Relationship Between Land Degradation and GEF Focal Areas

1. Biodiversity

PRC is one among the 12 so-called "megadiversity" countries, along with Indonesia, India, Malaysia, and the Philippines, which together account for 60 percent of the world's species. PRC's biodiversity is characterized by a high richness and a high endemism.

According to the *Biodiversity Action Plan* http://www.bpsp-eca.brim.ac.cn/books/actpln_cn/index.html the total number of all existing species in PRC is about 83,000, including marine organisms but excluding soil organisms, microorganisms, and insects. PRC is considered one of the major crop origin centers in the world. There are about 80 common vegetable species and 20,000 or so strains, most of which are specific to PRC, and about 30 species and 10,000 strains of commonly cultivated fruit trees. PRC has very rich forest resources, with about 8,000 species of woody plants, many endemic to the country.

Preliminary estimates place Chinese plant species at more than 600 species representing over 11 percent of the world total, among which are about 240 endemic species or genera. PRC also has one of the richest resources of wild animals in the world, with many rare and endemic species. PRC has 2,340 species of terrestrial vertebrates, accounting for 10 percent of the world total, and a large number of species of birds, accounting for 13 percent of the world total. Some 200 varieties of native poultry and livestock are recorded. In addition, there are 499 species of mammals in PRC, representing 11 percent of the world total.

Western PRC is rich in biodiversity and supports both Palaearctic species and those representative of more subtropical southern latitudes. The arid and semi-arid zones contain no less than 5,000 recorded species of plants and animals, including numerous endemics. Many of these species are endangered elsewhere in their range and threatened globally. Many plant species are useful to humans, including over 220 medicinal plants and herbs, grasses, and fruits. Western PRC includes nine out of the world's 238 eco-regions considered as priority regions for global conservation action. These are:

- the Altai-Sayan Montane Forests
- Middle Asian Mountains Temperate Forests and Steppe
- Central China Temperate Forests
- Eastern Himalayan Broadleaf and Conifer Forests
- Eastern Himalayan Alpine Meadows
- Tibetan Steppe
- Daurian Steppe
- Mekong and Salween River System
- the Yangtze River and Lakes system.

They harbor outstanding and representative examples of the world's ecosystems, which PRC is committed to protect under the Convention on Biological Diversity (CBD).

The Convention on Biological Diversity was ratified in 1993. The Convention on International Trade in Endangered Species of Wild Fauna and Flora was ratified in 1981.

To fulfil the CBD, the Government has formulated China's Biodiversity Conservation Action Plan and the Country Study Report on Biodiversity in China, carried out comprehensive assessments of its biodiversity, indexed endangered animals and plants, and put forward policy suggestions regarding the strengthening of national capacity for biodiversity protection and the sustainable utilization of biological resources.

PRC's nature reserves network has effectively protected many of the representative and scientifically valuable ecosystems, and rare and endangered species. By the end of 1996, there were 799 nature reserves (including 106 state-owned) which were designed for the conservation of a variety of species. The area of these nature reserves totals 71.85 million ha, accounting for 7.2 percent of PRC's land area. Twelve of these reserves have joined the Man and Biosphere International Protection Zone Network. PRC has also set up 752 forest parks with a total area of more than 6.6 million hectares.

Clearly the loss of forest cover, grasslands, and other ecosystems, as well as drying up of lakes, rivers, wetlands, and other water bodies, will have a major impact on biodiversity. However, there is no quantified relationship established between biodiversity loss and land degradation.

2. Climate Change

Global warming is the result of the release into the atmosphere of "greenhouse gases," i.e., gases that are relatively transparent to the passage of energetic short-wave solar radiation (sunlight) and, at the same time, reflect back much of the longer wave infrared (or heat) radiation generated when sunlight strikes the earth.

The most significant greenhouse gas is carbon dioxide, which has been released into the atmosphere in huge quantities as a by-product of burning fossil fuels in automobiles, power plants, and industrial processes such as steel production, and by wood burned for fuel and forests burned for land-clearing.

In 1950, 1.62 billion t/yr of carbon were released from burning fossil fuels; by 1991, this figure had increased to 5.854 billion t/yr. As carbon dioxide concentrations have risen, so too has Earth's temperature. Between 1975 and 1999, the average temperature increased from 13.94 degrees Celsius to 14.35 degrees, a gain of 0.41 degrees in 24 years. The warmest 23 years since record keeping began in 1866 have all occurred since 1975.

Fossil fuel combustion is currently the primary cause of rising carbon dioxide levels in the atmosphere, although the importance of land clearing and forest regrowth as a source or sink of carbon dioxide is still being debated. Because plants absorb carbon dioxide, expansion of forests, agricultural lands, and other terrestrial ecosystems offer significant carbon mitigation potential. Although not necessarily permanent, conservation and sequestration of carbon in agriculture and forests may allow time for other options to be further developed and implemented.

Changes in greenhouse gases and aerosols, taken together, are projected to lead to regional and global changes in temperature, precipitation and other climate variables, resulting in global changes in soil moisture, an increase in global mean sea level, and prospects for more severe extreme high temperature events, floods and droughts in some places. Climate models project that the mean annual global surface temperature will increase by 1-3.5°C by 2100, global mean sea level will rise by 15-95 cm, and that changes in the spatial and temporal patterns of precipitation will occur.

The average rate of warming probably would be greater than any seen in the past 10,000 years, although the actual annual to decadal rate would include considerable natural variability, and regional changes could differ substantially from the global mean value. These long-term, large-scale, human-induced changes will interact with natural variability on time scales of days to decades [e.g., the El Niño-Southern Oscillation (ENSO) phenomenon] and thus influence social and economic well-being. Possible local climate effects due to unexpected events like a climate change-induced change of flow pattern of marine water streams like the Gulf Stream cannot be predicted with confidence at present.

Changes in climate may affect the geographic location of ecological systems, the mix of species that they contain, and their ability to provide the wide range of benefits on which societies depend. Ecological systems are intrinsically dynamic and are constantly influenced by climate variability.

Climate change is expected to occur at a rapid rate relative to the speed at which ecosystems can adapt and reestablish themselves and the direct effects of increased atmospheric carbon dioxide concentrations may increase the productivity and efficiency of water use in some plant species.

Secondary effects of climate change involve changes in soil characteristics and disturbance regimes (e.g., fires, pests and diseases), which may favor some species over others and thus change the species composition of ecosystems. Changes in climate could exacerbate periodic and chronic shortfalls of water, particularly in arid and semi-arid areas.

Given the limited technical, financial and management resources possessed by developing countries, adjusting to shortages and/or implementing adaptation measures will impose a heavy burden on their national economies. Flooding is likely to become a larger problem in many temperate and humid regions, requiring adaptations not only to droughts and chronic water shortages but also to floods and associated damages, raising concerns about dam and levee failures.

Generally, middle to high latitudes may experience increases in productivity, depending on crop type, growing season, changes in temperature regimes and the seasonality of precipitation. In the tropics and subtropics where some crops are near their maximum temperature tolerance and where dryland, nonirrigated agriculture predominates, yields are likely to decrease.

In PRC, global climate change may trigger structural changes in the remaining temperate forests. The nature and magnitude of these changes, however, depend on associated changes in water availability, as well as water-use efficiency. Shifts in temperature and precipitation in rangelands may result in altered growing seasons and boundary shifts between grasslands, forests and shrublands. There is likely to be a decrease in water supply, except in a few river basins. Warmer winters may affect water balances because water demands are higher in spring and summer. Model results suggest that runoff in the northern part of PRC is quite vulnerable to climate change, mainly as a consequence of changes in precipitation in spring, summer and autumn, especially during the flood season. In PRC, across different scenarios and different sites, the changes in crop yields by 2050 are projected to be:

- rice, -78 per cent to +15 per cent
- wheat, -21 per cent to +55 per cent
- maize, -19 per cent to +5 per cent.

The definition of desertification adopted by the United Nations Conference on Environment and Development in 1992 is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variations and human activities. This definition cites climate variation as a direct causal factor and it implicitly links climate change and the assessment of the extent of desertification. Since arid, semi-arid and dry sub-humid areas are climatically defined, any change in climate which results in an expansion or contraction of these areas will alter the extent of the area in which desertification can be considered to occur.

For example, if an arid area converts to hyper-arid because of climate change, then the area in which desertification may occur will decrease. Hyper-arid areas are not included in the accepted definition. If a humid area converts to sub-humid, then the potential area within which desertification may occur will increase.

Climate change does alter the frequency and severity of drought in various parts of the world and can cause desiccation. It does not necessarily follow, though, that drought and desiccation will, by themselves, induce, or even contribute to, desertification in dryland regions. Whether or not this occurs depends upon the nature of resource management in these areas. Against a backdrop of management failure, climate change can certainly aggravate dryland degradation.

There is no doubt that desertification plays a role in altering the sources and sinks of greenhouse gases, contributing to global warming. Dryland degradation is likely to limit the local carbon sink by reducing the carbon stored in ecosystems and, as vegetation dies and soil is disturbed, carbon emissions will increase. Emissions of other greenhouse gases might also be affected by desertification.

For example, there may be greater methane production in poorly fed cattle in degraded areas. On the other hand, dry soils are methane sinks so desertification might reduce atmospheric concentrations. The net contribution of dryland degradation to global warming is difficult to quantify at this time. It is reasonable to conclude, though, that the global carbon release associated with dryland degradation is not more than a few per cent of the total greenhouse forcing associated with the major greenhouse gases.

There is also some evidence that dust storms from desertified areas can prolong droughts, thus setting up a vicious circle. Windblown desert dust can choke rain clouds, cutting rainfall hundreds of miles away. Hence droughts over arid regions, such as western PRC, are made worse by damaging land- and livestock-management methods that expand the desert.

Scientists previously expected that the largest dust particles would form giant cloud condensation nuclei, which produce larger cloud droplets that speed the formation of rain. However, desert dust particles contain very little water-absorbing matter. As a result, even large dust particles form relatively small cloud droplets.

Activities that expose and disrupt topsoil, such as grazing and agricultural cultivation, can increase the amount of dust blown into the air. More dust reaching rain clouds actually produces less rainfall, which exacerbates the drought conditions and contributes to desertification of the landscape.

Using different satellite observations, cloud droplets are apparently smaller as dust concentrations increase. NASA's Tropical Rainfall Measuring Mission (TRMM) spacecraft captured images of clouds over the Atlantic Ocean off the coast of northern Africa during a major dust storm in March 2001. Droplet sizes steadily increased the farther the clouds were from dust-filled air. Rain was falling only from the dust-free clouds even though all the clouds contained equal amounts of water. Similar behavior was observed in clouds over the eastern Mediterranean Sea in March 1998, using data from aircraft and a U.S. weather satellite.