

**ASIAN DEVELOPMENT BANK**

**INTEGRATED  
ECOSYSTEM MANAGEMENT  
FOR  
THE DRYLANDS OF THE PEOPLES REPUBLIC OF CHINA**

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**February 2004**

## CURRENCY EQUIVALENTS

(as of 5 February 2005)

|               |   |            |
|---------------|---|------------|
| Currency Unit | – | yuan (CNY) |
| CNY¥1.00      | = | \$0.1208   |
| \$1.00        | = | CNY8.2772  |

## ABBREVIATIONS

|         |   |  |
|---------|---|--|
| ADB     | – | Asian Development Bank   |
| CAS     | – | Chinese Academy of Sciences  |
| CBD     | – | Convention on Biological Diversity   |
| CCD     | – | Convention to Combat Desertification   |
| CCD-NAP | – | Convention to Combat Desertification-National Action Program to Combat Desertification |
| CCICCD  | – | Chinese Committee for Implementation of the Convention to Combat Desertification       |
| CPF     | – | country programming framework  |
| DFID    | – | Department for International Development   |
| EIA     | – | environmental impact assessment  |
| FAO     | – | Food and Agriculture Organization of the United Nations                                |
| GEF     | – | Global Environment Facility  |
| GIS     | – | geographic information system  |
| GTZ     | – | Deutsche Gesellschaft für Technische Zusammenarbeit                                    |
| IA      | – | implementing agency  |
| IEM     | – | integrated ecosystem management  |
| IFAD    | – | International Fund for Agricultural Development  |
| MOA     | – | Ministry of Agriculture  |
| MOF     | – | Ministry of Finance  |
| MWR     | – | Ministry of Water Resources  |
| OP12    | – | Global Environment Facility Operational Program on Integrated Ecosystem Management     |
| PCO     | – | Project Coordination Office  |
| PMO     | – | Project Management Office  |
| PRC     | – | People's Republic of China   |
| SEPA    | – | State Environmental Protection Administration  |
| SFA     | – | State Forestry Administration  |
| TA      | – | technical assistance   |
| UNDP    | – | United Nations Development Programme   |
| UNEP    | – | United Nations Environment Programme   |
| UNCCD   | – | United Nations Convention to Combat Desertification                                    |
| WB      | – | World Bank   |
| WDS     | – | Western Development Strategy   |

## WIEGHTS AND MEASURES

|                 |   |                  |
|-----------------|---|------------------|
| ha              | – | hectare          |
| km              | – | kilometer        |
| km <sup>2</sup> | – | square kilometer |
| t               | – | ton              |

This report was prepared by a team from the PRC-Global Environment Facility Partnership on Land Degradation in Dryland Ecosystems (OP12). Key contributions came from Malcolm Douglas, Ian Hannam and Niu Zhiming (consultants to the Partnership), with inputs from international experts including Brian Bedard, Fee Busby, Brant Kirychuk, Clemencia Licon-Manzur, Des McGarry, Vic Squires, Michael Stocking and Phil Young. ADB staff contributions came from Bruce Carrad. Administrative assistance was provided by Sherry Li at the Asian Development Bank's People's Republic of China Resident Mission.

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Table 1: COMPARISON BETWEEN VARIOUS COUNTRIES AND PEOPLES REPUBLIC OF THE PRC: GENERAL FACTORS IN RURAL LAND MANAGEMENT

## SUMMARY

1. Experience from around the world, including from the Peoples' Republic of China (the PRC), shows that it is possible to address the inter-linked problems of land degradation and rural poverty through the adoption of an integrated ecosystem management (IEM) approach. IEM is a holistic scientific approach, that is based on understanding: (i) the natural resource characteristics of individual ecosystems (climate, soils, water, plants and animals); (ii) the environmental functions and services provided by healthy ecosystems (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, bio-diversity preservation etc); and (iii) the constraints to, and opportunities for, the sustainable utilisation of an ecosystem's natural resources to meet peoples' welfare and economic needs (e.g. for food, medicine, fuel, shelter, income, communication, recreation).

2. IEM recognizes that people and the natural resources on which they depend, directly or indirectly, are inextricably linked. For planners, advisers, researchers, and the land users themselves, IEM requires the integration of both natural and social sciences, rather than keeping them in separate compartments. It requires them to combine knowledge from a diversity of disciplines, such as agronomy, animal husbandry, silviculture, ecology, sociology and economics, in order to better understand an ecosystem's natural properties (and society's dependence on them), and to determine the necessary technical, policy and institutional requirements for their productive and sustainable use.

3. The arid, semi-arid, and subhumid (dryland) zones of western PRC cover 40 percent of the country and contain some of the most severely degraded land to be found, both within the country and globally.<sup>1</sup> The PRC's drylands have been adversely affected by such degradation processes as severe wind and water erosion, soil nutrient losses, water logging, salinization, river system sedimentation, deforestation, grassland degradation and bio-diversity loss. This has not only impacted on the lives of the people, who reside in the area, but has also affected the quality of life for many more living in central and eastern PRC through increased exposure to severe dust storms, originating in the west, as well as reduced quality and quantity of water, especially in the middle and lower reaches of the Yellow River.

4. The drylands of western PRC are home to over 250 million people, including several large ethnic minorities. While western PRC contains large deposits of valuable minerals (oil, gas, coal etc), most of the population still live in rural areas and pursue agriculture-based livelihoods (rainfed and irrigated crop production, and livestock rearing). Farmers and herders have to cope with low and erratic rainfall, water scarcity, fragile soils, and natural vegetation with low resilience to disturbance. Low land productivity, and high susceptibility to degradation, are thus inherent problems for the use of dryland ecosystems. As a consequence the drylands are amongst the most poverty stricken parts of the country. The biodiversity of the western region is characterised by fewer plant and animal species than the rest of the country, however its endemic species richness (and therefore global importance) is higher than elsewhere. Much of this is currently threatened with extinction.

5. Over the last twenty years the PRC has invested heavily in new environmental policies and programs within its dryland areas. The Ministry of Water Resources (MWR), State Forestry Administration (SFA) and the Ministry of Agriculture (MoA) have been at the forefront of such efforts. However these have generally been undertaken on a sectoral basis, in accordance with the technical mandate and legal responsibilities of the implementing agency, and designed and implemented in a top-down manner using centrally determined

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<sup>1</sup> Comprising the following provinces/autonomous regions: Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi, Xinjiang Uygur, Sichuan, Chongqin, Yunnan, Guizhou, Guangxi, Xizang Zizhiqu, and two prefectures in Hunan and Hubei.

unit costs and targets. Evidence of environmental progress can now be seen in many areas. However, these efforts have not resulted in a strong understanding of area-wide ecological systems. They have also hindered the identification of area specific problems and solutions, preventing the serious problem of dryland ecosystem degradation from being addressed in a coordinated, systematic and integrated manner.

6. Furthermore many well meaning policies and programs have inadvertently caused or exacerbated land degradation, examples include: (i) conversion of grasslands to irrigated agriculture resulting in increased pressure on the remaining livestock grazing areas, and local problems of water logging and salinization; (ii) resettlement of farmers from over populated uplands into marginal lowland areas with very limited potential for profitable and sustainable agriculture; (iii) industrial development in remote and water deficient areas; (iv) low water pricing policies that provide little incentive for the adoption of efficient water use practices; (v) conversion of farmland to forests and/or grasslands where single species of trees and/or grasses have been planted over large areas thereby further reducing local biodiversity; and (vi) promotion of mechanical tillage, and removal of all crop residues for stall feeding livestock, leading to loss of soil organic matter, nutrients and topsoil structure, reduced protective ground cover, and increased susceptibility to wind and water erosion.

7. The top-down single sector approach is incompatible with the requirements for productive and sustainable ecosystem management. Instead what is needed is an approach that recognises the area specific nature of the problems and solutions, and which fosters community participation, inter-disciplinary cooperation, and inter-agency coordination. In developing its own IEM strategy for combating dryland ecosystem degradation, the PRC has the opportunity to learn from the experiences of other countries, notably Australia, United States and Canada. In all three countries a large proportion of their dryland areas became severely degraded in the 1930s as a result of poor land use practices, and inappropriate government policies. Through a process of trial and error each country developed its own successful recovery program for integrated natural resource and ecosystem management. Common elements in these programs include: (i) the development of an enabling policy and legislative framework; (ii) government agencies working in partnership with local communities and land users to design and implement local land degradation control plans; and (iii) targeted incentives, and disincentives, designed to encourage environmentally beneficial changes in land management practices. Table 1 presents a summary of land management principles in these three countries, as compared to the PRC. It illustrates the major gaps between best international practices and the current situation in the PRC.

8. This paper argues that there would be significant environmental, cost reduction and human benefits for the PRC from the adoption of an IEM based approach to land degradation control within the drylands of the western region. This requires the formulation of a PRC-specific IEM strategy, with an associated action program, with the aim of meeting the ever-growing demand on the limited ecosystem resources of the dryland region in ways that are both productive and ecologically sustainable. The best way to design and implement such a strategy is to start from the bottom-up, not top-down, involving participation by a sample of communities and local governments. Local ownership is vital for successful implementation. The PRC-Global Environment Facility (GEF) Partnership on Land Degradation, coordinated by the ADB on behalf of development partner agencies, is currently assisting the Government to prepare such a strategy for the six most degraded dryland provinces/autonomous regions: Inner Mongolia, Gansu, Ningxia, Qinghai, Shaanxi and Xinjiang. From 2006, all 12 provinces/regions of the western region will become eligible for support under the Partnership.

## **I. LAND DEGRADATION IN THE DRYLANDS OF WESTERN PRC**

### **A. Current Situation**

9. The PRC suffers from some of the world's worst land degradation problems with over 40% of its land area adversely affected. Given the country's limited natural resource base, in relation to its population size, current rates of land degradation pose a threat to the future economic welfare of the nation. The PRC has to feed 22% of the world's population, having at its disposal 6.4% of the world's land area, 7.2% of the world's farmland and only 6.2% of the world's renewable fresh water. The availability of water is not only affected by volume but by quality as well – currently, experts report that 52% of 135 main rivers in PRC are heavily polluted and significant clean up is not expected in the short term.

10. A large number of the ecosystems of the PRC, with their rich and diverse biodiversity, are directly threatened by land degradation. The most highly degraded are predominantly located within the western region<sup>2</sup>. Approximately one-half of this region suffers from moderate to severe land degradation. An increasing amount of land within the arid, semi-arid and sub-humid (dryland) zones of the PRC, primarily in the western provinces, is prone to wind erosion and other forms of desertification (about 2.5 million ha currently affected). Over the last fifty years the rate of expansion of the area affected by desertification has increased from some 1,560 km<sup>2</sup>/yr in the 1950s-1970s, to 2,100 km<sup>2</sup>/yr in the mid 1970s-1980s, 2,400 km<sup>2</sup>/yr in the early 1990s and nearly 3,500 km<sup>2</sup>/yr by the late 1990s. Dust storms originating in western PRC have increased from an average of 0.5 per year in the 1950s to 2.3 per year throughout the 1990s. Along with similar storms originating in Mongolia, they have increased in severity in recent years impacting negatively on major population centres in the east, notably Beijing, as well as on occasion Korea and Japan.

11. Over 30 per cent of the country's grasslands (mostly located in the western region) suffer from moderate to severe degradation, and pressure is increasing on these as demands for meat and other livestock products rise in conjunction with urbanisation and rises in living standards. The natural biodiversity of the western region is under threat with some plants and animals at risk of extinction. While the biodiversity of the region is characterised by fewer species than the rest of the country, its endemic species richness (and therefore global importance) is higher than elsewhere. The greatest threat to the region's biodiversity, comes from habitat loss through forest and woodland clearance, overgrazing of grasslands, and other forms of land and vegetation degradation. New threats are emerging from poorly managed ecotourism ventures, although with proper safeguards ecotourism can provide economic benefits from biodiversity preservation. Current efforts to protect and manage the remaining natural areas and biodiversity hot spots are inadequate and fail to meet the PRC's broader national conservation objectives, and international obligations, for the protection of wetlands and other critical dryland ecosystem habitats, as well as preserving individual threatened species.

### **B. Social and Economic Factors**

12. The drylands of western the PRC are home to over 250 million people, including many ethnic minorities. While western the PRC contains large deposits of valuable minerals (oil, gas, coal etc), most of the population still live in rural areas and pursue agriculture based livelihoods (rainfed and irrigated crop production, and livestock rearing). Land productivity, over much of the western region, is generally low, due in part to low and erratic rainfall, fragile soils, scarce surface and groundwater resources, and sparse natural

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<sup>2</sup> Comprising the following provinces/autonomous regions: Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Sha'anxi, Xinjiang Uygur, Sichuan, Shanxi, Yunnan, Guizhou, Guangxi, Xizang Zizhiqu, and two prefectures in Hunan and Hubei.

vegetative cover. Low land productivity, and high susceptibility to degradation, are thus inherent problems for the use of dryland ecosystems. As a consequence the drylands are amongst the poorest parts of the PRC, with a high incidence of rural poverty.

13. Within the western region there is a high degree of overlap between ecologically sensitive areas and “poverty counties” with some of the most extreme levels of soil erosion, salinity and water shortages being found here. The social and economic consequences of dryland land degradation are profound. They include lower household incomes and increased poverty in many rural communities, higher unemployment rates, and higher migration rates. Not enough jobs are being created to lift people out of poverty and absorb surplus rural labour. The problem has been exacerbated by a progressive reduction in the productivity of the region’s agricultural and pastoral lands, increased damage to roads and other infrastructure (from water and wind erosion), and a loss of ecosystem environmental services (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, etc).

14. The direct economic losses due to land degradation are estimated, for the country as a whole, at about Yuan 64 billion annually, or Y176 million per day (equivalent to \$21.2 million/day). When broken down by degradation type the losses come to: (i) Y40 billion due to water erosion; (ii) Y3.5 billion due to wind erosion; and (iii) Y19 billion due to salinisation and loss of organic matter. The annual losses from dust storms have been estimated at Y1.5 billion. The indirect annual economic loss from land degradation is estimated at Y288 billion, over four times as much as the direct economic losses. The direct and indirect economic losses are currently at least the equivalent of 4.1 % of GDP, a rise from 2.2% in 1992.

15. Although it is now government policy to change from a command, centrally planned, economy to a supply driven market based one, market failures are a major factor explaining why farmers use their land and water resources in an unsustainable way. Central and local government funded rural services, and incentives, are increasingly inadequate when it comes to providing information on, and support for, sustainable resource use. Most rural households do not have access to efficient or effective financial services. Lack of credit is a barrier to the adoption of many improved land management practices, and limits farmers opportunities for adopting more productive (and higher value) forms of cropping and animal husbandry. Although a scarce commodity the price farmers pay for water does not reflect its true value, hence there is little incentive to adopt water efficient irrigation practices. Likewise, fees for communal land lease contracts do not reflect real land values and only encourage inefficient high input low output production systems. The private sector has yet to establish itself as an effective alternative to government as a provider of services to farmers and herders within the western region. However private sector involvement can be expected to increase as opportunities open up for the provision of goods and services related to: (i) improved farm machinery (especially conservation tillage implements); (ii) seasonal farm inputs (improved seed, fertiliser, agro-chemicals); (iii) animal health (commercial feeds, veterinary services, drugs); (iv) financial services; (v) produce marketing services; and (vi) eco-tourism ventures.

### **C. Land Use Policies**

16. Many well meaning policies and programs have inadvertently caused or exacerbated land degradation, examples include: (i) conversion of grasslands to irrigated agriculture resulting in increased pressure on the remaining livestock grazing areas, and local problems of water logging and salinization; (ii) resettlement of farmers from over populated uplands into marginal lowland areas with very limited potential for profitable and sustainable agriculture; (iii) industrial development in remote and water deficient areas; (iv) low water pricing policies that provide little incentive for the adoption of efficient water use practices; (v) conversion of farmland to forests and/or grasslands where single species of trees and/or

grasses have been planted over large areas thereby further reducing local biodiversity; and (vi) promotion of mechanical tillage, and removal of all crop residues for stall feeding livestock, leading to loss of soil organic matter and nutrients, loss of topsoil structure and compacted subsoil layers, reduced protective ground cover, and increased susceptibility to wind and water erosion.

17. The land conversion and human resettlement policies enacted in both mountain and desert areas have had significant environmental impact. While closure to livestock grazing has dramatically improved vegetative cover, and reduced soil erosion, within mountain areas, it hasn't addressed the wider problem of excess livestock numbers, and has led to increased pressure on areas where grazing is still taking place. The 'desert transformation' policy has resulted in further ecosystem degradation and continuing poverty, as people and livestock have been moved into highly fragile ecotypes that have little, if any, potential for profitable and sustainable use. Likewise many other ecological reconstruction projects, involving wide-scale tree planting, fodder growing, and terrace construction, are failing to deliver the anticipated ecological, economic and conservation benefits.

#### **D. Policy and Legislative Framework**

18. Work undertaken during the preparation of the 2002 *National Strategy for Soil and Water Conservation* found that the PRC's environmental laws and policies were not adequately equipped to deal with land degradation problems. In general, current laws and policies relevant to land degradation lack many of the essential legal and institutional elements needed to enable them to recognise ecological problems, establish effective land management programs and targets, and enforce compliance standards. Hence considerable effort is needed to assess, review and revise these laws and policies in order to improve their capability to address the problem of land degradation and to bring them up to the required standard. Of critical concern is the need for laws that recognise rural property rights, provide security of land tenure, and protect the rights and interests of individuals with regard to access to, and use of, land and water resources. There is also a need to substantially improve the institutional capacity at the central and provincial levels to understand the role of such laws and policies, and to be able to improve the policy and regulatory framework, as part of a comprehensive IEM strategy for improved ecosystem management within the country's dryland areas.

#### **E. Institutional Data Limitations**

19. Land degradation data is collected and compiled by different institutions, according to their sectoral responsibilities, notably: (i) the State Forestry Administration (SFA) monitors desertification and forest cover; (ii) the Ministry of Water Resources (MWR) monitors soil erosion and water resource quality and quantity; (iii) the Ministry of Agriculture (MoA) monitors soil fertility and grassland quality; (iv) the State Environmental Protection Administration (SEPA) monitors ecological changes and biodiversity; (v) the Ministry of Land Resources (MLR) monitors changes in land use and land conversion; (vi) the PRC Meteorological Administration (CMA) monitors climate change and dust storms; and (vii) the State Bureau for Surveying and Mapping (SBSM) monitors spatial data on infrastructure development.

20. Data is rarely shared between institutions, and comparisons between data sets are difficult, due to the different approaches used to acquire and process the data. There is also no universally accepted definition of what constitutes land degradation, different agencies defining the problem according to their own institutional mandates and responsibilities. The lack of an institutional mechanism for pooling the different degradation survey results means that there is no comprehensive assessment of the true nature, severity and extent of land degradation within the drylands of the PRC. Likewise an inadequate understanding of the

various dryland degradation processes at work, makes it difficult to identify which specific factors have contributed to a reduction in: (i) the productivity of crop (rain fed and irrigated), grass, and forest lands; (ii) water resource quality and quantity; and (iii) air quality (dust storms). Without such information it is difficult to design and implement effective field level interventions for restoring the productivity, and protective functions, of dryland ecosystems.

21. While individual institutions may have their own natural resources databases these are usually narrowly focussed on specific sectoral concerns and lack the information needed for determining regional scale land capability limitations or land use enterprise suitability at the local/ ecosystem level. This has hindered the development of much needed common standards and targets for the rehabilitation of degraded areas within the drylands of the western region.

## **F. Technological Research and Development**

22. Within the PRC substantial research has been conducted into many aspects of dryland degradation and this has resulted in many successful technologies for: (i) controlling erosion on sloping farm land - by reducing slope length and angle through the construction of different types of terrace; (ii) controlling gully erosion - through check dams, warp dams and gully head protection; (iii) protecting sloping land by vegetative means – taking land out of crop production and putting it under trees (orchards, economic, or protection forests) or improved grasses/fodder legumes; (iv) stabilising mobile sand dunes, by laying out a checkerboard pattern of straw and/or twigs combined with the planting of grasses, shrubs and trees, as well as aerial seeding; (v) improving soil fertility – through the use of organic manures, cover crops and balanced fertiliser application; (vi) reducing soil salinity by digging deep drainage ditches to lower the water table; and (vii) grassland restoration, involving fencing, planting of ‘artificial’ grasses, and closure to grazing.

23. However few of these technologies have been properly evaluated according to their site-specific technical suitability and cost effectiveness. Many technologies, that have been successful in one area, are widely promoted elsewhere, without taking account of ecosystem differences, and with centrally determined unit costs. Such blanket recommendations are often inappropriate at the field level, as they fail to take into account differences in soil type, slope, or climate, as well as variations in local market conditions that affect land users input costs and produce prices.

24. Little research has been directed at understanding the underlying causes of degradation, which may require changes within the wider social, economic and policy environment, rather than just technological solutions. Research investigations have rarely considered the impact of individual technologies on ecosystem stability within different parts of the landscape, or in relation to different land use actions and pressures. The environmental cost-benefits of different rehabilitation treatments, promoted by many dryland ecological reconstruction programs, have been inadequately investigated. Research and extension programs have generally been treated as separate rather than linked activities. Little work has been done to develop modern people centred extension methods.

## **II. CURRENT LAND DEGRADATION CONTROL STRATEGIES AND APPROACHES**

25. Overall, the approach to land degradation control in the drylands of the western region has been disjointed and inefficient. Most control efforts have been undertaken under the auspices of domestically funded programs, implemented by individual sector agencies. These domestic efforts have been supplemented by international donor supported projects.

### **A. Government Funded Programs**

26. During the 1990s, total public investment in land degradation programs almost tripled, to over 54 billion Yuan. Government expenditures in the six most degraded dryland areas (Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi, and Xinjiang Uygur) in 2002 were approximately equivalent to \$1 billion, almost twice the 2000 level. Most of this investment has been directed at projects and programs that have been planned, funded and implemented using only national, provincial and local government resources. International donor funds make up a relatively small proportion of the total investment in land degradation control within the PRC.

27. To date the domestic program for combating land degradation within the PRC's drylands has been dominated by a national government sectoral agency led approach, in which each agency separately plans and implements its own activities. The national and provincial level institutions currently involved directly, or indirectly, in the domestic program, include: (i) Ministry of Water Resources (MWR); (ii) State Forest Administration (SFA); (iii) Ministry of Agriculture (MoA); (iv) Ministry of Land Resources (MLR); (v) State Environmental Protection Agency (SEPA); (vi) Ministry of Finance (MoF); (vii) National Development Reform Commission (NDRC); and (viii) the Ministry of Science and Technology (MST). However primary responsibility for the domestic program (and the bulk of the domestic funding) has been assigned to just the first two of these (SFA and MWR). There is currently no overall coordinated strategy for the sustainable management of the PRC's drylands, and conflicting institutional mandates, responsibilities, priorities and policy objectives have limited the effectiveness of past efforts.

28. Ecosystem elements are currently treated in isolation from each other, in line with the mandates of the concerned institutions. As a result there is no strong understanding of area-wide ecological systems and how to address their management problems, in a coordinated, systematic and integrated manner. For example water is treated differently depending on whether it is managed for livestock needs, irrigated agriculture, forestry purposes, industry or domestic consumption. Likewise different agencies deal with soil erosion, depending on whether it is induced by water (MWR) or wind (SFA). This creates problems because most dryland ecosystems suffer from a combination of both. The agency responsible for desertification (SFA) is not responsible for the management of grasslands (MoA), despite the fact that grassland degradation is a major cause of desertification.

29. The lack of an integrating institutional coordination mechanism for the current domestic program has resulted in: (i) a failure to mainstream land degradation control efforts within the past and present (10<sup>th</sup>) national five year plans; (ii) each sector setting ever increasing targets for its own technical solutions; (iii) an expansion in the number of potentially conflicting development policies and environmental laws; (iv) poor coordination among line agencies resulting in wasted resources and duplication of effort; and (v) insufficient attention given to formulating enabling policies and laws which encourage the resource users to take primary responsibility for improved management of their local natural resources. In addition opportunities have been missed to achieve synergies between land degradation control, biodiversity conservation, and climate change mitigation. The lack of any clear authority and coordinated institutional control over the exploitation of the western region's natural resources (soils, vegetation, water and biodiversity) is a primary reason why the domestic program has so far had limited impact on improving the environment and alleviating the accompanying poverty.

30. The emphasis of the domestic program has to date been on top down public works style solutions (eg. (i) construction of terraces, check dams and other physical conservation works; (ii) the planting of economic trees and protection forests; (iii) conversion of farmland to forests on a sector basis (eg. forestry, agriculture, or water resources). Individual project activities have typically been promoted by government technicians, with minimal participation of the 'beneficiary' communities during the planning and design stages. Furthermore the

component activities of many national and provincial projects have been driven by centrally determined targets (eg. area to be planted to trees), rather than based on a local assessment of the need and ecosystem suitability.

31. A more logical approach to land management would have included the coordination of land assessment, land planning, research, agricultural and forestry extension advice services, community participation, and a system for monitoring the changes in land condition and recovery. To date, the ecological linkages between the dryland natural systems and the people have been ignored or compromised in the planning, design and execution of agricultural and pastoral land management programs. There has also been little attempt to address the root causes of land and ecosystem degradation, which typically lie within the wider economic, social and policy environment, in particular poverty and the lack of alternatives to current unsustainable land management practices.

32. The domestic program includes a number of major land development and utilisation projects which have often failed to deliver the anticipated ecological, economic and conservation benefits, for instance:

- (i) **Grassland conversion:** Following the conversion of grasslands, within dry marginal areas, into irrigated croplands farmers have experienced problems of low yields due to increased soil and water salinity and water logging. Loss of grazing resources, and poor quality fodder from salt affected croplands, has exacerbated livestock feed problems. Over extraction of ground water has reduced local and regional aquifers.
- (ii) **Cropland conversion to forest and grassland:** Wholesale conversion of croplands to tree monocultures has produced little of ecological value with minimal erosion control benefits. Scarce water resources have been used to plant trees in dry areas, instead of being used for the production of higher value crops and pastures. Cropland conversion and tree planting targets have been met through the use of short to medium term financial incentives (free grain and cash for up to 8 years). Insufficient attention has been directed at providing those affected with the long term financial and extension assistance required to develop alternative secure livelihoods. Without this, once the financial incentives for conversion are no longer available, individual households may have little option but to revert to the growing of annual crops to meet their livelihood needs, thereby undoing any ecological gains.
- (iii) **Water and soil conservation/watershed protection:** The primary emphasis in water erosion control and watershed protection programs has been on the construction of physical conservation works, for the creation and protection of basic farmland, and reducing downstream flooding and sedimentation. This engineering approach has by and large been successful, however it has several drawbacks namely: (i) it cannot be replicated without further program support due to the high construction costs and technical design skills required; (ii) earthwork construction involves the disturbance of large areas of land which can increase short term soil and water losses; (iii) the agronomic practices followed on the terraces are of secondary importance, with the emphasis on conventional high input monoculture agricultural and horticultural cropping systems, rather than conservation agriculture practices; and (iv) generally less attention is paid to biodiversity preservation and the conservation of natural ecological features.
- (iv) **Resettlement:** Several programs have sought to reduce land use pressures by resettling rural people from overcrowded to more sparsely populated areas. However this has often been done without the benefit of detailed ecological surveys to determine whether the land and water resources in the areas earmarked for resettlement have the potential to sustain increased numbers of people and livestock.

Many resettlement programs have resulted in increased land degradation and continued rural poverty. Resettlement should only proceed once detailed land capability assessments have shown the area to be suitable, and the necessary support services are in place to provide the settlers with the technical advice and financial support required to pursue profitable land use enterprises without degrading the local ecosystem resources.

- (v) **Non-farm employment:** The PRC needs to create 15-20 million non-farm jobs each year within the rural, urban and industrial sectors to absorb new labour market entrants, re-employ redundant workers from state-owned enterprises, and allow some of the 150 million surplus rural labourers to exit the agriculture sector. Ultimately increasing non-farm employment opportunities represents one of the best long term solutions for reducing pressure on the vulnerable land and water resources of the drylands of the PRC.
- (vi) **Resource exploitation:** High economic growth within the PRC's industrial and commercial sectors has substantially increased pressure within the north-western region for the exploitation of its natural mineral resources. However much of the large-scale industrial development required to exploit these resources: (i) is located in remote and generally water-deficient areas; (ii) fails to follow satisfactory environmental management standards; (iii) has failed to balance the water usage needs of both the industrial and agriculture sectors; and (iv) has seen little of the profits made channelled back into dryland conservation.
- (vii) **Irrigation:** The continual expansion of irrigated agriculture within the drylands has further depleted limited surface and groundwater resources. Insufficient attention has been given to increasing the productivity of dryland farming through the development and promotion of water saving, and water harvesting, techniques and other crop and land management practices that could increase effective rainfall while reducing the volume of water required for irrigation. Poor irrigation practices have not only resulted in aquifer depletion, but have also increased salinity, which in turn has reduced crop production and water quality. Low water prices provide little incentive for farmers to adopt water efficient irrigation techniques.

## **B. Internationally Supported Projects**

33. A number of international agencies have worked in partnership with the government to improve natural resources management within the drylands. Internationally supported projects have principally focused on activities related to improved dryland agriculture, forestry development, grassland improvement, and multipurpose water resource management, including irrigation and flood control. Examples from the past decade include: (i) World Bank (WB) Loess Plateau Project in Sha'anxi and Gansu Provinces; (ii) Federal Republic of Germany support for the Three Norths Afforestation Program; (iii) Government of Australia support for the Qinghai Natural Resources Management Project and Alxa League Environmental Rehabilitation and Management Project in Inner Mongolia; (iv) Canadian Government support for sustainable agriculture and grassland improvement in Inner Mongolia; (v) Government of Japan support for water-saving irrigation in Gansu and Xinjiang and Loess Plateau reforestation in Shaanxi, Inner Mongolia and Ningxia; (vi) United Kingdom support for the Water Sector Development Project in Gansu Province; (vii) Swedish Government support for Water Use Efficiency in Shaanxi; (viii) UNDP support for Development of Capacity to Save Water Use Efficiency in Ningxia and the Yellow River Basin; (ix) UNEP/GEF Nature Conservation and Flood Control in the Yangtze River basin; (x) Belgian-supported Afforestation, Forestry Research, Planning and Development in the Three North Region; (xi) FAO technical support through projects relating to forestry, agroforestry, conservation agriculture, salinity control and the GEF/UNEP/FAO project "Land

Degradation Assessment in Drylands", which covers six western province; (xii) GTZ-support for Combating Desertification in Ningxia; and (xiii) UNDP's Grassland Rehabilitation project in Hebei and Inner Mongolia. The total value of grants provided by international donors, under the Ninth and Tenth Five Year Development Plans is estimated to be \$100 million, whereas loan-funded projects under these plans is estimated to be in the range of \$ 50 million-\$100 million. Some of their best features – including participatory approaches to sustainable land management, bottom-up target setting and local community ownership – have typically not been replicated into the Government's programs.

34. The PRC-GEF Partnership on Land Degradation in Dryland Ecosystems has prepared a 10 year (2003-2012) country programming framework (CPF) aimed at combating land degradation, reducing poverty and conserving biodiversity through capacity building investments, and developing viable model investment projects. The CPF was approved by the GEF Council in October 2002.<sup>3</sup> The funding requirement for investment projects under the CPF is estimated at about US\$ 1.5 billion, of which GEF will provide \$150 million in grant assistance, while Government funding, concessional loans and grants will make up the remaining \$1,350 million. The CPF's initial focus (2003-2005) is on six provinces/autonomous regions<sup>4</sup> in the western region that are both national priority areas, as well as of global significance for land degradation control and biodiversity preservation. During the remaining period of the CPF (2006-2012) all western region provinces/autonomous regions will be eligible for support. Two projects have already been approved and funded under this CPF, namely: (i) the GEF/ADB supported Capacity Building to Combat Land Degradation Project; and (ii) the World Bank/GEF-supported Gansu-Xinjiang Pastoral Development Project. Several other investment projects have been proposed under the CPF for ADB loan and GEF grant funding, including: (i) the Ningxia Integrated Ecosystem and Agricultural Development Project; and (ii) the Shaanxi Qinling Mountain Ecosystem Protection Project.

35. A number of recent ADB technical assistance projects have also played a key role in developing and promoting the concepts, principles and procedures involved in an integrated strategic approach to improved dryland ecosystem management, specifically: (i) TA 3548: *National Strategies for Soil and Water Conservation*; (ii) TA 3663: *Optimizing Initiatives to Combat Desertification in Gansu Province*; (iii) TA 3657: *PRC-GEF Partnership on Land Degradation in Dryland Ecosystems*; and (iv) TA 3708: *Proposal for the Yellow River Law*. Under the auspices of the CPF and with the support of the GEF/ADB Capacity Building to Combat Land Degradation Project an international workshop was held in November 2004 with the objective of bringing together various world experts, Chinese experts and officials from central agencies and western provinces/autonomous regions, and NGO experts, to discuss and debate how integrated ecosystem management could be implemented within the drylands of the PRC.

36. Through such projects the PRC has been introduced to a number of international best practices (technologies and approaches) for improved dryland natural resource management, including the concept of integrated ecosystem management. However the experience gained has yet to be mainstreamed within the domestic funded program, in part

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<sup>3</sup> The CPF involves 11 key central agencies, including National Development and reform Commission, Ministry of Finance (the executing agency), Ministry of Agriculture, Ministry of Water Resources, Ministry of Land and Resources, State Environmental Protection Agency, Chinese Academy of Sciences, Ministry of Science and Technology, Legislative Work Committee of the National People's Congress, Legislative Affairs Office of the State Council and the State Forestry Administration. A steering committee chaired by the Vice-Chair of the Committee on Population, Resources and Environment of the Chinese People's Political Consultative Congress, directs the work program. A project coordination office is located in the Ministry of Finance, and a project management office is located in the State Forestry Administration.

<sup>4</sup> Namely Gansu, Inner Mongolia, Ningxia Hui, Qinghai, Shaanxi and Xinjiang Uygur covering a population of approximately 120 million.

because there has been limited sharing of experience between the international funding agencies, as well as with the government executing sectoral agencies. As in the domestic program, the lack of any formal coordination, between the international supported projects, has often resulted in duplication of effort, conflicting interests, promotion of opposing methods, and contradictory outcomes. There are lessons that can be learnt from both the domestic and international programs which should serve as the basis for the development of a new approach for managing the PRC's drylands.

37. Taken together, the efforts of the domestic program and the international supported projects have been piecemeal, fragmented and inefficient, and unable to satisfactorily arrest land degradation and improve the condition of the country's dryland ecosystems. The PRC therefore must look for new solutions for the problems of the drylands. In seeking these it can draw on the experiences of other countries that have developed successful integrated sustainable land management recovery programs in response to intense periods of severe degradation in their own dryland landscapes.

### **III INTERNATIONAL DRYLAND MANAGEMENT EXPERIENCE**

38. Australia, the United States, and Canada, are three countries that have experienced severe land degradation and ecosystem damage within their drylands, as a result of poor land use practices, and inappropriate government policies. Through a process of trial and error each country developed its own successful recovery program for integrated natural resource and ecosystem management. Various aspects of the recovery programs adopted by these countries are applicable to the PRC.

#### **A. Australia**

39. Approximately 80% of Australia is arid and semi-arid dryland. From the 1930's to 1960's Australia's dryland ecosystems experienced severe degradation from the effects of over-clearing of indigenous vegetation, rapid expansion of cultivation practices, and excessive irrigation development. Major ecological problems that resulted included severe wind and water erosion, water logging, nutrient decline, and loss of biological diversity, soil structure decline, vermin and weed infestation and salinization of water and soil. The Australian landscape is geologically very old and its soils are very fragile with naturally low nutrient levels. Many soil and water degradation problems were indirectly caused, or exacerbated, by government land use policies and land administrative priorities that focused on rapid land development and expansion of agricultural and forestry activity. There was little requirement to use conservation practices, and compliance and enforcement was overshadowed by the demands of domestic and international market growth.

40. Such was the diversity and intensity of the problems that it has taken the Australian landscape around forty years to successfully recover. Significantly, the response taken by the government was to replace the single-sector system of natural resource administration (where key departments of soil and water conservation, forest administration, and environmental planning were independent administrations), with an administrative system where integrated natural resource management functions became the basis for reorganising bureaucracies and their main programs. The objective was to focus on land planning and decision-making functions that enable ecosystem maintenance and improvement within Australia's main bioregions and drainage basins.

41. The period of greatest change was the 1980s-1990's when the national government, and the six sovereign states and territories, put in place various national conservation agreements, strategies and laws, that set out a common set of national ecological standards for state and local level implementation. These include standards for catchment management, water allocation (including environmental flows), biological diversity, land

degradation control, rangeland management, and conservation farming and sustainable agriculture. Local level community groups work in partnership with government agencies to design the specific land management programs that are then co-financed between the national and state governments. Major integrated natural resource management programs are financed through the Natural Heritage Trust, a national environmental fund specifically established for land conservation and sustainable management investments.

42. The main characteristics of the new approach in Australia are as follows:

- (i) A combination of national-state resource management laws covering water, soil, biodiversity, environment protection, and agriculture;
- (ii) A system of national-state resource management strategies and policies covering salinity management, river basin management, rangelands, ecologically sustainable development, and national forest areas;
- (iii) Specific transjurisdictional, or “common boundary” rules between states, especially for water trading;
- (iv) A national legislative framework (under the national Environment Protection and Biodiversity Conservation Act) with “rules” for integrated ecosystem management;
- (v) A system of bioregional-based river basin actions plans (salinity; biodiversity; flood management; environmental flows; soil erosion control);
- (vi) A series of comprehensive community participation plans.

43. The Australian Landcare movement has been at the forefront of the development of a community-based approach to the improved management of the country’s natural resources within an agricultural context. As a result natural resources management in Australia is now conducted as a partnership between government, concerned institutions, and the affected community. Government works with the community and institutions to agree on common land use standards, and to set national conservation and land management targets. The community works with the institutions to develop local and regional projects, under nationally agreed guidelines, which are then forwarded to the national government for funding. All projects are subject to monitoring and auditing for compliance with national standards.

## **B. United States of America**

44. The United States experience parallels that of Australia in many ways. In the 1930-1940 period the Great Plains area of the USA was severely damaged by wind erosion, dust storms and sedimentation. The main causal agent was the vigorous land settlement policy under the national Homestead Act, which encouraged land clearing and excessive cultivation without any requirement to follow conservation farming techniques. The Great Plains of the USA were fully settled by the onset of the severe drought of the 1930's, and farmers were under substantial pressure to produce food for a growing population, so vast areas had been cultivated.

45. National action taken in the 1950-1960 period to rehabilitate the land began with the government purchase of degraded lands to establish permanent re-vegetation sites. The Soil Conservation Service (established in the late 1930s) rented private lands from farmers on which to demonstrate conservation practices, as well as paying farmers to apply their own practices. Under a system of local Soil Conservation Districts, local people were engaged to help farmers prepare conservation plans, through which farmers could receive financial assistance to build the required terraces, plant windbreaks and shelter belts, and undertake contour ploughing. At the national level, new agricultural policies and goals were established to maintain farm income (through crop price support schemes), control production (by controlling the size of planting areas), and provide cheap food for the domestic market and for export. In the 1980's a number of new national conservation programs were introduced:

(i) the conservation reserve program; (ii) prohibition against cultivation; (iii) prohibition against wetland destruction; and (iv) conservation compliance.

46. An integrated ecosystem approach is now applied through large-scale integrated natural resource management projects, some of which focus on major river basins. These areas contain a mixture of government owned lands (managed by the Forest Service and Land Management Bureau), private lands, and land leased from government by private owners. Ecosystems are managed under special land use plans and activities that follow procedures set down in a system of federal laws including the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA). The NEPA requires all national agencies to inform the public of any potential environmental impact, and the ESA requires the national government to determine the conservation status of all species. A species conservation and recovery plan must be prepared where the foraging pattern of livestock on the rangelands is a potential threat to habitat. Importantly, integrated ecosystem management is appropriate when opportunities or problems exist that cannot be addressed through individual action, and which involve complex environmental, social, economic and political issues that affect the whole community. Importantly, local communities drive the process, but work with experts from outside the region, under an agreed set of goals, to produce a common action plan. An important part of the process is regular monitoring of plans to determine the effectiveness of the integrated ecosystem management approach.

### **C. Canada**

47. Like the United States, Canadian agriculture was severely affected in the 1930's by major soil erosion events and rangeland degradation triggered by the collective effect of drought, economic depression, accelerated agricultural production growth and the consequences of inappropriate historic policies for the settlement and use of marginal lands. The result was not only general environmental degradation but also severe social and economic impacts on the farmers. These problems were addressed by slowly improving the information available to farmers on conservation agricultural techniques, implementation of land management programs, and some direct government action. The long-term contribution to Canadian agriculture as a result of this was the formation of a federal institution, the Prairie Farm Rehabilitation Administration along with the development of comprehensive agricultural extension services at provincial level.

### **D. Conservation Agriculture**

48. A major lesson from the Australian, USA and Canadian dryland experience is that substantial ecological and environmental benefits can be gained from adopting conservation agriculture practices. Worldwide, conventional agricultural practices, notably tillage (ploughing and harrowing), removal of crop residues and mono-cropping, are increasingly recognised as causing land degradation. Such practices have led to deterioration in soil structure, loss of soil organic matter and nutrients, increased soil erosion, reduced rainfall infiltration, increased surface runoff and flooding, air quality problems (dust), global warming and loss of biodiversity.

49. The conventional, central government 'top-down' approach to soil and water conservation in an agricultural context, has failed to get the full involvement and 'ownership' of local people, and relies heavily on engineering structures (once common in Australia, United States and Canada, and still the norm in the PRC). In contrast conservation agriculture (CA) aims to restore, sustain and enhance agricultural production through the integrated management of locally available soil, water, and biological resources, combined as required with cost-effective use of external inputs. CA also has the wider aim of contributing to conservation of the natural environment, particularly with regard to soil, water and biodiversity conservation. It is a holistic approach to agricultural production based on

enhancing natural soil biological regeneration processes involving: (i) improved soil organic matter management for the efficient use of rainfall, soil moisture and plant nutrients; and (ii) the maintenance of soil physical properties through keeping mechanical tillage to the absolute minimum required for direct planting/seeding. The following interrelated criteria distinguish CA from conventional agricultural systems: (i) reduced or zero tillage; (ii) permanent soil cover (plant residues and/or cover crops); (iii) crop rotation; and (iv) minimal in-field traffic. Other activities implemented in conjunction with these practices include routine monitoring of soil condition, improving farmer's ecological knowledge and land management skills, forming local 'conservation farming' community groups and developing effective national farmer led organisations. All of these work better through an integrated system of decision-making and cooperative responsibility.

50. Over the last 20 years considerable experience has been gained with CA in Latin America, North America, Australasia, central Asia and Africa. This has led to the development of a range of technologies and their adaptation for: (i) large, medium to small farm sizes; (ii) different soil types; (iii) different cropping systems; and (iv) a range of tropical, sub-tropical and temperate climatic zones. Currently CA is practised in an estimated 90 million ha of lands, worldwide (Canada 4.1 million; USA 22.4 million; Brazil 17.3 million; Australia 9 million; Paraguay 1.3 million; Argentina 17 million; rest of world 2.3 million). A recent review for the PRC notes 700,000 hectares of CA demonstration sites, country-wide.<sup>5</sup>

51. Farmers in the dryland parts of the PRC suffer from very similar problems to those that drove farmers, in the USA, Brazil and elsewhere, to look for, and develop, alternative sustainable and productive land management practices. Hence the rationale for developing CA systems, and the guiding principles and practices of CA, also apply to the PRC. Whereas the PRC has experience with all the key components of CA, they have yet to be integrated into sustainable cropping systems that can be adopted by Chinese farmers. The PRC has the opportunity to benefit from the growing body of international experience with conservation farming and integrated resource management practices. There are many international farmer groups and international support agencies, that can provide information on a range of CA practices, farm implements and other input needs. Information is also available on the ecological and economic benefits of CA at the farm (reduced labour, increased yields, decreased chemical input use, reduced erosion), community (reduced migration, increased income, food security, reduced infrastructure damage), watershed (better water quality, reduced flooding, increased bio-diversity), and global (carbon sequestration, less pollution, reduced land degradation) levels.

## E. Regional Planning

52. International experience also includes the development of regional planning techniques for the design and implementation of integrated natural resource and ecosystem management programs in dryland environments. They are all based on a multi-sectoral approach requiring the cooperation and active involvement of many specialist technical and planning agencies. In the case of the PRC regional planning would need to include not only such technical agencies as the MWR, SFA, MoA and SEPA, but also those with a planning and policy remit such as the Ministry of Land Resources, MOF and the NDRC. Of particular interest are the following two regional planning approaches:

- (i) **A 'bioregional' approach:** which focuses on planning and managing the protection of ecosystem services and biodiversity at the bioregional scale. A bioregion is a geographic area that, on the basis of its ecology and community and government

<sup>5</sup> McGarry, Des, 2005. "Current Status" of Conservation Agriculture in the PRC. Preliminary report for the OP12 Partnership. ADB. This report is being further developed and a final report will be available by mid-2005.

structure, forms an appropriate unit for land planning and decision-making. The drylands of the western region could be considered as one bioregion.

- (ii) **An eco-region approach:** which considers the conservation of large units of land or water that have a characteristic set of species, communities, dynamics and environmental conditions. Examples of distinct Chinese dryland eco-regions requiring special conservation techniques would include the Loess Plateau and the Tarim Basin.

53. Each approach shares a core vision of integrating the management of natural resources and ecosystems with agricultural, livestock and/or forestry development. They focus conservation actions on ecotypes and natural areas that have important environmental values, crucial to the maintenance of dryland ecological functions and to the inhabitants of the dryland region. At the same time, these approaches recognise the need to define and accommodate human livelihood activities that are both economically viable and ecologically sustainable.

#### **IV INTEGRATED ECOSYSTEM MANAGEMENT AS AN ALTERNATIVE APPROACH FOR THE PRC**

##### **A. The Integrated Ecosystem Management (IEM) Approach**

54. Experience from around the world, including from within the PRC, shows that it is possible to address the inter-linked problems of land degradation and rural poverty through the adoption of an integrated ecosystem management (IEM) approach. IEM is a holistic scientific approach, that is based on an integrated understanding of: (i) the natural resource characteristics of individual ecosystems (climate, soils, water, plants and animals); (ii) the environmental functions and services provided by healthy ecosystems (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, bio-diversity preservation etc); and (iii) the constraints to, and opportunities for, the sustainable utilisation of an ecosystem's natural resources to meet peoples' welfare and economic needs (eg. for food, medicine, fuel, shelter, income, communication, recreation). It thus represents an ecological approach to natural resource management that aims to ensure productive and healthy ecosystems by integrating social, economic, physical, and biological, needs and values.

55. IEM recognizes that people and the natural resources on which they depend, directly or indirectly, are inextricably linked. Rather than treat each resource in isolation it offers the option of treating all elements of ecosystems together in order to obtain multiple ecological and socio-economic benefits. For planners, advisers, researchers, and the land users themselves, IEM requires the integration of both natural and social sciences disciplines, rather than keeping them in separate compartments. It involves problem solving by combining knowledge from a diversity of disciplines, such as agronomy, animal husbandry, silviculture, ecology, sociology and economics. This provides the key to a better understanding of the natural properties of ecosystems (and society's dependence on them), and the social, economic and political factors that contribute to their disturbance, only then is it possible to determine the appropriate technical, policy and institutional requirements for their productive and sustainable use.

##### **B. Some IEM Principles**

56. The following key IEM principles are complementary and interlinked:

- (i) **Ecosystem resource management objectives are a matter of society's choice** - Different sectors of society view ecosystems in terms of their own economic, cultural

and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.

- (ii) **Management should be decentralised to the lowest appropriate level** - Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation, and use of local knowledge.
- (iii) **Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems** - Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.
- (iv) **IEM should be undertaken at the appropriate scales** - The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the interaction and integration of genes, species and ecosystems. Hence it may be necessary to define the management scale beyond the boundaries of a single habitat type, conservation area, political or administrative unit, in order to encompass an entire ecosystem.
- (v) **IEM planning should be flexible and adaptive** - Ecosystems can change naturally over time, including species composition and abundance. Likewise the human pressures on ecosystems will change in response to changes in the wider socio-economic environment. IEM planning should be flexible and adaptive in order to anticipate and cater for such changes and disturbances, and to be able to respond to new information and experience gained. It should seek to avoid making management decisions that may unnecessarily foreclose future options, while at the same time, considering any mitigating actions that may be required to cope with long-term changes, such as climate change.
- (vi) **IEM should seek the appropriate balance between, and integration of, conservation and use of biological diversity** - Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which humanity ultimately depends. Instead of managing components of biological diversity either as protected or non-protected, the need is to shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.
- (vii) **IEM should involve all relevant sectors of society and scientific disciplines** - Most problems of biological-diversity management are complex, with many interactions, side-effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.

### **C. Rationale for the Adoption of the IEM Approach in the PRC's Drylands**

57. The IEM approach offers the PRC a new way to plan and manage the natural resources within its drylands. It also provides an integrated planning approach within which to develop the legal, policy, institutional, and socio-economic systems required to support the sustainable utilisation of dryland ecosystem resources. The overall rationale for the PRC to adopt the approach, is that IEM serves as the basis for greater efficiency and sustainability:

- (i) coordinating across different sectors by recognising common concerns, establishing common goals, and exploiting the synergistic benefits of working together on the identification, design and implementation of common dryland ecosystem management programs;
- (ii) reaching cross sectoral agreement on a common set of ecological and land use management standards, as well as clearly defined targets for improving the ecological and economic situation within the drylands over time;
- (iii) achieving cross sectoral consensus on investment project and program planning priorities for individual ecosystems and the drylands as a whole – therefore achieving considerable cost savings;
- (iv) incorporating socio-economic concerns into natural resource management, so as to promote equity within the community and address the link between poverty and land degradation;
- (v) bringing together the scientific knowledge of technical experts and the indigenous local knowledge of rural communities to find locally appropriate solutions to dryland ecosystem management problems;
- (vi) developing a comprehensive understanding of the ecological and socio-economic situation within the drylands through improving the sharing of information between different sectoral agencies;
- (vii) monitoring and evaluating the effectiveness of different improved dryland management field activities and investment programs, using a common set of ecological and socio-economic verifiable indicators and success criteria.

### **D. Requirements for the Adoption of the IEM Approach in the Drylands**

58. The successful adoption and implementation of a 'made in the PRC' IEM approach for solving the land degradation problems of the country's drylands will require effective coordination at all levels of society (national, provincial/region, county, communities, individuals). It will need to be underpinned by an integrated decision-making procedure, enhanced sectoral awareness and institutional capacity, and multi-stakeholder participation.

59. Based on the experience of other countries, the development and adoption of a PRC specific IEM approach would take some time and should be considered as a staged approach. The required activities would include:

- (i) Awareness raising and capacity building amongst the concerned sectoral agencies;
- (ii) Developing effective institutional coordination mechanisms and consensus agreement, amongst the institutional stakeholders, on the problems and methods for addressing them;

- (iii) Community level participatory awareness raising, to explain and promote the approach amongst the land users and other private sector stakeholders;
- (iv) Incorporating IEM concepts and principles into the laws, regulations and policies for land degradation control;
- (v) Establishing reliable methods for assessing land capability and land use suitability as the basis for future land allocation and land management and protection schemes;
- (vi) Reorganising research to improve the scientific knowledge on integrated ecosystem resource management techniques;
- (vii) Building the capacity of government and private sector advisory support service providers to meet the needs of the land users for the advice and information, equipment and seasonal inputs, required for the adoption of conservation agriculture and other sustainable ecosystem management practices; and
- (viii) Adapting or establishing new monitoring and evaluation systems that can reliably measure the adoption and benefits of improved natural resource management (eg, growth in adoption of conservation agriculture practices), and changes in the ecological condition of the dryland region.

60. One key element for the successful adoption of an IEM approach for the drylands is awareness and education. This would require the government, as part of a national IEM strategy, to develop a comprehensive education and information program outlining the role and benefits of IEM for all levels. The program should target the provincial and local government administration, private enterprise, farmers and herders, and provide them with information on the practical and economic benefits of an integrated way of thinking about ecosystem management, with the aim of creating a land stewardship ethic. In this regard the PRC could adapt lessons learnt from the experience of the Australian Landcare movement, and other community driven efforts from North America and Asia. Landcare started locally, but grew into a national movement entirely from the grass roots level. Once Landcare had the involvement and support of national farmer organisations, the government stepped in with major financial and investment packages.

#### **E. A National IEM Strategy for the Drylands**

61. The presentations and discussions during the International IEM workshop, held in Beijing 1-2 November 2004, highlighted the need for a national IEM strategy for the PRC's drylands. Such a strategy should guide the formulation of, and be implemented through, the 11<sup>th</sup> Five Year Plan. The strategy should focus on: (i) the aims and objectives of improved dryland ecosystem management; (ii) dryland management policy making procedures; (iii) improvements needed to existing national laws and regulations so as to incorporate the essential elements required for IEM; (iv) primary standards for land management; (v) targets for land degradation control; (vi) priority land management programs; (vii) methods for promoting community participation; (viii) the supporting role of international agencies; and (ix) financing arrangements. Under such a strategy IEM would be expected to become a principal aim and objective of any national and/or provincial natural resource management programs undertaken within the drylands (eg, for dryland farming development, grassland rehabilitation, wetland management, desertification control, watershed management, biodiversity protection, and poverty alleviation). The strategy would also provide a basis for natural resource management standards and targets to be utilised in the procedures for allocating finance for individual resource management programs.

62. As formal government policy, the goals, concepts and principles of IEM could be used to underpin environmental law and policy reform procedures at the national and provincial levels (eg, procedures for EIA should consider the potential impact of developments on ecosystem stability). The strategy would also serve as the basis for re-evaluating the national action plans for the implementation of the UN Conventions on Biological Diversity and Combating Desertification, to ensure they adequately take into

account the needs of a multi-sectoral and integrated approach to dryland ecosystem management.

#### **F. Role of the Different 'Actors' in IEM**

63. An IEM strategy would need to identify the different 'actors' with responsibility for various IEM related activities and functions at different levels, including: (i) **national level** (State Council, National People's Congress, central agencies - state level policy and law, auditing, financing); (ii) **provincial level** (Vice-Governors, provincial agencies and bureaus - provincial level policy and regulations, project development, implementation, auditing); (iii) **local government level** (county and township officials - project development, implementation); (iv) **community level** (village officials, community and non-government organisations, private sector traders, schools, conservation groups - support services, education); and (v) **farm/rural household level** (farmers, herders, rural workers - use of conservation agriculture practices).

64. An IEM strategy would need to identify the role of the different actors in improved dryland ecosystem management and determine their specific responsibilities. In particular with regard to responsibility for the following:

- (i) Preparing detailed information on land degradation status, land capability and land use suitability as the basis for developing natural resource use standards, and targets, for land degradation control and ecosystem utilisation and protection (from a bioregional to local scale);
- (ii) Setting natural resource management standards that can be applied during law-making and law enforcement;
- (iii) Developing a procedure for transferring international ecological standards into a system of dryland land management strategies;
- (iv) Developing education and awareness programs on the benefits of IEM;
- (v) Developing the tools, procedures and institutional capacity for 'bottom-up' community-based participatory planning;
- (vi) Developing information systems for recording ecological and agricultural land use changes;
- (vii) Preparing environmental impact assessment procedures that can properly evaluate the impact of development proposals on dryland ecosystems;
- (viii) Developing plans for exploiting eco-tourism potential in dryland areas without compromising ecosystem stability;
- (ix) Developing research programs focusing on the specific ecosystem protection and management needs of dryland areas; and
- (x) Defining the land use rights, and stewardship responsibilities, of those who depend on using dryland ecosystem resources to meet their livelihood needs.

#### **G. Priority Actions**

65. The PRC faces many challenges in successfully adopting the IEM approach. Overcoming these will require intervention in a number of priority areas, including:

- (i) **Improving knowledge of the natural resource base of the drylands:** There is a priority need to share information between agencies in order to have a comprehensive understanding of the status of all forms of land degradation within the drylands. There is also a need for good quality natural resource data that can be used as the basis for determining land capability and land use suitability within individual dryland ecosystems. Such information should serve as the basis for developing area specific standards for sustainable natural resource use and realistic targets for land degradation control and ecosystem protection programs;

- (ii) **Understanding ecosystem limitations:** It is important to understand the bio-physical limitations, as well as any local socio-economic constraints, when seeking to change the way particular dryland ecosystems are currently managed. Restoring, sustaining and enhancing an ecosystem's productive and protective functions requires information on the characteristics and qualities of the land resources (soils, water, vegetation, climate etc) and determining the extent to which they match the production, management and conservation requirements of different land uses.
- (iii) **Assessing environmental impact:** Programs that involve major changes in the utilisation of particular ecosystems need to be properly assessed as to their environmental impact, both within and outside the ecosystem. While closure and resettlement, may result in improved ecological stability within the targeted ecosystem, the overall environmental impact could be negative if the end result is to increase land use pressure on another fragile ecosystem (eg. resettling people from mountain areas into the desert margins). Hence the need for good environmental impact assessment procedures to be developed and used in IEM programs;
- (iv) **Mitigating the impact of non-renewable natural resource exploitation:** Exploitation of the western regions geological resources, needs to be undertaken in ways that will not impact negatively on renewable land use development (eg. crop, livestock and tree production) and bio-diversity conservation objectives;
- (v) **Improving social equity:** It is important to ensure that the costs and benefits from particular IEM technical and policy interventions are shared equitably between, and within the affected rural communities. Particular attention needs to be given to ensuring disadvantaged groups (ethnic minorities, the poor, women etc) enjoy equal rights of access and usage of natural resources and that they have equal opportunities to benefit socially and financially from the improved management and/or protection of their local ecosystem resources;
- (vi) **Generating greater public transparency:** While government at the central, provincial and local levels has to take a leadership role, in the planning and implementation of IEM programs, public transparency requires that they be receptive to the needs of the people so that IEM field level activities are demand driven and community-based;
- (vii) **Creating greater access to information:** The widespread adoption of IEM practices requires that the public has access to adequate knowledge on the concepts and principles involved as well as information on specific improved ecosystem management technologies. This requires the development of appropriate public information, education and communication programs as well as effective government and private sector advisory support services;
- (viii) **Improving ecosystem monitoring and evaluation:** There is a need to improve the current sector-based land degradation monitoring and evaluation programs. This requires the sharing of data and agreement on common assessment standards so as to be able to accurately report on the current overall degradation status, and identify changes over time, concerning the condition of the ecosystem resources within the PRC's drylands;
- (ix) **Creating access to financial resources:** There is a need for providing cost-effective rural credit services for dryland farmers in order to provide them with access to the additional financial resources they may require to pursue alternative higher value and more sustainable agricultural enterprises;

- (x) **Raising awareness through IEM forums and dialogue:** Mainstreaming the IEM approach will require raising awareness, at the national, provincial and local government levels, on what is involved and the benefits to society as a whole from its adoption. To do this requires the development of a national program of workshops, meetings and other forums for encouraging dialogue between the different stakeholders.

## V. CONCLUSION

66. If the PRC is to adopt an IEM approach, for the improved management of its dryland resources, it will be necessary to make major changes with regard to natural resource allocation and land-use planning to make the process more transparent and accountable. Greater emphasis should be placed on the economic issues at stake in the dryland environment, and the costs of the indirect damages that new developments are causing. New procedures will be required to monitor and report on the state of dryland ecosystem resources. In the development of a new approach, a greater share of the real and potential benefits from improved dryland ecosystem management and biodiversity conservation should go to those land users with primary stewardship responsibility for the land. Unless land users perceive that there are tangible social and financial benefits to be gained from changing current land management practices, they can be expected to continue to pursue land use enterprises that will produce short-term outputs while causing medium to long-term ecosystem damage.

67. An IEM strategy is needed, with an associated action program. Its aim will be to address the growing demand on the limited ecosystem resources of the dryland region in ways that are both productive and ecologically sustainable. The best way to design and implement such a strategy is to start from the bottom-up, involving participation by a sample of communities and local governments. It cannot be successfully designed or implemented from the top-down. Local ownership is vital for successful implementation. As extension/information services are currently inadequate to bridge the gap between the farmer-land user's need for advice on sustainable practices and the market's typically short term incentives for increased output, building understanding and capacity in local institutions is a vital factor.

68. The PRC-GEF Partnership on Land Degradation is currently assisting the Government to prepare such a strategy for the six most degraded dryland provinces/autonomous regions: Inner Mongolia, Gansu, Ningxia, Qinghai, Shaanxi and Xinjiang. Importantly, all participating provinces/autonomous regions have agreed that their own agencies will take the lead in developing their own IEM strategies, commencing in early 2005, with back-up support from the Partnership. Key areas of support currently being provided are shown in Table 1, with improvements in 8 key areas: (i) institutional capacity building, (ii) conservation agriculture, (iii) coordination mechanisms, (iv) the enabling environment, (v) Government/community partnerships and a 'bottom-up not top-down' approach, (vi) land assessment, (vii) farmer organizations, and (viii) applied research. These are some of the key areas where the PRC currently lags behind international best practices. From 2006-2012, the end of the Partnership period, all 12 provinces/regions of the western region will be eligible for support.

**Table 1: COMPARISON BETWEEN VARIOUS COUNTRIES AND the PRC  
GENERAL FACTORS IN RURAL LAND MANAGEMENT**

| <b>COUNTRY/<br/>FACTOR</b>                  | <b>AUSTRALIA</b>  | <b>UNITED STATES</b>  | <b>CANADA</b>   | <b>PRC</b>  |
|---|---|---|---|---|
| <b>% Rural population</b>                   | <ul style="list-style-type: none"> <li>8.4%</li> </ul>  | <ul style="list-style-type: none"> <li>21.2%</li> </ul>   | <ul style="list-style-type: none"> <li>19.9%</li> </ul>   | <ul style="list-style-type: none"> <li>62.3%</li> </ul>   |
| <b>Farm size</b>                            | <ul style="list-style-type: none"> <li>Mainly large</li> </ul>  | <ul style="list-style-type: none"> <li>Mainly large</li> </ul>  | <ul style="list-style-type: none"> <li>Mainly large</li> </ul>  | <ul style="list-style-type: none"> <li>Very small</li> </ul>  |
| <b>Conservation agriculture *</b>           | <ul style="list-style-type: none"> <li>Substantial usage</li> </ul>   | <ul style="list-style-type: none"> <li>Conservation tillage, Integrated pest management, nutrient management, conservation buffer zones</li> <li>Government policy and funding</li> <li>Environmental lobby strong</li> </ul>           | <ul style="list-style-type: none"> <li>Substantial usage</li> <li>Government policy and funding</li> <li>Environmental lobby strong</li> </ul>  | <ul style="list-style-type: none"> <li>Little usage</li> <li>Some government programs</li> <li>Government policy initiated</li> </ul>               |
| <b>Coordinating mechanisms *</b>            | <ul style="list-style-type: none"> <li>Government, farmers, community</li> </ul>  | <ul style="list-style-type: none"> <li>NGOs, Conservation Tillage Information Center, Conservation Districts, farmers, community</li> </ul>   | <ul style="list-style-type: none"> <li>Government, farmer organizations, community</li> </ul>   | <ul style="list-style-type: none"> <li>Government driven</li> <li>Low private, community inputs</li> </ul>  |
| <b>Enabling environment *</b>               | <ul style="list-style-type: none"> <li>Integrated natural resource management (INRM) laws, policies</li> <li>Government-community agreements</li> </ul>               | <ul style="list-style-type: none"> <li>INRM laws, policies</li> <li>US Government Agric Conservation Programs</li> </ul>  | <ul style="list-style-type: none"> <li>INRM laws, policies</li> <li>Farmer organisations, community input</li> </ul>  | <ul style="list-style-type: none"> <li>Sectoral laws, policies</li> <li>Low community input</li> </ul>  |
| <b>Government and partnerships *</b>        | <ul style="list-style-type: none"> <li>Works in partnership with local communities</li> </ul>   | <ul style="list-style-type: none"> <li>Works in partnership with local communities</li> </ul>   | <ul style="list-style-type: none"> <li>Works in partnership with local communities</li> </ul>   | <ul style="list-style-type: none"> <li>Government dominant</li> <li>Limited community involvement</li> </ul>  |
| <b>Role of private enterprise *</b>         | <ul style="list-style-type: none"> <li>Major interest</li> <li>Substantial private investment</li> </ul>  | <ul style="list-style-type: none"> <li>Major interest</li> <li>Substantial private investment</li> </ul>  | <ul style="list-style-type: none"> <li>Major interest</li> <li>Substantial private investment</li> </ul>  | <ul style="list-style-type: none"> <li>Minor interest</li> <li>Low private investment</li> </ul>  |
| <b>Community participation *</b>            | <ul style="list-style-type: none"> <li>High participation</li> <li>Landcare groups</li> <li>Catchment committees</li> <li>Many advisory bodies</li> </ul>             | <ul style="list-style-type: none"> <li>High participation</li> <li>Conservation districts</li> <li>Many advisory bodies</li> <li>Environmental groups influential</li> </ul>  | <ul style="list-style-type: none"> <li>High participation</li> <li>Farmer conservation groups and districts</li> <li>Advisory bodies</li> <li>Environmental groups influential</li> </ul> | <ul style="list-style-type: none"> <li>Low participation</li> <li>No formal participatory groups</li> <li>Few advisory bodies</li> </ul>            |
| <b>Land assessment *</b>                    | <ul style="list-style-type: none"> <li>Comprehensive coverage</li> <li>High reliability</li> <li>National / state agreed standards</li> </ul>                         | <ul style="list-style-type: none"> <li>National and state implement</li> <li>National standards</li> <li>Comprehensive</li> <li>High reliability</li> </ul>   | <ul style="list-style-type: none"> <li>Province's implement</li> <li>Provincial standards</li> <li>Comprehensive</li> <li>High reliability</li> </ul>                                     | <ul style="list-style-type: none"> <li>Low level of assessment</li> <li>Poor coverage</li> <li>Low reliability of information</li> </ul>            |
| <b>Role of farmer organisations *</b>       | <ul style="list-style-type: none"> <li>Major</li> <li>Organise markets</li> <li>Influence trade policy</li> <li>Industry standards</li> </ul>                         | <ul style="list-style-type: none"> <li>Major</li> <li>Organise markets</li> <li>Influence trade policy</li> <li>Industry standards</li> </ul>   | <ul style="list-style-type: none"> <li>Major</li> <li>Organise markets</li> <li>Influence trade policy</li> <li>Influence industry standards</li> </ul>                                   | <ul style="list-style-type: none"> <li>Minor</li> <li>Government organises</li> <li>Government sets trade policy</li> </ul>                         |
| <b>Rural education and information</b>      | <ul style="list-style-type: none"> <li>Major government investment</li> <li>Well educated</li> <li>High variety of information sources</li> </ul>                     | <ul style="list-style-type: none"> <li>National funded</li> <li>Well educated</li> <li>Good variety of information sources</li> </ul>   | <ul style="list-style-type: none"> <li>Federally, provincially funded, plus business</li> <li>Well educated</li> <li>Good variety of information sources</li> </ul>                       | <ul style="list-style-type: none"> <li>Low level of education</li> <li>Poor and inconsistent information sources</li> </ul>                         |
| <b>Monitoring and evaluation *</b>          | <ul style="list-style-type: none"> <li>High coordination</li> <li>State of environment reports</li> <li>Environmental auditing</li> <li>National standards</li> </ul> | <ul style="list-style-type: none"> <li>High coordination</li> <li>Conservation Tillage Information Center, USDA Natural Resources Conservation service</li> <li>State of environment reports</li> <li>Environmental auditing</li> </ul> | <ul style="list-style-type: none"> <li>Medium coordination</li> <li>National system being developed</li> <li>State of environment reports</li> <li>Environmental auditing</li> </ul>      | <ul style="list-style-type: none"> <li>No coordination</li> <li>Various centres, few links</li> <li>No national environment reporting</li> </ul>    |
| <b>Research *</b>                           | <ul style="list-style-type: none"> <li>Government &amp; private partnerships</li> <li>Driven by community needs</li> <li>Results publicly published</li> </ul>        | <ul style="list-style-type: none"> <li>Agric experiment stations, USDA sustainable agric research program</li> <li>Community involvement</li> <li>Results publicly published</li> </ul>   | <ul style="list-style-type: none"> <li>Government &amp; private partnerships</li> <li>Driven by sector priorities</li> <li>Results publicly published</li> </ul>                          | <ul style="list-style-type: none"> <li>Government dominant</li> <li>No community involvement</li> <li>Much research not widely published</li> </ul> |
| <b>Government subsidies to rural sector</b> | <ul style="list-style-type: none"> <li>None in major industries</li> <li>Good tax benefits</li> </ul>   | <ul style="list-style-type: none"> <li>Substantial to major industries<sup>6</sup></li> <li>High tariffs</li> </ul>   | <ul style="list-style-type: none"> <li>Some subsidies</li> <li>Good tax benefits</li> <li>Low tariffs</li> </ul>  | <ul style="list-style-type: none"> <li>Some subsidy in specific industries, eg, grain, but decreasing</li> </ul>                                    |

<sup>6</sup> US\$ 16.4 billion in 2003, Environmental Working Group Farm Subsidy Database.

|                           |   |   |   |   |
|---------------------------|---|---|---|---|
|                           | <ul style="list-style-type: none"> <li>• Low tariffs</li> </ul>   | <ul style="list-style-type: none"> <li>• Good tax benefits</li> <li>• Conservation incentives</li> </ul>    | <ul style="list-style-type: none"> <li>• Conservation incentives</li> </ul>   | <ul style="list-style-type: none"> <li>• trend</li> <li>• Major environmental funding to forestry</li> </ul>  |
| <b>Financial services</b> | <ul style="list-style-type: none"> <li>• Substantial sources</li> <li>• Good information sources</li> </ul>   | <ul style="list-style-type: none"> <li>• Substantial sources</li> <li>• Good information sources</li> </ul> | <ul style="list-style-type: none"> <li>• Substantial sources</li> <li>• Good information sources</li> </ul>                             | <ul style="list-style-type: none"> <li>• Minimal sources</li> <li>• Poor information sources</li> </ul>   |
| <b>Extension services</b> | <ul style="list-style-type: none"> <li>• Substantial government</li> <li>• Good private enterprise</li> </ul> | <ul style="list-style-type: none"> <li>• Moderate government</li> <li>• High private</li> </ul>             | <ul style="list-style-type: none"> <li>• Moderate government</li> <li>• Moderate private enterprise and non-government orgs.</li> </ul> | <ul style="list-style-type: none"> <li>• Dominant government: many staff, little funding, weak mandate</li> <li>• Private enterprise extension beginning</li> </ul> |

\* Areas where the PRC-GEF OP12 Partnership on Land Degradation in Dryland Ecosystems (phase 1, 2003-2005) is assisting the central Government and Inner Mongolia, Gansu, Ningxia, Shaanxi, Qinhai and Xinjiang. In the second phase, 2006-2010, corresponding to the 11<sup>th</sup> Five Year Plan), the Partnership will broaden its assistance to include all 12 provinces of the western region.