling (Figure 1.1). The human species, while buffered against environmental changes by culture and technology, is ultimately fully dependent on the flow of ecosystem services.

On the one hand, the impact of ecosystem degradation on human well-being and economic development is increasing sharply with each passing day, and on the other hand, proper ecosystem control for eliminating poverty and achieving sustainable development provides people with hard-won opportunities. Right due to full understanding of this situation, UN Secretary-General Kofi Anan delivered the following speech at the UN general meeting in April 2000 (Millennium Ecosystem Assessment, 2003): Without sufficient scientific information, we can’t develop any sound environment policy. Although we’ve got a great deal of data and information in some fields, our knowledge is still insufficient. Particularly, up to now, we haven’t carried out any global ecosystem assessment. MA is right the important international cooperation program that aims to describe the status of the Earth’s health through international cooperation.

#### 1.1.1. **Connotation of MA**

At present, people need ecosystem services a great deal, so it has become an important principle to consider the relations between the ecosystem services. For instance, a state can increase supply of grains by felling forests and expanding farmlands. As a result, other services of ecosystems are weakened. In the

forthcoming several decades, the weakened ecosystem services may be of the same importance as or more important than food provision. It is estimated that the world population will increase by over three billion and the world economy will double in 2050, which means the demands for and consumption of biological resources will soar drastically, and increasingly affect ecosystems and their services.

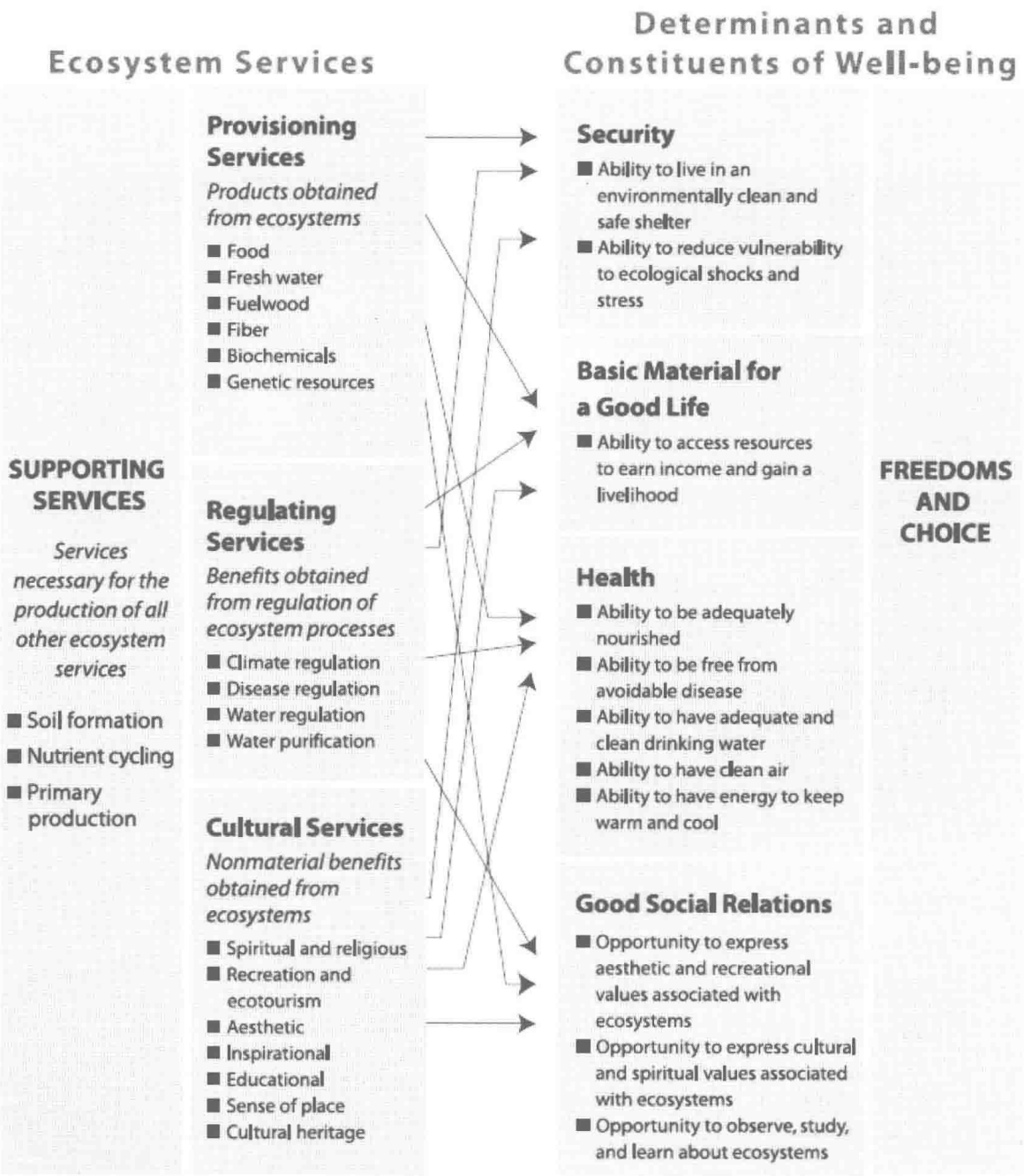


Figure 1.1. Ecosystem services and their links to human well-being

Ecosystems degrade with each passing day, while people’s demands for their services constantly increase. This seriously impacts on the sustainable development people expect. Human well-being is affected by not only the gap between demand for and supply of ecosystem services, but also the rising fragility of individuals, communities and states. Highly productive ecosystems and their services can assure the security of people. Well managed ecosystems can reduce risks and fragility, while poorly managed ecosystem may lead to flood, aridity, poor grain yield, or diseases, thus further increasing risks and fragility.

In recent decades, the world’s ecosystems have changed a great deal, and complicated changes have taken place in the social system as well. Meanwhile, the changes of the social system have result in both



pressure on ecosystems and opportunities of relieving the pressure. As the force of a more complicated system combination (containing regional administrations, transnational companies, UN and non-governmental organizations) increases constantly, the force of individual states decreases accordingly. The colonies of various interests have participated in the decision-making processes more actively. Ecosystems can be affected by the decisions of a range of departments, so it becomes an increasingly severe challenge to provide the decision-makers with information about ecosystems. Meanwhile, new systems provide unprecedented opportunities for information about ecosystems to expand quickly. In order to improve control of ecosystems and achieve the purpose of boosting human well-being, it is necessary to develop new system and policy combination, and change the ownership of resources and the right to use them. On the background of fast social development today, it hasn't been more possible to obtain the above-mentioned conditions than any time before.

### 1.1.2. Conceptual framework of MA

The conceptual framework for the MA assumes that people are integral parts of ecosystems and that a dynamic interaction exists between them and other parts of ecosystems, with the changing human condition driving, both directly and indirectly, changes in ecosystems and thereby causing changes in human well-being (Figure 1.2). At the same time, social, economic, and cultural factors unrelated to ecosystems alter the human condition, and many natural forces influence ecosystems. Although the MA emphasizes the linkages between ecosystems and human well-being, it recognizes that the actions people take that influence ecosystems result not just from concern about human well-being but also from considerations of the intrinsic value of species and ecosystems. Intrinsic value is the value of something in and for itself, irrespective of its utility for someone else (<http://www.millenniumassessment.org>).

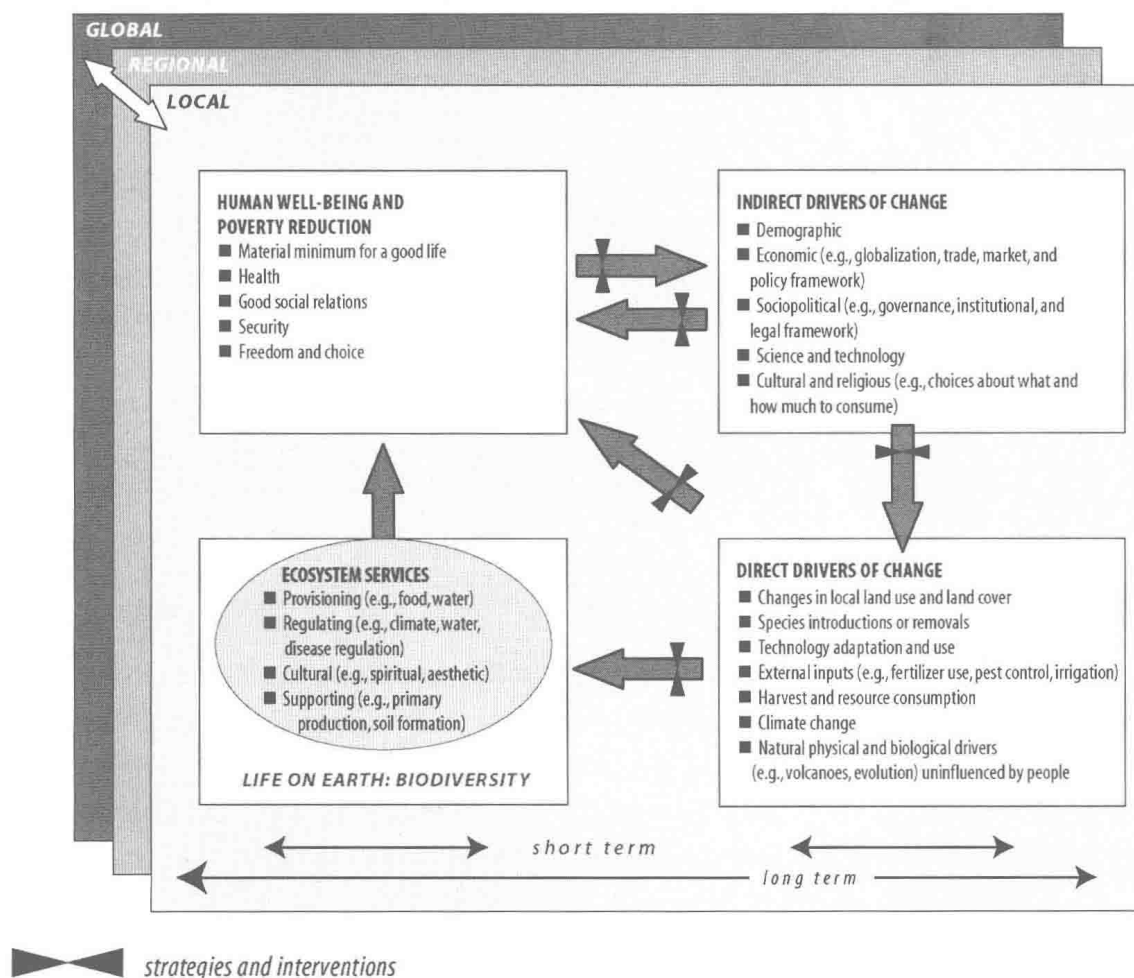


Figure 1.2. MA conceptual framework

### 1.1.3. Spatial distribution of MA sub-global assessments

Changes in drivers that indirectly affect biodiversity, such as population, technology, and lifestyle, can lead to changes in drivers directly affecting biodiversity, such as the catch of fish or the application of fertilizers. These results in changes to ecosystems and the services they provide, thereby affecting human well-being. These interactions can take place at more than one scale and can cross scales. For example, an international demand for timber may lead to a regional loss of forest cover, which increases flood magnitude along a local stretch of a river. Similarly, the interactions can take place across different time scales. Different strategies and interventions can be applied at many points in this framework to enhance human well-being and conserve ecosystems.

In addition to its distinct focus on ecosystems and human well-being, the MA includes another pioneering aspect that distinguishes it from past ‘global’ assessments. It is being conducted as a ‘multi-scale’ assessment with integral assessment components being undertaken at local community, watershed, national and regional scales, as well at the global scale. Each of the assessments at sub-global scales contributes to decision-making in the regions and communities where they are being undertaken, and each will be strengthened by the information and perspectives gained from each other and from the global assessment. Assessments at sub-global scales are needed because ecosystems are highly differentiated in space and time, and because sound management requires careful local planning and action. The sub-global assessments will directly meet the needs of decision-makers at the scale at which they are undertaken, strengthen the global findings with on-the-ground reality, and strengthen the local findings with global perspectives, data, and models.



**Figure 1.3. Spatial distribution of the MA sub-global assessments**

( represents the approved sub-global assessment,  represents the associated assessments)

Sub-global assessments that have been approved by the MA include Small Islands in Papua New Guinea, the Philippines Millennium Ecosystem Assessment, Downstream Mekong River Wetlands Ecosystem Assessment of Vietnam, **Integrated Ecosystem Assessment of Western China**, Altai-Sayan Ecoregion, Local Villages in India, Southern African Sub-Global Assessment, Norwegian Millennium Ecosystem Assessment, Ecosystem Management and Social-Ecological Resilience in Kristianstades Vattenrike and River Helgeå Catchment, Stockholm Urban Assessment, Portugal Millennium Assessment, Assessment of the Northern Range of Trinidad, Vilcanota Sub-Region of Peru, Salar de Atacama of Chile, Assessment of the Caribbean Sea, Coastal British Columbia in Canada, and the Pan-Tropic Research Sites of the CGIAR “Alternatives to Slash and Burn”(Figure 1.3).

The associated assessments include Arab Region Millennium Ecosystem Assessment, Sinai Sub-Global Assessment, Arafura and Timor Seas Sub-Global Assessment, Indonesia Sub-Global Assessment, São Paulo City Green Belt Biosphere Reserve Assessment, Chirripo Basin of Costa Rica, Ecological Function Assessment of Biodiversity in the Colombian Andean Coffee-Growing Region, Assessment of the Central Asian Mountain Ecosystems, The Great Asian Mountains Assessment, The Upstream Region MA of the Great Rivers, Northwest Yunnan of China, Fiji Sub-Global Assessment, Environmental Service Assessment in Hindu-Kush Himalayas Region, Indian Urban Assessment with Focus on Western Ghats.

## 1.2. Western region of China and western development strategy

### 1.2.1. The western region of China

The western region of China is administratively composed of twelve provinces (city, region) that are Sichuan Province, Chongqing city, Guizhou Province, Yunnan Province, Tibet Autonomous Region, Shaanxi Province, Gansu Province, Qinghai Province, Ningxia Huizu Autonomous Region, Xinjiang Uygur Autonomous Region, Inner Mongolia Autonomous Region and Guangxi Zhuangzu Autonomous Region. The western areas cover approximate  $6.75 \times 10^6 \text{ km}^2$ , which account for 71% of the total (Figure 1.4). By the end of 1999, the population of the western areas was approximately  $3.65 \times 10^8$ , accounting for 29% of the total.



**Figure 1.4. The western region of China**

(The red points represent typical areas at local scale, as see in section 4)

The western region of China has a vast territory, complicated natural conditions, diverse geomorphic landforms, and largely distributed land areas that are hardly to be utilized. Mountainous areas account for the highest proportion, about 49.7%. Hilly areas, tablelands, plains and plateaus account for 14.9%, 1.7%, 17.1% and 16.6% respectively. In addition, such lands that are hardly to be used as deserts, Gobi, and stony and rocky lands are widely distributed. There are abundant natural resources and biological diversities in the western region, which are the cradles and catchments of a range of big rivers such as Yangtze River,

Yellow River, Heihe River, Lancang River and Pearl River. In the western China, the climatic conditions vary a lot. It is arid and short of precipitation in Northwest China, temperate, wet and rainy in southwest China, and cold and short of oxygen in Qinghai-Tibet Plateau. The western region of China is featured by vast land and rich natural resources. On the one hand, the standard of living of the people in the western region is much lower than the average level of the whole China; the economy the western China is relatively backward; and the economic volume is small. On the other hand, resource and economic development is extensive and backward; the industrial output value is low; and the economic structure and exploitation of natural resources at the core sharply increases the pressure on the ecological environment.

### 1.2.2. The Western Development Strategy

The purpose of the Western Development Strategy is to, through generations of strenuous work, fundamentally change the relatively backward status of the western region, apparently shorten the development gap between different areas, and spare no effort to establish new western region featured by prosperous economy, advanced society, stable life, unity of various nationalities, beautiful mountains and rivers, as well as rich people in the middle of the 21st century when modernization is basically accomplished. Over the past five years, our central government has emphatically offered great support to the Western Development Strategy in respect of programming, construction of major projects, fund and investment, policies, etc. Accumulatively, our central government has invested approximate  $4.60 \times 10^{11}$  RMB in the western region for construction, and more than  $5.0 \times 10^{11}$  RMB as fiscal transfer payment and special subsidies, considerably boosting the economic construction and social development in the western region. People in different areas and different departments, particularly, the cadres and broad masses of people in the western region, earnestly carry through the Western Development policies and arrangements developed by CPC Central Committee and the State Council. They have made great efforts and dedicated a lot. As a result, important progress has been made in Western Development, and the urban and rural areas in the western region have all taken on a new look.

Economy in the western region of China steps on the juice. From 2000 to 2004, the GDP of the western region grew annually at a rate of 8.5%, 8.8%, 10.0%, 11.3% and 12% respectively, higher than the growth rate of the previous years. In the western region, economic re-structuring has been accelerated; industries with distinguishing features start to move; fiscal revenue has been growing year after year; economic returns have been increasing step by step; and the standard of living has been improved.

Considerable progress has been made in construction of infrastructure facilities. Over the past five years, investments in fixed assets have been growing by over 20% per year on average in the western region, much higher than the mean level of the whole country. Sixty important construction projects have been started successively, and the total investment of these projects amounts to approximate  $8.50 \times 10^{11}$  RMB. The construction of such major infrastructure facilities as some communication trunk lines, some key water control projects, the west-east power transmission project, the west-east gas transmission project, and the communication network project has been carried out successfully. Progress has also made in the construction of some rural infrastructure facilities, like asphalt roads to counties, power supplies to towns, radio and television to villages, drinking water supplies to people and domestic animals, utilization of marsh gas, and water-saving irrigation.

Eco-environmental protection and construction have been apparently reinforced. In the western region, more than  $7.35 \times 10^9$  mu ( $1 \text{ mu} = 1/15 \text{ hm}^2$ ) lands have been returned from farmland to forest; more than  $9.57 \times 10^9$  mu wastelands have been forested;  $1.90 \times 10^8$  mu lands have been returned from grazing lands to grassland. Exciting achievements have been made in protection of natural forests, control of the sources of