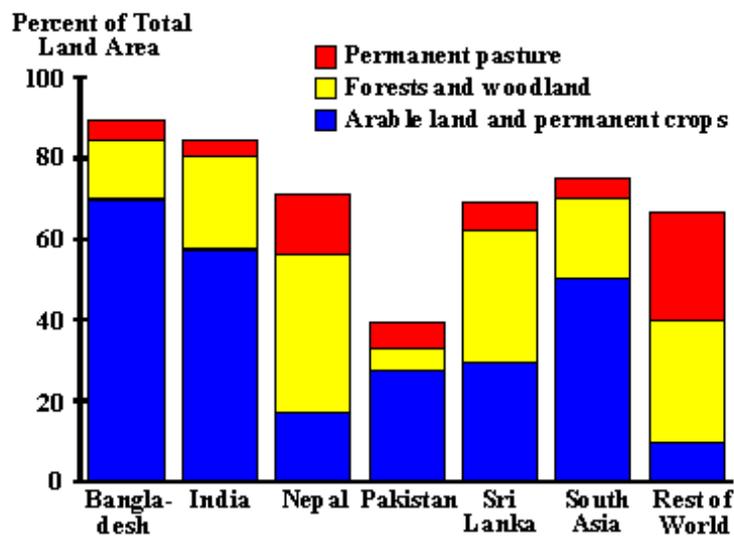


## Managing Resources for Sustainable Agriculture in South Asia

Gerard J. Gill

In the next 25 years, South Asia's food requirements are likely to double, while its natural resource base is likely to shrink. The subcontinent, which carries 21 percent of the world's population on just 3 percent of its land area, already has a high proportion of its land under cultivation and relatively little under forest and pastures (Figure 1). Industrialization and urbanization will further encroach on agricultural and forest land. Over the next quarter century, countries in the region will need to feed their growing populations on increasingly restricted natural resources, with the added requirement of safeguarding the environment and natural resource base.

Figure 1--Land use by category, 1992



Source: Calculated from Food and Agriculture Organization of the United Nations, *World Food Model* (Rome, 1993), Table 1.

The role of agriculture and the policies needed will be quite different in areas that are agriculturally favored, such as those with advantageous topography, good infrastructure, irrigation potential, and market access, and those that are unfavored, like remote areas, hillsides, forests, and places with problem soils. To generate the most benefits in terms of both food production and sustainable use, favored areas will need to move toward an agricultural structure based on comparative advantage in keeping with their natural resource base (rather than

concentrating solely on feeding the population from local production). Efforts in unfavored areas, however, must concentrate on removing policies and practices that encourage degradation.

### **The Current State of the Natural Resource Base**

One of the main problems facing natural resource management in South Asia is that the links between food production and the natural resource base, although strong, are both complex and poorly understood. High priority must be given to finding better methods of measuring and monitoring the natural resource base so as first to avoid counterproductive policies and then to design policies that help maintain and enhance the environment.

Although the nature, extent, and consequences of South Asian deforestation--particularly in hill areas--have been exaggerated, there is no doubt that deforestation is taking place or that it has negative effects on agriculture. These harmful effects include increased seasonality of stream flow, erosion of biodiversity, and the loss of forest-induced rainfall. The loss of leaf fodder and bedding materials resulting from deforestation means that fewer animals can be kept, which in turn has a negative effect on the organic content of the soil. Reduced availability of firewood also means that most of the remaining dung must now be used as fuel instead of being returned to the land.

Soil structure of farmland in South Asia is deteriorating as a result of the switch to inorganic fertilizers and more intensive cropping. Unbalanced use of fertilizers has led to micronutrient deficiencies. Soil erosion is depleting yields now and poses a long-term threat to sustainability.

As industrialization and urbanization increase, more water will have to be diverted to industries and cities, and the use of water for irrigation will therefore have to become more efficient. At present, wasteful flood irrigation is the norm, often encouraged by subsidies. Application is excessive, and evaporation and seepage losses from both canals and fields are high. Often the plants cannot use more than a fraction of the water provided.

### **Managing Resources in Unfavored Areas**

Growing global awareness of the need for environmental protection in unfavored areas has in many cases generated more problems than solutions. Individuals from the developed world often assume that solutions appropriate to their own natural resource problems can be applied globally. The resulting pressures have often led to quick-fix technical approaches to complex social and economic problems. Large-scale government afforestation schemes in South Asia, for example, have failed to solve the problems they were designed to address because the nature of those problems was not well understood beforehand. Before appropriate technologies can be identified,

much research needs to be done on the extent, causes, processes, consequences, and costs of environmental degradation in South Asia. Nonetheless, agricultural researchers are much more optimistic about generating sustainable production increases in such areas than they were 25 years ago.

This does not mean that no action should be taken while research is being conducted. Sufficient information exists about the socioeconomic aspects of an appropriate resource management strategy, even if the details need to be fine-tuned to make them site- and group-specific. For instance, state ownership of natural resources is emerging as one of the most important causes of environmental degradation. Government-owned rangelands and forests are often the most degraded, and the performance of public-sector irrigation schemes has been often grossly inefficient. The mere fact of government ownership has often caused users to adopt an attitude of dependence and short-term gain toward resource management issues.

Throughout South Asia governments have made an important start in promoting user management of common property resources such as forests and irrigation systems. Adoption of this participatory approach demands removal of policy anomalies, enactment and enforcement of laws on users' rights, and above all, decentralized decisionmaking. If recent trends in this direction continue, users themselves will increasingly have to bear the costs of any wasteful use of resources instead of being able to pass these costs on to others. Such a change can only have beneficial effects on the resource base. Conflicts over resources will of course continue to arise, and training in conflict resolution is required at all levels.

### **Managing Resources in Favored Areas**

Favored areas are those in which the Green Revolution flourished. Despite what is often said by its denigrators, the Green Revolution has to its credit the fact that it saved much of South Asia from the famine that was widely predicted 25 years ago. Grain yields have grown dramatically over the past quarter century (Table 1). In the absence of such intensification, production could only have been maintained by bringing more and more fragile and marginal lands into cultivation. However, the Green Revolution has also imposed a cost in the shape of growing use of potentially harmful inputs.

**Table 1--Growth in foodgrain yields and use of inputs, irrigation, and tractors in South Asia, 1977/79 to 1987/89**

<b>Indicator</b>	<b>Bangladesh</b>	<b>India</b>	<b>Nepal</b> (percent)	<b>Pakistan</b>	<b>Sri Lanka</b>
Average yield of food grains(a)	28	42	15	14	24
Fertilizer use	115	114	229	102	55
Pesticide use(b)	n.a.	1	n.a.	-12	n.a.
Irrigation use	73	14	127	13	7
Tractor use	39	136	50	136	54

Source: Computed from World Resources Institute, *World Resources: A Guide to the Global Environment* (New York: Oxford University Press, 1992), Tables 18.1 and 18.2.

Note: n.a. indicates not available.

(a)1978/80 to 1988/89

(b)1975/77 to 1982/84.

The challenge for the next quarter century is to feed an ever larger population and to improve nutrition without further increasing pressures on a finite resource base or causing overrapid growth in reliance on imports. In the best-case scenario, by 2020 most countries in the region can be expected to have moved toward an agriculture based much more on comparative advantage and much less on the need to feed the population directly from the subcontinent's own resource base. Policies are needed over the next 25 years to facilitate this transition in agriculture while minimizing any adverse effects on natural resources.

Like policies for unfavored areas, policies for favored areas will require an approach that emphasizes participation, empowerment, and decentralization, but the mix of ingredients will be different because the social institutions and economic pressures and prospects are different. The technology problems are also different, since favored areas have gone through one round of productivity growth, and production from Green Revolution technologies has now, at best, plateaued.

Comparative advantage has a seasonal dimension that technology development could help exploit. For most of the year, land and fresh water are in short supply, increasingly so, as urbanization and industrialization compete with agriculture for these scarce resources. In the monsoon season,

however, which affects most of the subcontinent, water is abundant and there is little that can be grown on flooded and waterlogged land. Rice is one of the few crops that will thrive in such conditions, so in terms of land and water there is little opportunity cost in growing it. Rice is also the preferred cereal for most people, so demand prospects are good. This suggests that research and extension resources might usefully be concentrated on improving productivity of rice in the monsoon season and noncereal, high-value, irrigated crops in the dry season.

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