Sustainable Agricultural and Rural Development of the Loess Plateau
Planning for the Future

Co-Chairs: Honglie Sun, Bernie Sonntag

Executive Summary

Background

Agriculture started on the Loess Plateau 7,000-8,000 year ago and hence can be considered one of the important birthplaces of Chinese and world agriculture. The climate is generally favourable to agriculture, though too dry in some areas. Most of the soils are very deep and suitable for good crop growth if well managed. These favourable natural resources permitted a productive agriculture that allowed the Zhu, Qin and Han Dynasties to flourish. Since then, however, there has been progressive environmental degradation. Deforestation from the Qin Dynasty onwards degraded the land and exposed the fragile soil to water erosion. Increasing population pressure from 500 B.C. and particularly during the past 500 years of almost exponential population growth, led to extensive clearance and cultivation of highly erodible slopelands, and to some of the most serious soil erosion in the world. Collectively, these two detrimental changes have contributed to progressive loss of the soil organic matter vital for sustainable agriculture, to poverty amongst rural people on the Plateau, and to both frequent floods and seasonal breaks in the flow of the Yellow River and its tributaries, causing loss of life and economic disruption respectively in provinces downstream of the Plateau. The environmental degradation of the Loess Plateau is therefore an issue for the whole of China and not just for Shaanxi and Shanxi.

This situation can be reversed or substantially improved. The environmental degradation and poverty can be overcome in two principal ways. Agricultural R & D in China and elsewhere in the world has provided the technological means to reverse much of the soil erosion and restore soil organic matter levels. Wise development of the huge energy resources of the Loess Plateau can provide the capital needed for the creation of dynamic local economies. It can generate rural and urban employment so that farmer families on the more marginal lands can progressively leave agriculture to gain a better living in the industrial or service sectors, and allow such land to revert to grassland, forest or scrub land in an environmentally sound way.

The Sustainable Agricultural Working Group (SAWG) has considered the issues surrounding the sustainable development of the Loess Plateau, and examined the opportunities for sound action. The most important activities were an extensive field visit to the Loess Plateau in mid-May 1999, and an International Workshop on Land Use and Sustainable Development of the Loess Plateau, held in Beijing at the end of May 1999. The former gave SAWG the opportunity of examining directly both the problems and some of the possible solutions and discussing these with senior provincial and local officials, scientists and farmers. The latter widened the involvement of SETC, MOA and other state officials and additional international and Chinese scientists. This report
concentrates on the main issues and opportunities identified by these two activities and on SAWG’s recommendations arising from them.

Issues and Recommendations for a Long-term Sustainable Development

I. Conservation based land and water management

Issues: The soils of the Loess Plateau are inherently low in organic matter and clay content. This makes Loess soils relatively easy to cultivate, but very susceptible to the serious wind and water erosion. These weaknesses are made worse by the widespread use of intensive tillage practices. Therefore it is essential that these tillage pressures are lowered and vegetation cover or crop residue protect soils. Every effort should be made to enhance the soil organic matter levels of these soils to improve their stability, ecology and productivity. Such measures will also help to reduce water evaporation and compensate for the lack of rainfall.

Recommendations: Greater priority should be given to on-going efforts to transfer Chinese and overseas R & D and experience on more sustainable tillage/cropping practices to Loess Plateau farmers, which do not leave loess soils without cover and vulnerable to erosion. A demonstration project should be mounted to train farmers in reduced tillage and stubble retention methods on their own land and then use these farmers and farms in a pilot farmer trains farmer programme for the promotion of the wider uptake of these methods.

Every effort should be made to stop the cultivation and grazing of steep slopes with special emphasis on those measures given in the following recommendations. These include the use of confined feeding systems for livestock, simple re-seeding techniques, grass strips instead of machine made terraces, replanting of slopelandes with grasses and shrubs to sequester carbon, and creating non-agricultural jobs for those currently farming fragile slopelandes.

It is suggested the use of various types of ground cover plants in apple orchards, etc. instead of the bare soil. The benefits of the cover crops include biological N fixation, reduced soil erosion, lower pest attacks, higher soil organic matter and better soil moisture holding capacity. The balanced fertilizer use for major users like wheat, with less N and more P and K is also important. The gains here are both global and national. China is a major contributor to the globally important increase in nitrous oxide emissions from N fertilizers. Balanced fertilizer reduces these emissions, reduces farmers costs and can lower soil erosion.

II Integrated Management of the Yellow River Basin

Issues: Erosion control in the Loess Plateau is central to the State Eco-construction Programme to reduce the major impact that soil sediments from this region have upon the flow and course of the downstream portions of the Yellow River. The enormous efforts being made in the Middle and Upper reaches of the Basin to control erosion through re-vegetation and engineering solutions are make good progress but are not
sufficient to prevent continued choking of the main channels with eroded soil, and major flooding the Lower reaches and provinces. The current rate of water extraction is causing the main lower channels of the Yellow River to run dry six years out of ten, compared with three years in ten around before 1990, and the situation is projected to get worse.

The current Committee of Water Conservancy of Yellow River does not have the necessary authority and resources to achieve equitable water sharing between provinces, realistic water pricing and cost sharing, and to implement a holistic natural resource management strategy. Consequently, for example, the Upper and Middle reach provinces are extracting too much water for inefficient irrigation, and causing severe water shortages in the Lower reaches. Moreover, the regional problem in Yellow River Basin is not only water conservancy, but water conservancy, agriculture, forestry, etc.

Recommendations: It is necessary to enforce the integrated management of Yellow River Basin, to reconstruct the Committee of Water Conservancy of Yellow River and change its name to Committee of Integrated Management of Yellow River. The Committee is entitled to bring State agencies together with all 11 provinces that are responsible for, and lie within, the Basin. It could be headed by a senior leader of Central Government (e.g. one vice-premier) to provide the necessary authority for implementation of its strategies. It could draw upon the experience of River Basin Management Authorities in other countries that have similar challenges in managing complex issues of water and land management across a range of jurisdictions. It should provide the co-ordination, sharing of costs and benefits and regulatory monitoring.

III. The Role of Livestock in Optimizing Resource Use

Issues: Improvement of Loess Plateau farmer incomes in dependent on raising their productivity and diversifying their products. They could respond more to the growing local markets for livestock products. At the moment they do not make full use of the potential for raising livestock on under-utilized crop-residues and forage resources. Ruminant animals can be an economic and ecologically sound way of using crop by-products and forage as the livestock feed base.

Recommendations: The agricultural structure should be changed and expansion of plant sector should be constrained. More should be done to develop ruminant animal husbandry among farmers of the Loess Plateau, primarily using confined feeding systems to reduce the risk of negative impacts of grazing on steep slopes. emphasis should be on local breeds of beef cattle, sheep and goats.

Advanced technologies can be very effective for restoring degraded land to provide both grazing land and forage, but they are generally too closely for widespread use. It is therefore recommended that R & D institutions and local officials do more to develop and disseminate “low technology” solutions to overcome soil erosion and the loss of vegetation. In particular, there are local forages, which are or could be as good as some
of the imported plant germplasm favoured by scientists. There are also simple native plant re-seeding techniques that could achieve vegetation restoration at very low cost.

IV. Improving the Client and Market Focus of Agricultural R & D and Extension Services

Issues: The State Government has conducted long-term research and demonstration projects on soil conservation and agricultural development on Loess Plateau since the 1950's. During the period from the sixth five year plan to the ninth five year plan the state government successfully enhanced R&D and demonstration activities resulting in improved technologies, new models of agricultural development, and more trained researchers. However, the potentials of these competent scientists and well-equipped institutions have not been fully utilized. For example, the current State Eco-construction Programme has been conducting R&D in some areas of the Loess Plateau, but few academic institutions have been involved, which is a serious under utilization of national scientific resources. Furthermore, it is difficult to ensure that the programmes are ecologically and economic sustainable.

There seems to be a tendency to continue research programmes longer than necessary and at times some reluctance to undertake R&D on techniques which will require major changes in local farming practices. There are a number of appropriate technologies available in other countries that could make an important contribution to the restoration of the Loess Plateau. Some individual scientists have responded to these opportunities, but there appears to be no national or provincial strategy to exploit these opportunities.

Recommendations: Research institutions and scientists should be encouraged to support the State Eco-construction Programme and undertake innovative applied research on sustainable soil and crop management technologies. National and provincial authorities could take a more active role in promoting the adoption of appropriate technologies from other countries even though these may have low acceptance among farmers at the time, such as the reduced tillage technologies mentioned above.

V. Market Development, Market Competition and Comparative Advance

Issues: The move to a market economy in China and economic globalisation provides the Loess Plateau with good opportunities for development, but also presents the region with greater risks and uncertainties regarding agricultural diversification. The ever increasing market (price) fluctuations faced by farmers demands that thorough market analysis is completed before promoting new industrial or product development. This analysis must determine whether there are viable long-term markets for new products. It is clear from the SAWG field survey in May 1999 that the local policymakers have not paid enough attention to these issues.

Loess Plateau farmers have successfully adopted fruit tree cultivation, but they are now finding it difficult to sell their apples profitably. The problem seems likely to get worse as production is still expanding on the Loess Plateau and elsewhere in China. It is
critically important that there is thorough analysis of the real market opportunities before making massive investments in new production capacity, and every effort is made to avoid farmers being discouraged in the future from adopting new innovations. Farmers have production experience but little formal education and limited skills in marketing, financial management and human resource management.

These difficulties regarding the development of new crops are particularly important given that China currently does not have international comparative advantage for a number of bulk crops, and policy makers have not adequately addressed this fact. For example, the protection rate for wheat and corn (that is, the amount by which local prices exceed world market prices) has been up to 20-30% in recent years.

Recommendations: Further economic development should be based on the optimal utilisation of resources and comparative advantages. Policy-makers should assess thoroughly the comparative advantage of local products in national and international markets before encouraging farmers to change their cropping systems. Greater emphasis should be given to (i) assessing the long-term comparative advantage of the Loess Plateau for fruit production; (ii) providing more training to farm advisors on marketing aspects; (iii) supporting farmers by a better information system about present and potential markets for different crops and their prices and helping them to improve their financial management skills; (iv) fruit processing units should be established to widen market opportunities. A concerted effort should be made by the Chinese government to improve the skills of extension and farm service personnel with emphasis on marketing and financial management.

VI. Getting the Best Return from Investment

Issue: Machine made wide terraces have been very successful in controlling soil erosion and raising farm incomes such that the non-labour construction costs of c. 700 RMB/mu can be paid back within about 3 years. However, the total costs are higher because of labour, road construction and other supporting activities, so other erosion control measures like grass strips can be more cost-effective in the longer-term and more sustainable because of their contribution to higher soil organic matter content and productivity. Moreover, (a) some of the terraces now being built may be too small in the longer-term for profitable intensive farming, and (b) the area of slopeland needing soil erosion control is much greater than that for which funding of machine made terraces can be found. It is unlikely that relying on such machine-made wide terraces can ever provide for more than a small proportion of all needy farmers and vulnerable sloping lands in the Loess Plateau.

Recommendation: The choice between alternative soil conservation techniques should be based on a more comprehensive analysis of short-term economic costs and longer-term productivity benefits. Alternative ways of terracing should be devised, which integrate where possible other objectives, such as infrastructure, energy and rural development. For example, through the construction of small to large-scale man made plains.
VII. Improving Land Property Right and Rural Credit Services

Issues: Unclear or insecure land property rights and inadequate credit services on the Loess Plateau and elsewhere in China have become important constraints to farmer’s investment in land improvements and the rapid development of the rural areas. Secure property right is a vital catalyst for sound natural resource management and economic development. Farmers have to own the land or be confident that they will have user rights long enough to receive the full benefits of any investments they make in it. Different land property systems exert different impacts on productivity and resource degradation. The redistribution of farmland can have beneficial impacts on resource utilisation, farmer income parity, soil quality and institutional system developments (for example, the land rent market). A survey on the Loess Plateau has highlighted inadequacies in current rural credit services with many farmers in Shangxi Province, for example, being unable to obtain loans. Interestingly, 50% of the farmers wished to get loans from non-agricultural industries.

Recommendations: Land property rights on the Loess Plateau should be clarified to encourage farmers to increase investment on land, and to improve the rational use and conservation of natural resources.

Rural credit services should be improved, possibly modeled on the current small-scale loan project which has been very effective in raising rural household economic development in less favoured areas.

VIII. The Role of the Loess Plateau in National and Global Development

Issues: National food security policy and its implementation via provincial and local government responsibility for grain supplies with restrictions on internal grain trading may have a number of adverse affects. Farmers incomes and local development opportunities could be reduced. They may result in unnecessary grain production, and prevent comparative advantage determining where grain supplies can be developed most efficiently and achieving the most appropriate mix of products and production options. They could adversely affect sustainable agricultural development by forcing more agricultural production increasingly onto more marginal lands.

The Loess Plateau has vast energy resources which are progressively being developed but the main economic and employment benefits are gained by other regions of China in the form of cheap energy and the raw materials for petro-chemical industries which in turn support a wide range of manufacturing companies. Thus the Loess Plateau, for example, receives much of the environmental damage from coal mining, but none of the employment benefits of the down-stream industries that could provide higher incomes than from the farming of the marginal slopelands.

This energy generation makes a significant contribution to China’s carbon dioxide emissions. The Loess Plateau through many of the above recommendations, for example, the promotion of reduced tillage, grass strips, and cheaper vegetation restoration techniques greatly contribute to China’s international obligations. Such
actions could sequester large amounts of carbon dioxide as soil carbon. Thus, the Loess Plateau could sequester over 4 million tons of carbon annually from arable land, and possibly double this amount from restored slopeland re-planted with grasses and shrubs.

Recommendation: Planning of Loess Plateau development should be more closely integrated with national planning so that (i) national and regional grain policies do not have adverse effects on environmental sustainability; (ii) people of the region receive a more equitable share of the benefits of the energy resources they provide to China, and (iii) so that it can make a major contribution to meeting China’s international obligations for climate change mitigation.