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Damage Caused to the Environment by Reforestation Policies in Arid and Semi-Arid Areas of China

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Abstract Traditional approaches to ecosystem restoration have considered afforestation to be an important tool. To alleviate land degradation in China, the Chinese government has therefore invested huge amounts of money in planting trees. However, the results of more than half a century of large-scale afforestation in arid and semi-arid China have shown that when the trees are not adapted to the local environment, the policy does not improve the environment, and may instead increase environmental degradation. When precipitation is lower than potential evaporation, surface soil moisture typically cannot sustain forest vegetation, and shrubs or steppe species replace the forest to form a sustainable natural ecosystem that exists in a stable equilibrium with the available water supply. The climate of much of northwestern China appears to be unsuitable for afforestation owing to the extremely low rainfall. Although some small-scale or short-term afforestation efforts have succeeded in this region, many of the resulting forests have died or degraded over longer periods, so policymakers must understand that these small-scale or short-term results do not support an inflexible policy of large-scale afforestation throughout arid and semi-arid northwestern China. Rather than focusing solely on afforestation, it would be more effective to attempt to recreate natural ecosystems that are better adapted to local environments and that thus provide a better chance of sustainable, long-term rehabilitation.

Keywords Afforestation policy · Environmental degradation · Desertification · Environmental restoration · Livelihood · Soil moisture · Vegetation cover

INTRODUCTION

Land degradation is a major environmental problem around the world, and has become particularly severe in recent

decades, particularly in China (Jiang et al. 2006). A half-century period of forest exploitation, monoculture planting, and overgrazing in China has led to large decreases in species diversity and large increases in insect and disease problems in monoculture plantations (Liu et al. 2003). To alleviate the problem of land degradation, the Chinese government has invested huge amounts of money in planting trees (e.g., the Three Norths Shelter Project, the Grain for Green Project). Recently, China allocated 60 billion RMB (US\$7.3 billion) to combat dust storms by means of afforestation during its 10th Five-Year Plan Period from 2002 to 2006 (Jiang et al. 2006; Bureau of Forestry of China 2006). Although past government policies have encouraged environmental remediation through large-scale tree planting in semiarid and arid areas, such projects have proven economically costly and ecologically unsustainable (Wang et al. 2003; Su 2004; Huang 2006; Xu et al. 2006). In fact, most of the trees planted in the past have either died or are now dying, and the afforestation has not produced the desired ecological effects (Jiang et al. 2006). Given China's tremendous size, widespread afforestation failures will have important global consequences.

It is well known that afforestation can have many positive impacts on degraded land, including conservation of soil on degraded land by reducing soil erosion, as well as increasing soil organic matter, improving soil structure, sequestering carbon, increasing nutrient cycling, providing wildlife habitat, improving the landscape and biodiversity, and promoting the livelihood of farmers by permitting agroforestry that reduces the pressure on forested lands. However, afforestation is not a panacea. Although many small-scale or short-term assessments have shown clear benefits, this afforestation has often failed in the long term or over large areas when the species chosen for the project were poorly adapted to the local environment; the resulting