4. DEMONSTRATION PROJECTS FOR THE PREVENTION AND CONTROL OF DUST AND SANDSTORMS

4.1 Rationale

DSS has an enormous damaging effect on the environment, economy, and society in the countries of the Northeast Asian region. The cost of damages is, by and large, a function of the intensity of DSS events as well as the values at risk. Direct damage cost caused by DSS include loss of crops and livestock, loss of topsoil, damage to property, industries and businesses, critical facilities and infrastructure, disruption to transportation systems, road accidents, and closures of schools and services. Indirect damage cost of DSS include: increased medical costs, impact on human health, costs of cleaning residential and commercial buildings, repair and reconstruction costs, and wear and tear on machinery and equipment due to DSS. Chinese researchers[1] estimated that land degradation costs their nation approximately US$6.7 billion each year, and the indirect costs of damages are 4.5 times that of the direct costs. The costs of damages associated with DSS in the PRC alone are estimated to range from US$70 million to US$239 million per year.

Stepping up DSS prevention and control is justified, given the enormous damage costs by DSS and the urgent need to reduce the frequency and severity of DSS. The benefits of anti-DSS efforts include the reduction in economic losses and the restoration of damaged ecosystems. Above all, the most important benefits are the higher standards of living for millions of people in the DSS source areas and pathways as well as the improved public health and safety in all DSS-affected areas. First and foremost, the impact of DSS on human health is of great concern in DSS source areas as well as along the DSS transport routes downwind. Given the high population density of metropolitan centers, health concern with DSS is particularly high.

4.2 Lessons Learned

Mongolia and the PRC have formulated their respective National Action Programs to combat desertification. Due to political commitment and increase in budgetary allocations to desertification control on the part of the central government in each country and technical and financial assistance from a number of donor agencies, some best practices and mitigation approaches have emerged, and a few lessons have been learned as follows:

- The realization that DSS is non-point source and serious transboundary environmental problem, which requires an integrated regional approach. Moreover, a coordinated regional approach is needed in tandem with national initiatives.
- There is need to undertake interventions and remedial actions on a scale that is commensurate with the scale of the DSS–source areas.
- A cross-sectoral approach in combating desertification is more likely to achieve desired results. Likewise, undertaking one activity in isolation (e.g., only the planting of trees) will not solve the DSS problem.
- It is essential for all stakeholders (particularly the local community in the source areas) to work together for DSS reduction. Varying responsibilities are required from the national government, local governments, and local communities.
- It is possible to develop packages of measures that can be applied at reasonable cost over large areas.

[1] Lu Qi and Wu Bo, 2002 Population, Resources and Environment in China 12(2): 29-33.

4.3 Investment Strategy for Demonstration Projects

In the context of existing international, regional and national frameworks for the control of land degradation, environmental protection, and sustainable development at large, an investment strategy for DSS prevention and control is being proposed. The strategy aims at safeguarding the environmental, economic and social sustainability of the Northeast Asian region at a broad level, and envisages improving the health, safety and welfare of the peoples in DSS source areas, pathways and impacted downwind locations. The goals, priorities and scope of investment strategy have been proposed taking into consideration:

- Feasibility;
- Affordability;
- Sustainability;
- Novel approaches and methodologies; and
- Ongoing policy/institutional initiatives.

The situation in the PRC and in Mongolia is somewhat different. Therefore, the investment component of the strategy for each country will be quite different. The PRC is a partner with ADB/GEF under OP12. Over the next 10 years US$1.5 billion will be spent on projects aimed principally at combating land degradation and alleviating poverty. The aims of this effort are complementary with the aims of the DSS prevention and control proposal. Therefore, the PRC should align and tailor its program of evaluating the actions/measures to prevent and control DSS in line with the projects being developed under GEF's OP-12. Moreover, the resolution of *cross boundary issues* requires further international cooperation to augment the bilateral programs and partnerships.

Interventions and actions under the investment strategy to be undertaken on a scale that is commensurate with the size of the DSS source areas and values at risk in DSS-impacted areas. A package that comprises a hierarchy of measures at national/provincial and local levels needs to be designed as follows:

- administrative and policy measures that are applicable over an entire administrative unit and may require action at national or provincial level; and
- measures restricted to specific sites.

Elements of the package in the first category may include the revision of legislative, policy and administrative regulations to relieve the pressures that cause land degradation, technical measures for revegetation of degraded lands using methods such as grassland fencing and exclusion of grazing, and capacity building, training and extension services. Many of the technical approaches are proven to be effective in reducing DSS, but the optimum combination of elements needs to be determined. In the second category measures will be unique to specific field sites although some of these may be applied across a range of ecological conditions.

4.3.1 Selection of Demonstration Sites

In tackling the identified anthropogenic factors in DSS source areas, initially, attention will need to be given to focus areas and, in the interests of cost effectiveness, a demonstration project approach is recommended. The rationale for adopting a demonstration project approach in focus areas is threefold. *First*, the projects are relevant to government mandates, and they can be aligned with existing and emerging priorities of the government and responsive to other related issues, such as public health and safety. *Second*, they can be designed and programmed to suit diverse local conditions, operational requirements and

the availability of financial resources and implementation capacities. *Third*, they help provide value adding and generating results within a reasonable timeframe - the demonstration sites will serve as a test bed for evaluating the appropriateness of the technical measures, innovative trials, and institutional arrangements and policies.

The choice of the focus areas for the demonstration projects is the responsibility of the respective governments in the PRC and Mongolia. The selection of these areas should follow a set of criteria as outlined in the table below.

Table 4.1 Criteria for Selecting Demonstration Project Sites

	Criteria
General	• Criteria should be general enough to be used for future project development. • A guiding principle is that land in the process of degradation should be included in the chosen sites. • The project design should entail a comprehensive, integrated approach. • The demonstration projects should have synergy with ongoing work undertaken by local government and communities. • Local stakeholders should be involved in site selection and project implementation, that is, using a bottom up approach. • The recommended sites should be incorporated into each country's NAP. Alternatively, the recommended demonstration projects could be associated with key areas of provincial-level projects that tackle the same issues. • Local experiences and achievements in both technical and policy aspects of land management will be especially valuable in selection and design of the demonstration projects. • These sites must be located in DSS source areas or along the pathways and have an acceptable level of accessibility to the site from abroad. • The demonstration sites should be representative of different natural conditions
Additional	• State of land degradation should be substantial in extent and quantifiable by appropriate indicators that enable scientists to determine the original vegetation level. • Land degradation should be caused by human activity. • Land degradation is currently contributing to the increase of DSS events • Appropriate monitoring is possible to evaluate the effectiveness of DSS measures.
Specific	**Scope** - size of a project site generally greater than 10,000 ha. - components to be tested and demonstrated should be site specific. - focus areas should have a range of land forms, types and uses. - duration should be minimum of 5 years. **Purpose** - environmental - economic (cost effective) - sociological - replicable - contributing to poverty reduction. Livelihood: - The choice of livelihood should be indicated (continue to use land, not to use land, or find another livelihood for the local people; resettlement; etc.) Land Use: - Crop land: Cultivating methods, which avoid bare land between the months of February and April will be introduced. - Grazing land: Measures to avoid over-grazing will be inrtroduced. - Protected area: Enclosure, revegetation, and choice of plan species will be considered. Water Resource: - Estimation of available water resources and the distribution of limited resource will be considered. - Current water table and the appropriate level will be considered. - Control measures against over exploitation of ground water will be introduced. Estimation of the Effects: - The influence of DSS measures to the parameters, which describe dust entrainment will be quantified. - Estimation of the effectiveness of DSS measures by controlling simulation model parameters, which describe dust entrainment. Evaluation of the Demonstration: - The items and methodologies of DSS baseline data monitoring will be indicated. - Both detailed evaluation for the extent of DSS reduction and development of simple monitoring method for routine work will be needed. - Continuous (long span) monitoring to evaluate DSS reduction by using simple method will be needed.

The respective governments in the PRC and in Mongolia have nominated four focus areas within their territory and one cross-border site. Each is in a known DSS source area and/or in the pathway of DSS and all are characterized by poor ecological conditions due to a combination of natural and human-induced causes. The bio-physical, ecological, and socio-economic profile of each focus area has been described in *Volume 3 - Investment Strategy for DSS Prevention and Mitigation through Demonstration Projects* of this report. The focus areas were selected on the basis that they were representative of different ecosystems and as such presented an array of land uses, population densities, household livelihood strategies. Some actions/measures will be unique to some focus areas but others could be evaluated across a range of ecosystems. There is also a hierarchy of actions/measures. At the level of the province or *aimag* in Mongolia, there may be administrative or policy measures that apply over the whole administrative unit, whilst some actions/measures will be restricted to a specific site. Some sites will be large (10,000 ha for some rangeland components) but others such as alternative energy (wind and solar) may occupy <1 ha.

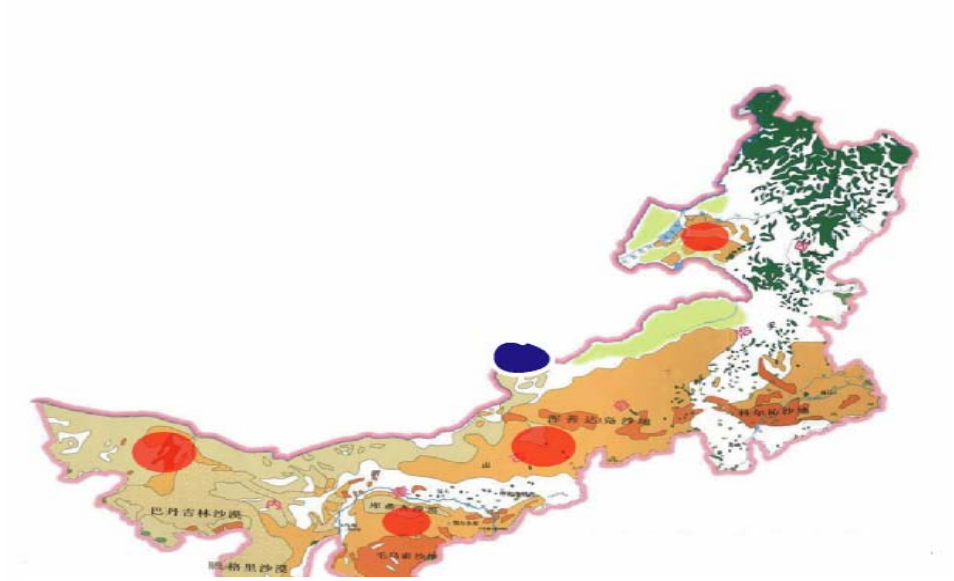
4.3.2 Proposed Focus Areas for Demonstration Projects in the PRC

Although DSS are known to originate in several places in western and northern the PRC, it was the decision of the Government of the PRC to restrict the choice of focus area for each demonstration project to Inner Mongolia Autonomous Region. The four focus areas for the demonstration projects (Alashan, Ordos Plateau, Xilingol and Hulunbuir) are located along a 1,500 km west-east transect that samples the various environments in the DSS source areas. These areas represent four important grassland ecozones, namely, Hulunbuir for mountainous meadow grasslands, Xilingol for typical grasslands, Ordos for dry grasslands, and Alashan for desert grasslands. The focus areas are those that are the degraded rangelands but are reversible, given appropriate measures and timely treatment. In the west, the Alashan area is arid (annual rainfall ranging 40-200 mm). In the Ordos area (annual rainfall ranging 190-300 mm), there is a mosaic of sandy land from source-bordering dunes along the Yellow River system, sand plains on the margins of the various deserts, and Loessal hills. In Xilingol (annual rainfall of >350 mm), there are plains with loess under a layer of sand. The grasslands of Hulunbuir are on rolling plains and the rainfall is > 300 mm. The soil is underlain with deep sand of the Quaternary age. Figure 4.1 shows the location of the PRC focus areas including the area for the cross-border demonstration project.

4.3.3 Proposed Focus Areas for Demonstration Projects in Mongolia

Four focus areas were selected in Mongolia after discussions with the government officials, scientists in research institutes, and after field visits. Each of the focus areas occupies several local administrative areas and each covers a significant range of physical and human resources. The locations, administrative boundaries and some relevant data on DSS are shown in Figure 4.2.

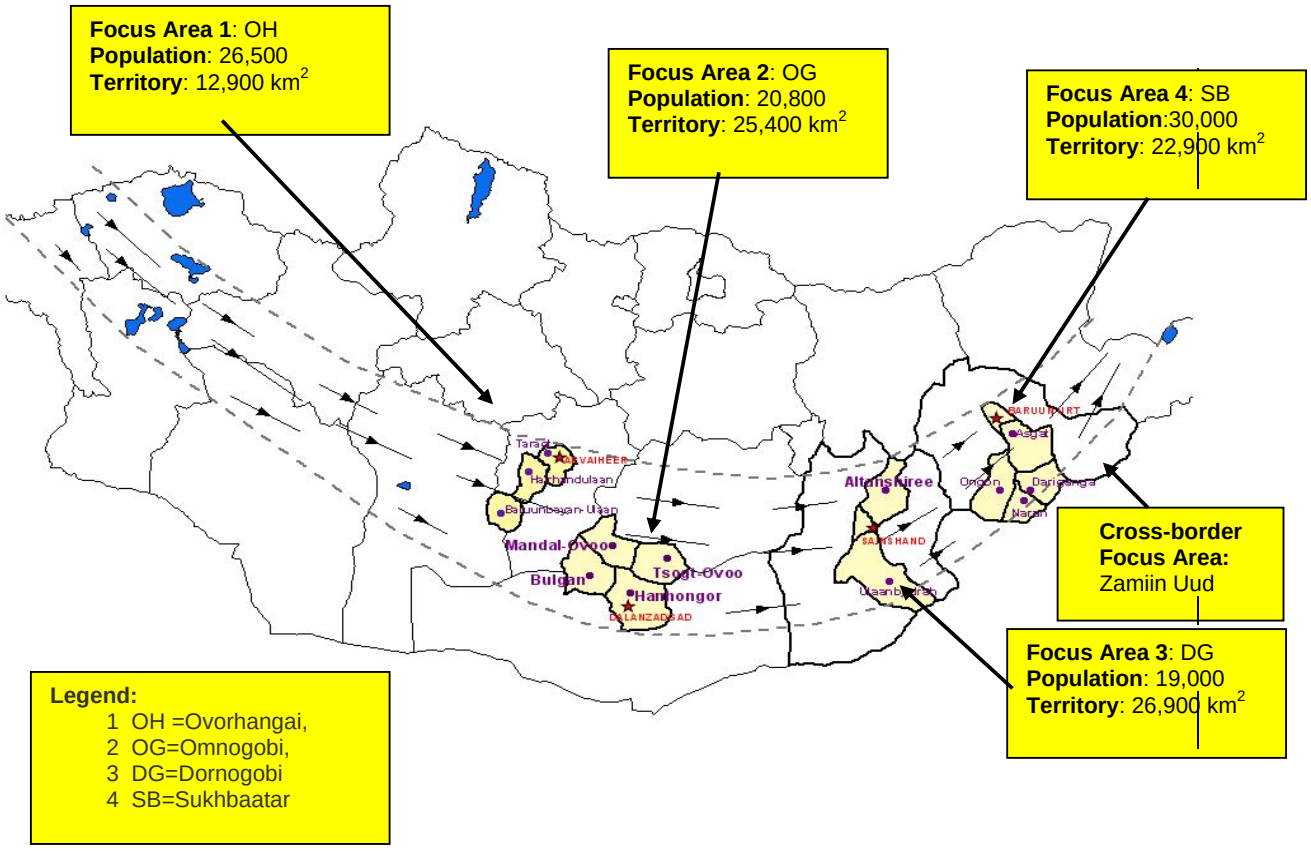
Figure 4.1 Map of Focus Areas in Inner Mongolia, the PRC



Legend:

Four focus areas in the PRC from west to east are Alashan, Ordos, Xilingol, and Hulunbuir
Cross-border focus area at Erinhot on the PRC side

Figure 4.2 Location of Focus Areas in Mongolia (including DSS path)



4.3.4 Proposed Cross-Border Demonstration Focus Area

The proposed focus area for the cross-border or sub-regional demonstration project is in the border region near Erinhot on the PRC side and Zamiin Uud on the Mongolian side (or the Erinhot-Zamiin Uud Focus Area).

Zamiin Uud focus area is located in Dornogobi *aimag*. It has a size of 12,900 km^2 and covers the entire territory of one *soum* (Zamiin Uud) It experiences the same severe climate as Erinhot and lies on the same substrate. Both communities face problems on lack of both surface and ground water. The particular challenge that the geographic location, climate, and general lack of natural resources poses have been addressed in different ways by the people on each side of the border.

In the PRC, much emphasis has been placed on ameliorating the environment through a combination of measures. The banning of grazing within a 10-km radius of the city center, planting of wind breaks and other protection forestry, and innovative uses of waste water (including sewerage) are some of the measures implemented. Technology transfer may be possible so that the Mongolian side can benefit from the lessons learned and techniques perfected by the PRC side.

There is a clear need for involvement in this subregional project by experts from the four partner countries. Potentially, the joint cross-border site should be an especially useful way to validate the ideas and approaches of many stakeholders. A training center should be established to facilitate exchange of technical know-how among the four partner countries. Likewise, a hi-tech plant nursery and plant propagation facility should be constructed. Mongolia recommended that attention be also given to fostering ecotourism with strict environmental safeguard controls in the Gobi regions on the Mongolian side as a means to provide alternative livelihood.

4.4 Proposed Activities and Investment Requirements

4.4.1 Project Activities in Focus Areas of the PRC

Table 4.2 sets out a summary of the major proposed actions/measures for each of the Focus areas in the PRC.

Table 4.2 Summary of Proposed Actions for Focus Areas in the PRC

Items \ Sites		Alashan	Ordos	Xilingol	Hulunbuir
Combating land degradation to prevent and control DSS	Prevention	Cropland conversion to forest/ grassland		Documentation of protection measures	
	Rehabilitation	Rangeland management	• Airseeding • Enclosure	Rangeland management	• Rangeland management • Enclosure
	Development	• Desert-based industries • Alternative energy sources	• Desert-based industries • Ecotourism[1]	• Artificial grassland management	• Artificial and natural grassland management • Alternative energy sources
Capacity Building to implement measures for DSS prevention and control		• Training Center for alternative skills • Capacity building for local government	Capacity building of local government	• Training Center for alternative skills • Capacity building for local government	• Training Base for grassland management • Capacity building for local government
Poverty Alleviation to reduce pressure on land and reduce dust entrainment		Solar/wind-power energy[2]	Better practices for fodder plantations	Better practices for fodder plantations	• Better practices for fodder plantations • Solar/wind power energy[2]
Social Development to improve livelihoods, reduce dependence on farming and animal husbandry, improve infrastructure		Develop off-rangeland skills		Develop off-rangeland skills	

[1] Ecotourism should be dealt within the environmental carrying capacity of the area with strict environmental safeguard controls.

[2] Introduction of renewable energy and other fuel-efficient cooking methods can reduce pressure on woody plants that should be left in place to stabilize the soil surface.

Based on the proposed actions/measures or project activities intended for each focus area in the PRC, an indicative cost and corresponding coverage is shown in Table 4.3.

Table 4.3 Indicative Costs and Coverage of Project Activities in the PRC

Area	Activity	Cost US$ Million	Coverage
Alashan	Rangeland Management	2	50,000 ha (includes training, capacity building, production of manuals, video, and posters)
	Private Sector-Desert based industries	1	10,000 ha
	Alternative Energy sources	5 – 10	5,000 -10,000 ha
	Skills training for Alternative Livelihood	3	500 persons (includes establishment, equipment ,and staffing)
	Capacity building for local government	1	100-150 cadre over 5 years
	Sub-total	**12.0 – 17.0**	
Ordos Plateau	Capacity building for local government	1	100–150 cadre over 5 years
	Desert based industries (Development Models)	20	50,000 – 100,000 ha
	Air seeding techniques	1	100,000 ha
	Fencing techniques	-	-
	Artificial grassland and shrub plantation	0.2	2,000 ha
	Sub-total	**22.2**	
Xilingol	Integrated package for area protection	0.5	25,000 ha
	Capacity building of local government	1	100-150 cadre over 5 years
	Skills training for resettled herders	3	500 persons
	Artificial grassland and shrub plantation	0.2	2,000 ha
	Rangeland Management	2	50,000 ha
	Sub-total	**6.7**	
Hulunbuir	Rangeland Management	2	50,000 ha (includes training, capacity building, production of manuals, video, and posters)
	Artificial grassland	0.2	2,000 ha
	Planting Chinese Pine	0.5	10,000 ha
	Alternative energy sources	10	5,000-10,000 ha
	Capacity building for local government	1	100-150 cadre over 5 years
	Fencing techniques	-	-
	Awareness campaign	2	100,000 ha
	Sub-total	**15.7**	

4.4.2 Project Activities in Focus Areas of Mongolia

Table 4.4 sets out a summary of the major proposed actions/measures for each of the focus areas in Mongolia.

Table 4.4 Summary of Proposed Actions for Focus Areas in Mongolia

Items \ Sites		Ovorhangai	Omnogobi	Sukhbaatar	Dornogobi
Combating land degradation to prevent and control DSS	Prevention		Plant trees to stabilize sand movement around *soums*	• Strengthen Darganga Natural Park • Plant trees to stabilize sand movement	Windbreaks along roads and railways
	Rehabilitation	• Rangeland management • Enclosure	Rangeland management	Rangeland management	Rangeland management
	Development	• Develop ecologically responsible mining • Renewable energy sources	Renewable energy sources		
Capacity Building to implement measures for DSS prevention and control		Capacity building of local government	Capacity building of local government	• Capacity building of local government • Awareness campaign	Capacity building for local government
Poverty Alleviation to reduce pressure on land and reduce dust entrainment		Renewable energy use			Strengthen environment sound poverty reduction policies and programs
Social Development to improve livelihoods, reduce dependence on animal husbandry, improve infrastructure			Develop Alternative Energy		Infrastructure and technology development

Based on the proposed actions/measures or project activities intended for each focus area in Mongolia, an indicative cost and corresponding coverage is set out in Table 4.5.

Table 4.5 Indicative Costs and Coverage of Project Activities in Mongolia

Area	Activity	Cost US$ Million	Coverage
Ovorhangai	Use of environment friendly technology for gold mining	0.7	100,000 ha per year
	Rangeland Management	1	100,000 ha. (includes training, capacity building, production of manuals, video and posters)
	Use of renewable energy resources	1 – 1.5	50 households per year
	Capacity building of local government.	1	100-150 cadre over 5 years
	Artificial grassland plantation	0.2	
	Sub-total	**3.9 – 4.4**	

(Cont. Table 4.5)

Area	Activity	Cost US$ Million	Coverage
Omnogobi	Rangeland Management.	1	100,000 ha (includes training, capacity building, production of manuals, video, and posters)
	Tree planting	1	100,000 ha
	Use of renewable energy sources	1 – 1.5	50 households/year
	Capacity building of local government	1	50-100 cadre over 5 years
	Sub-total	**4.0 – 4.5**	
Sukhbaatar	Strengthen Darganga Natural Park	0.3	20,000 per year
	Rangeland Management	1	100,000 ha (includes training, capacity building, production of manuals, video, and posters)
	Plant Trees to Stop Sand Movement	0.6	50,000 ha
	Capacity building of local government.	1	50-100 cadre over 5 years
	Awareness campaign	0.5	100,000 ha
	Sub-total	**3.4**	
Dornogobi	Windbreaks along roads and railways	0.5	253 ha per year
	Rangeland Management	1	100,000 ha (includes training, capacity building, production of manuals, video, and posters)
	Capacity building of local government	1	50-100 cadre over 5 years
	Strengthen of poverty-environment policies	1	Shainshand *soum* center
	Sub-total	**3.5**	

4.4.3 Project Activities in the Cross-Border Focus Area

The proposed major project activities for the cross-border focus area are given in the table below.

Table 4.6 Summary of Proposed Actions for Cross-border Focus Area

Items \ Sites		Erinhot-Zamiin Uud
Combating land degradation to prevent and control DSS	Prevention	Rangeland and livestock management
	Rehabilitation	Revegetation and tree planting
	Development	• Waste water re-use; Model forest planting with waste water irrigation • Alternative energy
Capacity Building to implement measures for DSS prevention and control		Training center for traditional and hi-tech nursery facility; training of local government officials
Poverty Alleviation to reduce pressure on land and reduce dust entrainment		Ecotourism[1/]
Social Development to improve livelihoods, reduce dependence on farming and animal husbandry, improve infrastructure		Awareness campaign for stakeholders

[1] Ecotourism should be dealt within the environmental carrying capacity of the area with strict environmental safeguard controls.

Table 4.7 Indicative Costs and Coverage of Project Activities in Cross-border Site

Area	Activity	Cost US$ Million	Coverage
Erinhot – Zamiin Uud	Hi-tech nursery and plant propagation facility	0.5	Area size variable; training of 100 technicians per year.
	Establish international training center	0.5	Training of 200 technicians per year
	Use of waste water	0.2	Erinhot
	Alternative energy sources	0.6	100 local herders per year
	Ecotourism 1/	1.0	Area of a *soum*
	Rangeland/livestock management	2.0	100 households
	Windbreaks/shelter belt	0.2	500 ha
	Sub-total	**5.0**	

1/ Rationale for this is that as a cross-border focus area on the transcontinental railway, there is a steady stream of visitors seeking to experience the Gobi desert and the herders' lifestyle. Income generation from this source can reduce pressure on grazing lands.

4.5 Financing Plans

The scale of the demonstration projects is flexible and can be tailored to the available funds. Preliminary estimates for each focus area range from US$ 3 million to over US$22 million but not all of the money needs to be available at one time. Some of the proposed project components can be funded as stand-alone measures and some are candidates for private sector partnerships. Among the donor community there may be project components that more closely fit their current aid program. A possibility is to establish a regional fund dedicated to prevention and control of DSS, which could receive contributions from the participating countries (including private corporations, international agencies or organizations). The funds could be used as the seed money and could serve as a vehicle to mobilize additional funding support from other sources, public or private.

Every demonstration project has its special capital costs. A major element of each site must be the installation of appropriate monitoring systems whose intent is to measure any reduction in frequency and intensity of DSS that can be attributed to the intervention being tested. The monitoring system will vary between sites but an extra 1% can be added to the cost estimates to provide for it.

There are a few possible funding sources for DSS investments, to wit:

- **Internal sources.** There is budget allocation for environment management in different levels of the national government but not much is available for DSS investment in the PRC and Mongolia. Likewise, internal resources can be tapped from the domestic private sector, communities, and small stakeholders of the project area.

- **Bilateral Channels.** The bilateral donors such as Japan typically concentrate on funding pre-project activities and pilot project. Bilateral assistance is most often given as grants. The bilateral support from donors has an important role in insuring that the projects are well documented and well structured through support for feasibility studies and pilot projects. Without the combination of bilateral assistance for feasibility studies and pilot projects with international financing of subsequent larger scale implementation many projects with important environmental benefits would not be implemented or their scope would be significantly reduced.

- **International Financing Institutions.** Apart from bilateral donors, a number of the international financial institutions are active in connection with the financing of environmental projects in the region. The most important actors are the Asian Development Bank (ADB), the World Bank, and the European Union. There is a well-developed cooperation between the Government of Mongolia and the international financial institutions. The large international financing institutions such as the World Bank and ADB typically provide long-term loans financing large-scale investment projects. However, governments are cautious on increasing their foreign debt and are least likely to borrow funds for the purpose of combating DSS.

- **Global Environment Facility.** GEF considers DSS as a subset of land degradation. However, there is a hope that GEF would consider Mongolia's case for funding because Mongolia has never received any financing from GEF for OP 15[2]. Everybody agrees that land degradation is becoming worse and worse in Mongolia. The PRC, on the other hand, is already a partner of GEF OP 12[3] on Land Degradation in Dryland Ecosystems.

- **Private Sector Involvement.** It should be expected that the opportunities for mobilizing additional resources for environmental investments through involvement of the private sector in a Public-Private Partnership. It should increasingly be tested in both DSS affected countries and source countries in the coming years. The Government of Mongolia will be following these developments and seek to contribute constructively to ensure that such new cooperation models are implemented in a way that secures the public interest. The need to mobilize additional resources for investments in DSS prevention and mitigation leads governments and international financing institutions to consider new forms of cooperation where the private sector is involved in a Public-Private Partnership. In conclusion, both the PRC and Mongolia should mobilize significant internal and external resources for investments, which are necessary for mitigating DSS impacts in the region. .

Since a phased approach is more viable to implement, the financing plan should strictly stick to the phased approach. The project should have three phases for the next 10 years (see Table 4.6).

[2] GEF's Operational Program on Sustainable Land Management, which includes creating appropriate enabling environment, institutional strengthening, and investments.

[3] GEF's Operational Program on Integrated Ecosystem Management.

Table 4.6 Phases of DSS Prevention and Control Program

Phases and Proposed Activities	Funding Needed (US$ 000)	Funding Sources 1/
Phase I. 2006-2007		
1. Feasibility studies	1,000	GIC, BS, PS
2. Capacity building	8,000	
3. Institutional development and policy framework	500	
4. Public awareness	500	
Subtotal	10,000	
Phase II. 2008-2010		
1. Implementation of pilot projects (Zamiin-Uud and Erinhot)	5,000	GEF, GIC, PS, BS
2. Monitoring (equipment)	1,600	
Subtotal	17,600	
Phase III. 2010-2015		
1. Implementation of projects in three dust source areas based on the feasibility studies and lessons learnt from pilot projects.	24,000	GEF, GIC, PS, BS
2. Monitoring (equipment)	240	
Subtotal	24,240	
Grand Total	**40,840**	

1/ GIC – Government in-kind contribution; GEF – Global Environment Facility; BS – Bilateral sources; PS – Private Sector.

As part of the regional master plan to combat DSS there is a need to replicate and expand the treated area. The “package” of measures/actions that are proven to reduce the frequency and severity of DSS should be scaled up to involve an area more commensurate with the size of DSS source area.