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TOWARDS AN INTEGRATED REGIONAL ENVIRONMENT MANAGEMENT (IREM) IN SOUTH ASIA

INTRODUCTION

At this critical juncture of South Asia's quest for development, attaining sustainable development appears to be the most daunting challenge facing the poor millions of the South Asian countries. Embarking on the journey of development since the early 1950s, the South Asian countries over the past decades emulated myriad orthodox development paradigms and strategies but ironically all were destined into the black-hole of underdevelopment. Earlier causal analysis of such failure focused primarily on the traditional "missing links" like, paucity of savings, investment of physical capital and advanced technologies, ignoring the most critical factor, the inexorable relationship between man and environment in the development process, the fundamental premise of sustainable development. However, during the early 1990s, the development thesis of South Asia has undergone a remarkable change. The global acceptance of sustainable development as a catchword of the development priority, on the one hand, and more importantly, the depletion of natural resources and alarming deterioration of environment in South Asian countries, on the other, have led the development practitioners of the region to redefine their development goals and recognize the crucial linkage between

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environment and achievement of sustainable development. Especially, in recent years, there is a growing concern that escalating retrogression of environment by indiscriminate and uncoordinated human activities in the region would not only undermine the present as well as future development capacity, but it may also bring devastating man-made catastrophes in near future.

Given this urgent need to arrest the prevailing environmental damage in South Asia and a strong positive correlation between development of environment and achievement of sustainable development, the imperative is to formulate an eclectic environment policy for the region and to develop a viable regional environment management system. Since environment is largely indivisible and transboundary in nature, only isolated national policies are bound to be inadequate and might appear even deleterious for the neighboring countries. Besides, the homogeneity of the prevailing human environment profile in South Asia and common environment problems encountered by the South Asian countries call for a strong desirability and argument for formulating and pursuing an integrated regional environment policy (hereafter, IREM). The present paper continues the ongoing develoment debate in environmental perspective with a view to highlighting the overriding need for an integrated regional approach for environment management in the South Asian region.

Section-I of the paper provides a brief account of the prevailing state of environment in the South Asian countries. Due to prioritization among numerous environment issues, the discussion is primarily focused on the most serious challenges that directly affect the welfare of the people and the development process itself. The nonavailability of the relevant set of data precluded the inclusion of Bhutan and Maldives in the individual country analysis. This limitation, however, does not undermine the quintessential exigency for an integrated regional environment policy and also does not alter the frontiers of an integrated environment management system in the region. Section-II explores the rationale for regional and integrated approach for environment

management in the region. Section-III attempts to analyze the feasibility and sustainability aspects of IREM.

I. THE STATE OF ENVIRONMENT IN SOUTH ASIA

This section contains an overview of the dominant environment issues and trends in South Asian countries. Among numerous constituents of the environment vector, the study explicitly recognizes human environment as the cardinal element. In the South Asian context, other major environmental issues are: water related environmental problems, air pollution, land degradation, forest resource depletion and, loss of biodiversity and habitat. It is important to note that intrinsically environmental problems are cross-cutting and impact of activities in one area often results in cascading effects across the other areas. Besides, the contrasts between urban and rural environment warrant separate analysis. Also, the different degree of vulnerability of different gender, age and socio-income groups to the environmental menaces deserve distinct attention.

Human Environment Profile (HEP) in South Asian Countries

Since human being is the center-piece of the total environment system, a comprehensive idea about human environment profile (hereafter HEP) is essential for any ultimate aim. Table-1 provides a summary information on major HEP indicators of South Asian countries. It is evident that except for Sri Lanka, prevailing HEP in South Asia is even worse than HEP of comparable developing countries. One may also observe a remarkable symmetry as regards the HEP among the individual countries in major areas. However, the similarities regarding the HEP are neither coincidental nor they are accidental phenomena. Rather, the essential homogeneity in the areas of resource endowment, environment, economic structures and socio-cultural milieus, resulted in similar structural rigidities and similar economic as well as environmental challenges. The most striking

feature of South Asian HEP is the high incidence of poverty of the ugliest and agonizing kind. The South Asian countries comprise 20 percent of world population but commands only 3.5 percent of world's total land area and account for only 2 percent of the world's gross national product. With its narrow resource base and low per capita income, the region houses half of world's poor and more than half of the region's population live in abject poverty. Although, the poverty trend is on the downswing in recent years, but its indolent progress marred further improvement in HEP indicators. In the critical areas of HEP as well as quality life indicators, like, access to water, health, sanitation, housing and education, the prevailing South Asian human environ appears to be extremely precarious (Table-1). Compared to 77 percent of the Asian average, only less than 5 percent of the rural population of South Asian countries have access to safe sanitation (Table-1). The suboptimal quality of the prevailing HEP is evident with a low life expectancy score in all the countries of the region[1]. While poverty exists in both rural and urban areas, it is well known that women and children are the main victims of poverty and numerous environmental hazards. A high incidence of infant mortality, maternal death rate, and child malnutrition as discerned from Table-1 validate this observation. Almost 50 percent of under 5 children in all South Asian countries suffer from malnutrition (Table-1). A high maternal death rate, low female education, and a low score of female advantage imply an anti-female bias of prevailing HEP in the region. The poor in South Asian countries are both victims and agents of environmental damages and are locked into the poverty-underdevelopment vicious trap. They not only live with a fragile HEP but are also deprived of the 'amenity', the basic right to enjoy the unspoiled nature. It is not that the poor are inherently myopic and lack stewardship rather little control and access over resources compel them to degrade the environment. The prevalence of interlocking factor market

1. Except for Sri Lanka, Average life expectancy rate in Sri Lanka is 72 years compared to 62 years of low-income countries (Table-1).

prevents the poor in South Asia from making necessary investment in improving the environment. Concomitant with market and policy failures, social and political rigidities, in the face of tangible human needs and at times of rapid change, also lead to worsening of HEP and environmental nonsustainability.

Another prime feature of South Asian HEP is high density of population coupled with its rapid growth. Population in South Asian countries more than doubled between the period 1960 to 1990 (Table-2). Although, the growth rate of population declined marginally, during the recent years, but not enough to prevent a population explosion by the year 2025 (Table-2). Needless to mention that high population growth perpetuates poverty, contributes directly to environmental damage as social and political systems fail to keep up with the growing demand. The other appalling aspect of South Asian HEP is rapid and uncoordinated urbanization process accompanied with higher increase of urban poverty. To date, around one third of the total population of South Asian countries live in the urban areas. The figure would rise to 50 percent by the year 2025 (Table-2). As the dramatic demographic shift is taking place in South Asian countries, the urban population is projected to exceed the rural population by 2025, when more than 1 billion people would be living in the already over crowded large cities of South Asia[2]. Currently, there are 31 cities in South Asia, having more than 1 million people[3], including 3 megacities (each having more than 8 million dwellers)[4]. Bangalore, Dhaka, and Karachi are also projected to join the 'megacity' club by the end of the century. Lack of non-farm employment opportunities in rural areas coupled with marginalization process of the rural poor resulted in extensive human erosion in rural areas and consequently,

2. Carter Brandon & Ramesh Ramankutty, *Toward an Environmental Strategy for Asia,* World Bank Discussion Paper 224, The World Bank, Washington, D. C., 1992, p. 47.
3. Out of these 31 cities, 23 are in India.
4. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 47.

caused massive influx of poor into urban areas. To date, although, cities have had a lower incidence of poverty than the rural areas but they are projected to converge by the year 2025[5].

Water Related Environmental Issues

For over five millennia water has been viewed as South Asia's most critical resource. But the growing depletion of this crucial resource, both in quantity and quality poses the most serious threat to the achievement of sustainable development in the region. Water related environmental issues are most crucial as they put forth multifarious impact on the quality of HEP and sustainable development in the region as well. Nowhere in the world, there are as many and diverse water related menaces as suffered by the South Asian countries. Moreover, the problems compound due to seasonality and the externalities of the water related environmental problems. In South Asia, the major water related environmental concerns are: water scarcity, water pollution, floods and riverbank erosion. It is to be noted that all the above problems are cross-cutting and inextricably inter-woven with the interactions of human activities with water resources.

Water Scarcity

From time immemorial, lives and livelihoods in South Asian region coupled with the existence of flora and fauna, are critically contingent upon the availability of water. Historically, the civilizations in this region had been developed centering around the major transbuondary river courses. The rivers provide drinking water, sustain agriculture, forestry, fisheries and inland navigation, support industrial activities and power generation, prevent salinity intrusion and above all, sustain the ecological balance. Also, the river flows are one of the main determinants of the availability of groundwater aquifers. So, the sustainability of lives, development efforts and the

5. *Ibid.*, p. 47.

ecosystems in the region is crucially dependent on the availability of water resources. In general, South Asia is treated as a water abundant area. A high per capita renewable water availability except for Pakistan and Sri Lanka often leads to such conclusion (Table-3). But the important fact is, water is rarely available in the right amount, at the right place and at the right time. The highly uneven seasonal water flows in the major rivers together with higher seasonal variance of precipitation pattern resulted in dual hazard of excess water during the monsoon and acute water shortage during the dry season. However, the uncoordinated human activities in the development process in tandem with isolated water management efforts of the individual countries are mainly responsible for turning the most abundant resource in the region into the most scarce one. Currently, acute man-made water scarcity in the region resulted in the noxious "Tantalus syndrome", posing multi-dimensional disasters in the region. The ratio of withdrawal to renewable water resources in the region is considerably higher and the trend is growing faster in the recent years, especially, in Pakistan and India (Table-3). A huge withdrawal of surface water and overpumping of ground aquifers spawned severe water shortage during the dry season and threatened the sustainability of rivers due lack of critical minimum flows. Irrigation accounts for more than 95 percent water withdrawals in all the South Asian countries (Table-3). Domestic sector accounts for only a marginal percentage, although, there is a large unpalled demand coupled with a growing future demand from increased population. Indiscriminate horizontal expansion of irrigation along with hydro-energy plants caused a disproportionate withdrawal of surface water and depletion of ground aquifers. The policy failures in the individual countries are also attributable to higher withdrawal rate, overpumping, and a higher incidence of water wastages[6]. Moreover, the unilateral water withdrawals of the upper

6. Over the past, the major focus of the South Asian countries had been area expansion of irrigated lands rather than intensive yield augmentation. Large irrigation projects in the region often resulted in excess withdrawal and wastage of water. Also, disproportionate subsidy on irrigation significantly induced wastage and overuse of water resources.

riparian areas, for irrigation, coupled with multi-purpose dams and barrages, turned the lower riparian areas and countries virtually waterless during the dry season[7]. This has not only brought colossal effects on environment and productive capacity of countries like Bangladesh but also indiscriminate water withdrawals undermined productive capacity in lower riparian areas within the same state[8]. The rapid urbanization in South Asian countries accentuated water scarcity especially, in the big cities. The growing demand for potable water exerted tremendous pressure on surface as well as ground aquifers. According to a World Bank study, the water demand in South Asian countries is projected to be doubled by the year 2025. Against this backdrop, if the current mode of water management in the region is

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7. Before India's water withdrawal at Farakka, the average discharge of the Ganges at Hardinge Bridge in Bangladesh was 74,000 cusec, despite the huge withdrawals in the upstream areas of India. But after water diversion at Farrakka, the average minimum flow during the dry season at the same place in Bangladesh dwindled to 13,000 cusec during 1975-1992. And it has further decreased to even 9000 cusec in recent years. Ainun Nishat, "Development of Water Resources of the Ganges and Brahmaputra Basins: Issues and Options", a paper presented at an International Seminar on *Water Power and People* organized by Bangladesh Study Group for Alternative Thinking (BASGAT), August 20-22, Dhaka, 1996; also see, the daily *Sangbad*, 02 September 1996, Dhaka.

8. In case of India, Verghese commented, ". . . India has in a sense subordinated or mortgaged the interests of its Northeast to Arayavarta (Bihar and U.P) in its zeal to reserve all but 1132 cusec of the lean season flow of the Ganga for the middle and upper Gangetic Basin above Farakka."; B.G. Verghese, *Waters of Hope*, Oxford and IBH Publishing Co. Ltd., New Delhi, 1990, p. 379. Also interesting to note that while, Indian foreign secretary Salman Haider recently went to Calcutta to assess West Bengal's opinion on water sharing arrangement with Bangladesh, according to the news media, West Bengal's Chief Minister Jyoti Basu categorically stated that water withdrawal in U.P and Bihar is to blame for the current water shortage in West Bengal and Bangladesh (The daily *Sangbad*, 02 September 1996). However, as earlier stated, after the inception of Farakka, water flow in Bangladesh experienced the drastic decline.

not reformed in an optimal manner, the current depletion and deterioration of water resources in tandem with growing future demand would certainly generate worst kind of inter- and inra-state conflicts and ruin the ecosystems in the region.

Water Pollution

Water pollution is a widespread and serious environmental problem in South Asian region. The growing trend of pollutant water in South Asian countries is not only responsible for acute health hazards but it has also telling effects on aquatic resources, ecosystems, hence, on the sustainable development in the ultimate analysis. The problem is severe, particularly in big cities. For instance, in the Jamuna river of India, the coliform count is 7500 organisms per 100 ml when it enters New Delhi and a staggering 24 million per 100 ml when it leaves the city[9]. In Kelani river of Sri Lanka, fecal coliform (FC) count is measured to be 682,000 per 100 ml[10]. Parallel to surface water, ground water is also polluted by cesspools, septic tanks, leaking swears and land fill sites. Another prevalent variant of water pollution is the high level of dissolved oxygen in the major rivers. Although there is acute shortage of reliable data in this regard but from previous partial estimates it is found that major rivers of South Asia are rapidly approaching the GEMS defined danger level of water quality standard (Table-4).

The water pollution in South Asia could be attributable to three main sources, mostly generating from the human activities. The high concentration of FC is mainly due to disease bearing human wastes.

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9. Center for International Environment and Development, World Resource Institute, *Toward an Environment and Natural Resource Management for ANE Countries in the 1990s*, report for the US Agency for International Development (USAID), Washington, D.C., 1990, p. 40.
10. Kazi Farhad Jalal, "Regional Water Resources Situation: Quantitative and Qualitative Aspects", paper presented in a Regional Symposium on *Agro-Socio Economic Development*, held in Dhaka during 4-8 August, 1985, p. 29.

As Table-1 reveals, around half of the urban people and only less than 5 percent rural people of South Asian countries have access to safe sanitation. In India, 90 percent of water pollution is caused by human wastes and the rest by industrial refuges[11]. In most cities and towns of South Asian countries, sewage system is very limited and mostly fragile. Of India's 3,119 towns and cities, only 8 have full sewage collection and treatment facilities; 209 have partial facilities[12]. Large rivers in Pakistan like Kabul, Ravi, Leh and Lyari which pass through big cities like Karachi and Rawalpindi are severely polluted with human discharges[13]. Less than 20 percent of the population of Colombo Metropolitan Area is served with swears and 75 percent of the city's untreated swages are discharged into the lower Kelani river[14].

Another major cause of water pollution is the hazardous industrial effluents. The major categories of water contaminating industrial pollutants include, oxygen demand substances, measured by biochemical oxygen demand (BOD) and chemical oxygen demand (COD); other standard pollutants such as total suspended solids, ammonia, phosphorous, oil and polluting characteristics (such as pH). In South Asia, most of the industries are concentrated on the river banks of the big cities and towns. Industrial dumps contaminated with heavy metals like lead and mercury mingled with non-soluble toxic wastes are dumped into the rivers posing high health risks and depletion of aquatic resources. Although, major transboundary rivers in the region like, the Ganges, Brahmaputra and Indus are found to contain less BOD and COD compared to worse affected other Asian

11. Hrishikesh Mandal, "Study of Environmental Crisis: An Ecological Approach", in *Environment Degradation and Development Strategies in India,* M.M. Jana (ed), Ashish Publishing House, New Delhi, 1991, p. 43.
12. Carter Brandon & Ramesh Ramankutty, *op. cit.*, p. 49.
13. Kazi Farhad Jalal, *op.cit.*, p. 25.
14. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience*, World Bank Environment Paper Number 10, The World Bank, Washington, D. C., 1995, p. 66.

rivers but are creeping to the saturation level with increasing industrial effluents[15]. All the major Indian rivers are found to contain a high amount of BOD. Especially BOD levels in the Ganges near Varanasi and Kanpur are at times reported to be 30 mg/1.[16] The Kelani river of Sri Lanka is found to contain a high amount of BOD. The chromium level is also found to be high in the river. Also, at Thulheriya, the Maha Oya river is contaminated with alkaline, organic and dye effluents[17]. In Bangladesh, BOD, COD and other hazardous industrial wastes are found in large quantities in Karnafuli, Buriganga, Balu, Halda, Bhairab, Rupsha and Sitalakya rivers[18].

Along with surface water contamination, industrial discharges also defile the groundwater aquifers. Water resources are also polluted by non-point pollution, such as run-off of agrochemical from farms, leaching and tailings from mining activities. Over the decades, there had been a widespread adoption of HYV technology in South Asian countries. As a consequence, chemical fertilizers and pesticides experienced a tremendous spurt. During 1961-63, South Asian countries consumed 559,000 metric tons of fertilizers against the consumption of 13,333,000 metric tons in 1987-89[19]. Concomitant with acreage expansion, intensity of use also recorded a phenomenal increase. As a result of this growing and indiscriminate use of agrochemicals, surface

15. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 68. However, the recent studies are showing a precarious condition of water quality in the Ganges compared to other Asian rivers. See, V.K. Vurma, "Water Quality in the River Ganges", in G.P. Chapman and M. Thompson (eds), *Water and the Quest for Sustainable Development in the Ganges Valley*, Global Development and the Environment Series, Manshell Publishing Limited, New York, 1995.
16. Kazi Farhad Jalal, *op.cit.*, p. 22.
17. *Ibid.*, p. 29.
18. *Ibid.*, p. 19.; Ainun Nishat and Shahjahan Chowdhury, "Water Quality: Problems and Need for Integrated Control in Bangladesh", paper presented in a Regional Symposium on *Agro-Socio Economic Development*, held in Dhaka during 4-8 August, 1985, p.11-18.
19. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 187.

water as well as ground aquifers of South Asian countries are increasingly becoming polluted.

Flood and Riverbank Erosion

South Asia is one of the most flood and associated disaster prone regions in the world. In terms of frequency and damages done, there is no other area in the world so severely devastated by floods like the South Asian countries over the past years. Significant areas of South Asian countries fall victim of floods and associated ravages in every year. In Bangladesh, nearly 18 percent of country's total land area inundates by floods in every year. At times of severe floods, the inundation goes nearly two-thirds of the total land area (more than 52,000 km^2)[20]. During 1986, country's more than 70 percent total land area were severely flooded affecting 90 percent cultivable land. In the current year, flood has inundated more than one third area of the country displacing half of the population. Also, the other South Asian countries, namely India and Nepal are susceptible to severe flood hazard. In India, about one fourth (40 million hectares) crop land is flood-prone, in an average year and 9 million hectares of crop lands are susceptible to flash floods[21]. Also, in Nepal, extensive flood during the monsoon season appears to be a regular phenomenon. Particularly, flood in the Tarai, each year inundates a vast area of the country[22]. In 1981,

20. Md. Nurul Huda and Jahir Uddin Chowdhury, "Floods and Erosion", paper presented in a Regional Conference on *Floods and Erosion*, organized by The Institution of Engineers Bangladesh and Federation of Engineering Institutions of South and Central Asia, held in Dhaka, on 7-10 September 1986, p. 1-4.
21. Centre for Science and Environment, *Floods, Flood Plains and Environmental Myths*, Centre for Science and Environment, New Delhi, 1991, p. 4-6.
22. A.M. Dixit, "Regional Sediment Erosion and Conservation in Nepal", paper presented in a Regional Conference on *Floods and Erosion*, organized by The Institution of Engineers Bangladesh and Federation of Engineering Institutions of South and Central Asia, held in Dhaka, on 7-10 September 1986, p. 21-25.

1984, 1985, 1987, and in 1993, Nepal experienced severe devastation caused by flood[23]. Compared to the worst affected countries of the region, although, the problem is less severe in Sri Lanka and Pakistan, but they are frequently afflicted with the burden of seasonal flood in every year.

Concomitant with flood hazard, riverbank erosion is also a major environmental problem in some of the riverine countries of the South Asian region. In terms of permanent displacement and marginalization of the people, it causes more telling effects than of flood. According to one study, out of total 464 thanas (police stations) in 64 districts of Bangladesh, 150 thanas, stretching over 50 districts are subject to severe riverbank erosion[24]. It is estimated that about a million people are directly affected each year due to devastation of riverbank erosion in Bangladesh. Also, a total of Tk. 200 million monetary loss per year is due to the problem. Erosion has also devastated a large area in Nepal, especially, in the Tarai and Sapt Kosi river bank areas[25]. According to one study, there are 16 'hot spots' comprising over 3000 square kilometers[26] with severe river bank erosion in Nepal.

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23. Vinod P. Shrestha, "Environmental Problems in the Nepal Himalaya", in *Contributions To Nepalese Studies*, Volume 21, Number 2, July 1994, Tribhuvan University Press, Kathmandu, p. 141-142.

24. K. Maudud Elahi, "Riverbank Erosion, Flood Hazard and Population Displacement in Bangladesh", paper presented in an International Symposium on *The Impact of the Riverbank Erosion, Flood Hazard and the Problem of Population Displacement,* organized by the JU, University of Manitoba, Winnipeg, and ITDRC, Ottawa, Dhaka, 1987, p. 31-32.

25. A.M. Dixit, "Regional Sediment Erosion and Conservation in Nepal", *op.cit.*, p. 17-21.

26. Batu Krishna Uperty, "Impact of Riverbank Erosion, Food Hazard and River Shifting in Nepal", paper presented in an International Symposium on *The Impact of the Riverbank Erosion, Flood Hazard and the Problem of Population Displacement*, organized by the JU, University of Manitoba, Winnipeg, and ITDRC, Ottawa, Dhaka, 1987, p. 28-30.

Air Pollution

One of the major areas of environmental concern in South Asian countries is the deteriorating quality of ambient. Unlike other environmental perils, air related pollutions are difficult to be quantified but they are more directly related with individual health. From recentl global studies, it is found that common pollutants of ambient namely, suspended particulate matters (SPM), sulfur dioxide, energy, and lead, pose great health risks, especially, to the children and to the poor. SPM is not only responsible for increased respiratory problems, chronic obstructive pulmonary diseases, pneumonia, and heart diseases, but it also results in loss of productivity. The health hazards from indoor pollution due to use of solid fuel and biomass could be identified for causing respiratory damages. Concentration of lead, not only causes sickness, but even worse, it hinders children's neurological development, including lower IQ and agility[27]. In addition to health matters, quality of air is closely associated with the opportunity of consuming the "amenity of nature" from unspoiled ambient.

One of the major regional as well as global concerns in air related environmental problem is the increasing trend of greenhouse gas emission in South Asian countries. Table-5 and Table-6 provide a static scenario of types, annual amounts and sources of greenhouse gas emission in South Asian countries. It is to be noted that in addition to CO_2, CH_4; N_2O also belongs to the category of greenhouse gases. Table-5 reveals a very high per capita CO_2 emission rate in India, followed by Pakistan. Although, the tables do not provide any information on the changes of the trends over a longer time period but from secondary sources, it is known that between the years 2010 and 2015,

27. A recent study found that a high incidence of lead poisoning (200,000-700,000) among the children of the Bangkok city caused a decline of total IQ per annum by 3.5 points per child through seven years. See, Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 51, & World Bank 1992, *World Development Report 1992: Development and the Environment, op.cit.*, p. 53.

the major South Asian countries will catch up the CO_2 emission rate of the OECD countries[28].

In the South Asian context, air related environmental problems could be identified in three major sources-energy use, rapid and unplanned urbanization and industrial pollution. Also, important to note that rural and urban environments are exposed in different degrees to different set of air related environmental problems. Indoor air pollution is the most prevalent form of air pollution in rural areas of South Asian countries. And especially, women and children are disproportionately exposed to inhouse pollution in rural villages. Biomass constitutes 23 percent of total energy use in the region, next to only solid fuels (39 percent)[29]. In Sri Lanka, 94 percent of households consume fuelwood for cooking purpose[30]. Fuelwood in Nepal, accounts for 95 percent of total wood consumption in rural areas and 87 percent of all energy consumption in the country[31]. Most of the inadequately ventilated huts of South Asian countries are contained with carbon monoxide, particulates, hydrocarbons, and nitrocarbons originating from toxic gases of biofuels[32]. Aerosol components also contain toxic substances. Air pollution levels are found to be in higher degree in rural household microenvironments than even most polluted urban environments[33]. From a number of studies it is found that in Nepal, chronic bronchitis was correlated with time spent near stoves, and acute respiratory infection among infants was associated with exposure to indoor

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28. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 89.
29. *Ibid.*, p. 91.
30. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience*, *op.cit.*, p. 67.
31. U. M. Malla and C. B. Shrestha, *Environmental Resource Management in Nepal*, Bhimsen Thapa Publishers, Kathmandu, 1983, p. 90.
32. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 96.
33. Kirk R. Smith, "Air Pollution: Assessing Total Exposure in Developing Countries", in *Environment* 30 (10), December, 1988, p. 19.

smoke[34]. In India, several studies correlated respiratory distress with inhouse smoky fuels[35]. The ambient quality in rural areas of South Asia is also spoiled by indiscriminate tree-cut, hazardous rural factories, and use of agrochemicals.

Air pollution is also very severe in urban areas of South Asian countries. WHO identifies that New Delhi, Calcutta and Bombay are among the 15 cities with the highest level of particulate matters. In overall ranking, among the 6 worst ranked polluted cities identified by Population Crisis Committee, Calcutta and New Delhi represent the South Asian banner[36]. Annual mean concentration of sulfur dioxide and SPM is considerably higher in these cities (Table-7). Particularly, their growing trend is a major concern. In Calcutta, 60 percent of the people suffer from respiratory diseases caused by air pollution compared to a national level of 2.5 percent[37]. The incidence of chronic bronchitis in New Delhi is 12 percent higher than the all-India average[38]. Other South Asian cities like Dhaka, Karachi, Bombay, Madras and Bangalore are also afflicted with similar level of ambient pollution. The major evils for spoiling urban ambient are: increasing transport, industry, solid wastes, domestic refuges, dusts and the energy use pattern. The growing transport use in South Asian cities amounts a substantial portion of air pollution in the big cities. In terms of numbers, although operative vehicles are less in South Asian cities,

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34. For a comprehensive scenario of health hazards originating from biofuels, see, Kirk R. Smith, *Biofuels, Air Pollution, and Health: A Global Review*, Plenum Press, New York and London, 1987.

35. B.H. Chen, C.J. Hong, M.R. Pandey, and K.R. Smith, "Indoor Air Pollution in Developing Countries", *World Health Statistics Quarterly*, 43(3), 1990, p. 127-138.

36. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 22.

37. *Ibid.*, p. 50-51.

38. B. Bhattacharya, "Defilement of Environment, Its Restoration and Management", in *Environment Degradation and Development Strategies in India*, M.M. Jana (ed), *op.cit.*, p. 14.

but in terms of pollution amount, transport sector of South Asian cities even surpass the pollution level of big cities of the developed nations[39].

Box-1

Air Pollution in Some Indian Cities due to Motor Vehicle Use

City	Year	Total emissions (ooo tons/year)	Percentage Attributable to Motor Vehicles					
			CO_2	HC	NOx	SOx	SPM	Total
Bombay	1981	546	86	20	44	X	3	31
Calcutta	1978	537	87	15	25	X	X	X
Delhi	1987	428	90	85	59	13	37	57

Source: World Bank, 1992

Industrial pollution is another major source of urban air pollution in South Asian countries. The conventional air pollutants from industry include, SOx , NOx, TSP, CO_2, and hydrocarbons. Besides, the industry sector also generates many other toxic pollutants. The following box depicts the growth factors of toxicity intensity of production in select South Asian countries. It is evident that growth factors of toxicity is highest in Pakistan, followed by India. The indus-trial sector in South Asian countries, uses most hazardous types of energies which is the main cause of urban air pollution. For instance,

Box-2

Growth Factors of Toxicity Intensity of Production

Country	Year covered	Growth Factor
Bangladesh	1976-86	1.75
India	1976-86	1.97
Pakistan	1974-84	3.17
Sri Lanka	1977-87	1.59

Source: IPPS, World Bank, 1992

39. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 49.

coal consumption in India annually produces 12 million tons of sulfur dioxide. Further, 20 tons of sulfur compound are emitted every year per mega watt of power generated by thermal plants. About 12000 tons of sulfur compounds, equivalent to 36,000 tons of sulfuric acid are released from 600 MW super thermal power stations[40]. Moreover, the energy consumption pattern by the domestic household sector in urban areas is also major contributor of urban air pollution. In New Delhi, the residential sector is the largest source of SO_2 (46 percent) and NOx (37 percent) and contributes a significant share of CO_2 (33 percent) and SPM (18 percent)[41].

Another major cause of urban pollution in South Asian countries is the huge amount of solid waste disposal. Table-6 provides an aggregate picture of solid waste disposal in select South Asian cities. Although per capita solid waste in South Asian cities is small but the total amount and the growing trend of solid waste are quite significant. Moreover, the limited capacity of cities to collect and dispose huge amounts of solid wastes are multiplying the hazards.

Box-3

Solid Waste Generation in Some South Asian Cities

City	Total (000 tons per year)	Daily per capita (kilograms)
Bombay	1150	0.55
Calcutta	X	0.36
Colombo	160	0.75
Delhi	X	0.58
Karachi	X	0.70
Madras	X	0.38
Lucknow	X	0.87

Source: World Bank, 1992

40. B. Bhattacharya, "Defilement of Environment, Its Restoration and Management", *op.cit.*, p. 14.

41. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 50.

Land related Environmental Problems

Land is the most scarce natural resource in the South Asian context. Most of the countries in the region are characterized by high density of population with small land-man ratio. The huge population with a sluggish declining growth rate resulted in increasing demand for food, fodder and housing, ultimately exerting enormous pressure on land resources. As a result, all the South Asian countries are burdened with exorbitant land related environmental damages. Both in terms of variety and intensity, land resources of the region are exposed to severe depletion and degradation.

Land Degradation

Land degradation can occur in a variety of ways: nutrient depletion, structural decline and compaction, biological decline, chemical deterioration (acidification and salinity), and soil erosion. Nutrient status of soil declines if the losses-outputs in crops and animal products, leaching, runoff, erosion, mineralization, and volatization-exceed the gains from the weathering of parent rock, atmosphere accession, biological fixation and fertilization. Loss of organic matter, often hastened by cultivation, leads to loss of soil structure that can reduce soil moisture-holding capability, increase runoff, and reduce aeration within the soil. Among various forms of soil degradation, effects of soil erosion had been most widely studied although the others may cause serious land degradation.

Soil Erosion

Soil erosion is the most prevalent form of land degradation in South Asia. Concomitant with natural factors, human interactions with land such as, poorly managed logging operations, indiscriminate land clearance, shifting cultivation, intensive cropping system, irrigation and agrochemicals, bare following, overgrazing, and stripping land for vegetation or fuel wood are also responsible for severe soil erosion in the region. It is estimated that in India, nearly 1.75 million square

kilometers of the country's 3.3 million square kilometers of territory, and 60 percent of the total crop area suffer significant soil erosion[42]. In aggregate, country's croplands are losing 6 million tons of soil per annum[43]. In Bangladesh, more than half of the total land is under severe soil erosion. In Sri Lanka, cultivation of marginal lands, particularly, the shallow and lateritic soils of the wet zone, resulted in serious landslides and soil erosion. Intensive cultivation caused soil infertility and land degradation in some 1.2 million hectares of land mostly in dry zone of Sri Lanka[44]. Nepal is also seriously affected by human induced soil erosion. The destruction of forest resources has resulted in changing eco-systems, leading towards aridity and loss of organic topsoils[45]. Each year during monsoon, 12 tons of top soils are lost from every acre of the hill side. In worst areas, 80 tons of soil cover are ripped from each acre of land[46].

The prevailing magnitude of soil erosion in South Asian countries contrived diverse land related perils involving excessive economic loss in the short run and more importantly, eroded the capacity of sustainable development in the long-run. Onsite impacts of soil erosion include reduction of yields due to degraded soil structure and depletion of land productivity, surface sealing and crusting, and desertification. In India, the average annual loss of plant nutrients from eroded soil is estimated to account for a loss of 30 to 50 million tons of agricultural production[47]. Soil erosion in India is estimated to

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42. Norman Myers, "The Environmental Basis of Sustainable Development", in *Environmental Management and Economic Development*, Gunter Schramm and Jeremy J. Warford (eds), a World Bank Publication, The Jons Hopkins University Press, Baltimore, Maryland, 1989, p. 60.
43. *Ibid.*, p. 60.
44. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience*, *op.cit.*, p. 65.
45. Vinod P. Shrestha, "Environmental Problems in the Nepal Himalaya", *op.cit.*, p. 140-143.
46. Geoffrey Lean, "Himalayas Are Being Washed Away", *The Times of India*, June 11, 1983.
47. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 118-119.

cost 8.4 million tons of nitrogen, phosphorous, potash and other critical soil nutrients each year. In the Nepal Himalayas, overall yields of cereal fell over by 1 percent from 1970-71 to 1980-81[48]. In Sri Lanka, productivity losses due to soil erosion is estimated Rs. 613 to 4283 million in every year. Concurrently, soil erosion produced some serious offsite impacts. Increased sedimentation due to soil erosion as a whole, increased the susceptibility of frequent flood in the region. Especially, huge soil loss in the upstream is one of the major causes of frequent flood intrusion in downstream countries like Bangladesh. Erosion changes the hydrology of catchment areas, thereby augmenting flood frequency and scarcity of surface water in the dry seasons. As a result, severe flood is frequently followed by worsened drought during the dry season, and the cycle continues with higher frequency and intensity in the subsequent periods. The classic example of such devastation is Bangladesh. Flood in the monsoon and drought in the dry season became a regular attribute of the country's prevailing environment. Besides, eroded soil deposits impinge water capacity of drainage channels, irrigation ditches and hydropower facilities like reservoirs and dams. Severe soil erosion has led to the Polgolla reservoir in Sri Lanka silting up to 45 percent of its capacity after only 12 years of operation[49].

Waterlogging and Salinity

Waterlogging and salinity are other major land related environmental problems. According to the World Bank, waterlogging and salinity resulted in wasteful land degradation in major South Asian countries, namely India and Pakistan. The incidence of waterlogging and salinity is also found to be alarming in Bangladesh and Sri Lanka. In India, nearly 20 million hectares of cropland (30 percent of total irrigated cropland) had been seriously damaged and farmers aban-

48. *Ibid.*, p. 118.

49. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience*, *op.cit.*, p. 65.

doned 10 million hectares of productive croplands due to waterlogging and salinity[50]. Similarly, in Pakistan, 3 million hectare (20 percent of irrigated land) croplands are affected with waterlogging and salinity intrusion[51]. Concomitant with natural parameters, human activities like rapid spread of irrigation, indiscriminate use of agrochemicals, uncoordinated infrastructure build up and over exploitation of ground aquifers are largely attributable for widespread waterlogging and salinity in South Asian region.

Forest and Biodiversity

In terms of forest area/total land ratio, except for India and Nepal, South Asia in general is not a very forest rich region (Table-12). But in terms of services rendered, richness of habitat and biodiversity, and influence on the ecosystems, forest is a cardinal factor in the region's environment. So, depletion of forest resources not only involves huge economic loss but also causes distortion of the complex balance of the ecosystems. Unfortunately, the wanton ruin of forest resources over the past years in South Asian region led to squandering damage of the regional ecosystem and threatened the environmental sustainability of the region.

Table-12 and Table-13 confirm a high incidence of deforestation in South Asian countries. Also, one may observe a significant disparity between the deforestation rate and plantation rate resulting in net loss of forest areas in South Asian countries (Table-12). According to Table-12, a total 339,000 hectares of forest area had been cleared in India between the years 1981 to 1990. From the same table one may observe that between 1981 to 1990, a total area of 77,000 hectares had been deforested in Pakistan. In Sri Lanka, there had been a rapid decline of the country's total forest cover, from 55 percent of total area in 1955 to 28 percent in the 1980s. It has been estimated that annual

50. Carter Brandon & Ramesh Ramankutty, *op.cit.*, p. 118-119.
51. *Ibid* , p. 119.

deforestation in Sri Lanka is 30,000 to 50,000 hectares in recent years[52]. Within a decade (between 1971-1981), Nepal has lost 50 percent of its forest cover[53]. With the destruction of 5.4 million hectares of national forests, the total forest area in Nepal reduced to nearly 27 percent of the total land area. In Bangladesh, similar forest butchery has taken her on the brink of destruction of its nascent forest resource base. In reserved forests of Chittagong Hill Tracts, tropical forest resources depleted from 23.80 million cubic meters in 1964-65 to less than 19.83 million cubic meters in 1985. There had been a depletion of 23 percent of forest resources in country's Sunderban area between 25 years from 20.31 million cubic meters in 1960 to 15.35 million cubic meters in 1985 at an annual deforestation rate of 8,000 hectares per year[54]. As a consequence, tree covered forest area reduced from 16 percent in earlier years to only 6.5 percent in recent years. Parallel to classified forest areas, homestead forest resources in South Asian countries had also been destroyed even at a higher rate.

Biodiversity is generally referred to the variety of living organisms and variability of genetic contents within species and populations in a particular geographic area and the ecosystem. It includes biodiversity of animals and plants as well. Box-4 provides a summary information of original habitat loss in South Asian countries. Concurrently, Table-13 exhibits detail scenario of habitat loss in South Asian countries up to 1980s. The box as well as the table depict a colossal scenario of habitat loss in South Asian countries. Unabated human assault on habitat resulted in unquantifiable

52. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience, op.cit.*, p. 65.

53. A.D. Moddie, "Himalayan Environment" in *The Himalayas Aspects of Change*, Lall and Moddie (eds), Oxford University Press Limited, New Delhi, 1981, p. 341-350.

54. M. Omar Ali, "Trees and Environment", in *Environment and Development in Bangladesh*, Atiq Rahman, Saleemul Huq, Rana Haidar & Erik G Jansen (eds), Volume two, UPL, Dhaka, 1994,, p. 221-222.

irreversible ruin of habit in the region. Also from Table-14, one can discern a higher incidence of endangered species and plants in the region. In aggregate, nearly three-quarters of the natural habitat in the South Asian region has been lost or irreversibly degraded. It is estimated that South Asia will lose a higher proportion of its species and living organisms and natural ecosystems than any other region during the next twenty-five years.

Box-4
Loss of Original Habitat in South Asian Countries

Country	Loss of Original Habitat (%)
Bangladesh	94
India	80
Nepal	54
Pakistan	76
Sri Lanka	83

Source: McKinon & McKinon 1986

II. RATIONALE FOR AN IREM IN SOUTH ASIA

Current section attempts to explore rationale for formulating an integrated regional environment policy and regional environment management in South Asian region. For this purpose, the analysis draws attention on two key agenda of the proposition. It attempts to explore why regional approach is necessary for optimal environment management in the South Asian region and secondly, why integrated policy is to be pursued for the same goal. Prior to formal discussion, it should be explicitly mentioned that in advocating the need for an IREM in South Asia, the study by no means undermines the need for viable national environment policies of the respective countries.

National environment policies of the individual countries and the proposed IREM are not mutually substitutive. Rather they are essentially complementary with each other.

Arguments for an Regional Approach in Environment Management in South Asia

It is generally argued that regional environment management is preferred to isolated national policies, for three distinct purposes: (1) it enables the countries to carry out new functions that they can not perform alone; (2) it can permit them to carry out their present functions better owing to economies of scale or technological exchanges; and (3) it can reinforce nation's capacity to restrain activities by politically powerful domestic elites that are injurious to a public good[55]. However, there are other fundamental arguments for IREM, some of which are very pertinent for South Asia. In this context, the urgent need for a viable means for combating the prevailing retrogression of environment and for its sustainable development, provides the key rationale for IREM in South Asia. The following analysis explores the intrinsic properties of environment which strongly justify IREM for attaining the above mentioned priorities. Besides, the analysis discusses the economic rationale and other primary arguments concerned with the facet.

Transboundary and indivisible nature of environment

Environment is intrinsically transboundary. All the individual constituents of environment within a seamless web of ecological interactions support a unique environment and ecosystem in a particular region. And also, environment works as a unitary whole, i.e. indivisible and does not abide by the artificially imposed divisions of humans. Demarcation of boundary can restrict the access to natural

55. John D. Montgomery, "The Asia-Pacific as an Environmental Region", in *The Journal of Developing Areas*, Volume 28, Number 1, October 1993, p. 5.

resources of a particular environment system but can not deny the important function of individual constituents of environment in supporting a unique environment system in a particular region[56]. South Asian countries although have separate territories, separate economies and other separating features, but objectively, they belong to an ecosystem which is regional in nature. They share common rivers, mountain systems, oceans, and common ecological cycles. Natural resources of the region like, water, air, soil, forests, etc. in addition to rendering sustainability of the development process of the individual countries, concurrently sustaining a regional environment, atmosphere and ecosystem. So, if the objective of the South Asian countries is to attain sustainable development through sustaining as well as developing environment, environment must be construed in its entirety and management of environment ought to be regional. Isolated environment policy and management is likely to fail to contain the regional dimension of sustainability of environment and even it might yield irreversible damage for the entire ecosystems of the region. Careful study of environmental perils in the region, reveals the fact that the environmental menaces are transboundary both in terms of cause and effects and all of them have regional dimension. As mentioned in the preceding section, currently, water pollution and water scarcity are major environmental concerns for all the South Asian countries. Both in terms of cause and effects, they transcend national borders. Pollution in the down streams or in a particular area is often originated from other regional sources as pollution in the up stream can not be restricted in that particular area. As a result, only individual national efforts to combat water pollution are flawed with inadequacies

56. In case of Himalaya-Ganga basin, Verghese rightly pointed, ". . . but all the others (the countries of the basin) constitute a single geo-political entity, divided by territorial sovereignties but bound together by a monsoon and the common river system that drains the Himalaya". The similar reasoning is also applicable for South Asian countries as they belong to an unified ecosystem and are tied with complementarities in other areas. B.G. Verghese, *Waters of Hope*, *op. cit.*, p. 390.

and at the ultimate end, bound to be unsustainable. In case of water scarcity, it must be borne in mind that water is both a national as well as regional natural resource. Since, major international rivers are the main source of water in the region, consequently, current water crisis in South Asia is a regional menace and its solution demands regional water management. In the South Asian context, earlier disaster studies emphasized that major disasters in the region, emanate from regional sources and exert spread-effect over the whole region. Apocalyptic floods and droughts arising from resource degradation and hydrological instability in the Himalayas, or rising sea level due to greenhouse effect, or cyclones and other disasters are environmental problems that do not respect national boundaries. Similarly, other environmental concerns originating from air, soil, and forest, all, have regional dimension as they are integral part of a unitary regional environment system. Therefore, the intrinsic regional dimension of environment and its indivisibility provide the fundamental argument for IREM in South Asia.

Cascading effect of individual activities and mutual interdependencies among major environmental areas

Environmental impacts are basically cross-cutting due to mutual interdependencies among the individual constituents of environment. Also, the impact of human interactions with environment can not be confined to that particular geographic as well as environmental area. As a consequence, human interactions with environment in a particular region yield multifarious cascading effect for the other regions, in various environmental areas. Indiscriminate forest butchery in Nepal and Bhutan brought wide range of environmental wreckages not only for them, but also, engendered the propensity of severe floods, river-bank erosion and other environmental perils for the other countries of the region. Besides, uncoordinated individual actions are damaging the 'regional commons', particularly, the regional ecosystems. More importantly, in terms of the marginalization and pauperization of the

people coupled with erosion of their productive activities, uncoordinated individual actions pose serious threats to the capacity of sustainable development of the other countries of the region. Similarly, effects of mangrove forest destruction in the Sunderban areas of Bangladesh are also borne by the same ecosystem sharing people and habitat of India. Sea water pollution and degradation of marine environment in a particular coastal area of a South Asian country analogously cause spill-over effects for the other countries, impeding their vital productive activities. Dumping of toxic industrial effluents, agrochemicals, and other water pollutants in the up stream, are not only borne in to the down stream but also affecting other economic activities and depleting other natural resources in those lower riparian areas. Concurrently, other human activities like building dams, reservoirs and uncoordinated infrastructure, and withdrawal of water for various economic uses, due to externalities and interdependencies, proliferate the existing environmental problems and spawn new set of environmental hazards for other areas. Consequently, the viability of sustaining and developing environment in a particular South Asian country is not only contingent upon its own national efforts but also it is critically dependent on human interactions with environment in the development process and environment management in other countries of the region. Therefore, the organic interdependencies among environmental areas and exernalities of human activities which create cascading impacts across various sectors for the whole region provide a strong case for IREM in South Asia.

Economic rationale

Concomitant with intrinsic properties of environment, there are also strong economic rationale for implementing an IREM in the region. In this regard, the main argument emanates from the inexorable mutual dependence between sustainable economic development and the development of environment. There is little dispute both at theoretical and empirical level that attainment of the former is

impossible ignoring the latter. Sustainable development of environment is the necessary condition for attaining sustainable economic development. It has been earlier argued that intrinsically an IREM is a more preferred means for combating the prevailing environmental degradation and for sustainable development of environment in the region. Since, development of environment is the prerequisite for attaining sustainable economic development, by the transitivity argument, it could be said that IREM is also a viable means for attaining sustainable economic development. An effective IREM potentially can unlock the South Asian economies from the underdevelopment trap and stimulate robust economic growth and development in the region. In this context, it should be noted that the economic benefits of an IREM are yet to be quantified. In addition to the targeted benefits, environmental investments very often yield numerous external benefits which to a large extent are currently out of the domain of market pricing system. So, economic gains from environmental investments are usually underestimated.

It is generally argued that South Asia is a resource poor region. A lower level of per capita and national income often lead to such a statement. Concurrently, it is also true that South Asia has a vast reserve of human and natural resources which are mostly untapped and are currently out of the productive uses. Moreover, the existing productive resource base is frequently eroded by its wasteful utilization. An effective IREM potentially can bring the untapped resources in to the productive uses hence, can shift the region's resource frontier upward. For example, South Asia has a vast renewable and environmentally clean energy potential[57]. Effective utilization of region's water resources through IREM could free the region from acute energy shortage and curb the dependency on hazardous energy uses. This would not only infuse robust economic growth but it would also render beneficial external linkages, such as, improved health, lower

57. *Ibid.*, p. 169-195.

incidence of soil loss, deforestation, floods, etc. Similarly, the region has a vast land, forest, marine and other natural resources which are largely unutilized and underutilized. IREM would bring the region's natural resources in a single integrated matrix and put them into the productive uses. Concomitant with widespread poverty in the region, potentially, South Asia is blessed with the abundance of human resources. In South Asian context, the most formidable challenge is to effectively combine the human resources with the environment and natural resources. The prevailing mode of resource management in South Asian countries very often lacks this crucial linkage which results in poverty and underdevelopment. IREM would be instrumental for productively combining human resources with nature and environment in the region. This would augment the resource base of the individual countries and the collective wealth of the region as well.

Efficiency and productivity are the key determinants of robust and sustainable economic growth and economic development. Governance of an economy is essentially the efficient allocation of scarce economic resources among various priorities. Allocation of resources also determines specialization of productive resources which in turn determines the intertemporal growth capacity of an economy. There is little dispute among region's development ponderers that the current mode of resource allocation pattern in South Asian countries is far from optimal. The nonoptimal resource utilization pattern in South Asian economies could largely explain their prevailing underdevelopment. The wasteful allocation and utilization of scarce resources incur lower economic benefits and huge resource wastages. Resources are often allocated in nonpriority areas where returns are minimum and often unsustainable. A highly disproportionate defence expenditure and poor allocation of resources in the social sectors amply justify the above observation. Moreover, most of the private investments suffer from nonsustainability and fraught with anti-environment bias. Besides, the current resource utilization pattern in South Asia tends to produce a huge gap between private versus social costs and returns. Frequently,

it is found that resource allocation pattern in a particular country impedes the productive activities of the neighbours and it brings adverse effects for the regional commons. Against this backdrop, IREM could render two gross economic benefits which would help attain sustainable economic development in the region. First, IREM could ensure optimal resource-mix and optimal allocation of resources in the region. The IREM would allocate the resources on the priority areas and through appropriate pricing and other incentive systems would encourage to specialize the resources on the basis of regional dynamic comparative advantage. This would bring allocational efficiency and provide the base for the region's dynamic growth. Secondly, IREM through an appropriate mechanism, would maximize the efficient use of productive resources which would minimize resource wastages and yield best economic returns for a robust economic performance. Through an integrated regional resource management, IREM would involve efficient use of resources, cost minimization in resource use and maximization of economic as well as the social returns. For example, an integrated regional land management system could prevent the prevailing wasteful utilization of this scarce resource with least cost. Similarly, an integrated regional water management system could best use this resource which would well cater the growing need of the individual countries of the region. Since, environmental investments address several priorities simultaneously, the aggregate cost would be minimum in IREM. For instance, investment in soil conservation would reduce costs on flood control. Similarly, investment in HEP would reduce the cost for protecting the natural environment. So, the mutual linkages among the environmental priorities provide the golden opportunity for minimizing the costs in overall resource management. Also, IREM would accrue the economies of scale which would minimize the cost and augment efficient use of region's scarce resources.

IREM is also instrumental for boosting trade and investment cooperation among South Asian countries. Currently, mutual trade

among South Asian countries is marred with various prohibitive policies and inter-state conflicts. An IREM would help resolve the prevailing conflicts and induce intra-regional trade liberalization. Also, their collective position through IREM would render better access in the global market. Effective implementation of an IREM in the region would also create a favourable environment for the effective implementation of SAPTA and SAFTA. It has been earlier argued that IREM would encourage the specialization of regional resources on the basis of regional comparative advantage. This would help developing the dynamic trade structure in the region. IREM would also create complementarities among South Asian economies which would induce mutual investment cooperation in the region. The vast South Asian market coupled with a common policy would attract the foreign investments in the priority sectors of the region. Besides, their collective bargaining power would render better access in the global capital market. IREM would also help develop an integrated transport network in the region which would further integrate the member economies. Besides, there are numerous external economies associated with an successful IREM which could render significant economic gains. An IREM would induce the regional efforts for developing appropriate technologies and technology transfer within the region. It would also initiate effective technical cooperation among the member countries of the region.

In fact the best economic return that could be accrued from IREM is the alleviation of the widespread abject poverty from the region. The cornerstone of IREM is to eradicate poverty coupled with environmental sustainability. Effective implementation of IREM could rid the region from its most stringent economic bottleneck and human cruse. An IREM would be the effective means for enhancing the access of the poor to the productive resources. It would also enhance the empowerment of the poor, especially the women which would provide both environmental and economic sustainability. Since, an IREM involves more effective participation of the poor in the resource

management and as the investments would have pro-poor and pro-environment bias, consequently, benefits distributed through IREM would be more egalitarian. However, one must admit that these are all potential benefits. The exact quantum of benefits would eventuality depend on the effectiveness of IREM which in turn is contingent upon the firm commitment and cooperation among the members.

IREM, an effective means for natural disaster management

South Asia is one of the most natural disaster prone regions in the world. It had been frequently ravaged by the most extensive forms of natural disasters during the past. The geo-climatic conditions coupled with geo-morphological parameters turned the region as the most fertile breeding ground for every kind of natural disasters. Consequently, for attaining sustainable development in the region, there is a binding imperative for developing an effective means for disaster management. It had been frequently argued by the experts and the donors that for effectively combating the disasters, individual national efforts supported by multilateral aids are not sufficient enough. Since, the disasters also have regional dimension a regional integrated approach could be a viable means for disaster management in the region. Potentially, an IREM could well cater this purpose. It could develop an early warning and preparedness system which would minimize the extent of the damages. As a medium and long term agenda, it could develop both structural and nonstructural measures for mitigating the natural disasters. It could be also instrumental for post-disaster rehabilitation programme and for augmenting the disaster coping capability of the region both at macro and micro level.

IREM as an instrument for confidence building among the neighbours

An IREM could play a catalytic role in the confidence building and conflict resolution process among the South Asian countries which would yield very high dividends. This argument has been recently coined by B.G. Verghese in advocating an integrated water

resource management system for the Himalaya-Ganga basin[58]. Nevertheless, the same argument could be applied in the South Asian context. At present, the mutual relationship among South Asian members is impregnated with numerous conflicts and mistrusts[59]. This has seriously impinged upon any sort of effective cooperation among the South Asian members. Moreover, this has severely degraded the security environs of the region and resulted in an ever increasing expenditures on the conventional security options. In this context, an IREM could be a critical instrument for confidence building among the South Asian members which would eventually pay a very handsome pay-off. Regional cooperation through IREM could help resolve the economic disputes and gradually reduce the prevailing threat perceptions concerning security among the members.

Arguments for Integrated Environment Policy in South Asia

Integrated environment policy is currently a widely accepted mode of environment management at various national as well as international level[60]. The arguments for formulating an integrated regional environment policy for South Asian region basically rest on two

58. *Ibid.*, p. 349.

59. See, Iftekharuzzaman, "South Asia at the Crossroads: Conflict and Cooperation", paper presented in an International Seminar on *South Asia at the Crossroads: Conflict and Cooperation,* organized by Bangladesh Institute of International and Strategic Studies (BIISS), Dhaka, 6-8 February, 1994.

60. Currently, most of the countries and regions of the world have accepted integrated approach for environment management. In the South Asian context, scholars are advocating to pursue the similar approach. Also, historically, this approach had been pursued in South Asia at the community level. See, B. G. Verghese, *Waters of Hope, op. cit.* p. viii.; B.M. Abbas, "Agreement on the Ganges", paper presented at a Regional Symposium on *Water Resources Policy in Agro-Socio-Economic Development,* Dhaka, August, 1985.

criteria. One, the facet of sustainability; second, the viability criterion. Nevertheless, both the criteria could be simultaneously explained within the framework of inexorable mutual interdependencies among major environmental areas and human interactions with natural as well as human environment. As previously discussed, natural and man-modified resources in the development process exhibit extensive interdependence. Due to externalities and cross-cutting nature, any natural or human-induced shock in any particular area of environment results in cascading effect in other areas and an overall effect for the entire environment system. For instance, loss of tree cover either from natural or from human sources, seriously thwarts the sustainability and productive capacities of other environmental areas and through mutual linkages, ultimately affects the human environs and also the productive activities of the whole economy. Hence, the intricate cobweb interdependencies between environmental areas and development activities leave no room for partial and isolated environment management. Rather, they render golden opportunity for effective cost minimization and at the same time accruing maximum returns through efficient utilization of the mutual linkages. More importantly, integrated environmental policy is desired for sustainability and for the ultimate success of environment restoration and development efforts particularly, at the regional level. Any isolated or unintegrated environment management effort might be seriously hampered from adverse cascading effects, originating from other areas. Even isolated environment management in a certain area may generate backlash effects, ultimately hindering productive capacities of other areas. Consequently, escalating both private and social cost would eventually frustrate the viability and sustainabity of environment management. Poor pay-off and unsustainability of unintegrated environment management efforts in South Asian countries testify the credibility of the above argument. For instance, lumpy coastal afforestation programmes in South Asian countries had often been pursued ignoring the involvement of local poor in the whole process. Similarly, water development projects had been undertaken by-passing the inevitable

repercussions in other environmental areas and also long term effects on the human environs. Consequently, most of the major environment projects in South Asian countries suffer from growing recurrent costs, lower returns and unsustainability. Hence, the indissoluble relationship between man and nature and among major environmental areas provide the strong justification for formulating an integrated regional environment policy for South Asian region.

III. FEASIBILITY AND SUSTAINABILITY NEXUS

Current section attempts to examine the feasibility and sustainability nexus of implementing an IREM in South Asian region. In South Asian context, there is much room for expressing skepticism on the feasibility and ultimate sustainability of such regional agenda, especially, in the face of higher population growth, acute resource paucity, structural rigidities and numerous intra and interstate conflicts in the region. Improving environment in South Asia involves financial investments, environment-friendly technologies and production techniques, policy reforms, proper institutional arrangements, and reorganization of productive activities and resources in the region. Nevertheless, this adjustment process at least, during the initial phase, may produce some trade-offs: between current vs. future benefits, local vs. regional needs, national vs. regional interests, and economic vs. environmental priorities. These conflicting pairs, coupled with other obstacles may weaken the feasibility and sustainability of the IREM in South Asia. Differences among the member countries also may crop up on the issues like, priority setting, mode of management, cost sharing and distributing the gains from IREM. The pertinent query is, can IREM be effectively implemented without trading-off the national concerns of the individual countries? Much of the sustai-nability of IREM is contingent upon this crucial factor. Moreover, there are also uncertainties concerning the natural parameters which may impinge upon the sustainibility of regional environment programmes in the long run. Against this backdrop, the subsequent discussion examines

some of the broader frontiers of feasibility and sustainability nexus of an IREM in South Asian region.

Financial Aspects of Feasibility

Addressing environmental priorities in the region would involve both static and dynamic costs and investments. However, bulk of the expenditures would eventually depend on the population growth, extent of integration, technologies, reorganization of productive activities and resources, standards chosen for pollution control, time span, economic efficiencies and policy instruments used for implementing the regional environment campaign. Although, the required costs for sustaining environs in South Asia are yet to be quantified, a preliminary assessment hints a huge amount of investment required for reversing the prevailing environmental retrogression and improving its sustainable productive capacity. The following box provides

Box-5
Additional Investment Required for Environment Sector in South Asia by 2000
(US$ billion per year)

Areas	Amount
Water supply & sanitation	5.4
Reducing emissions from energy generation	0.7
Controls on vehicle pollution	0.9
Reducing industrial pollution	1.2
Soil conservation & afforestation	3.6
Agriculture & forestry research	1.0
Family planning	1.0
Primary and Secondary education for girls	0.2
Total	14.0

Source: World Bank, 1992

only an indicative partial estimate of additional investments required for some critical areas of environment management in South Asia. Apart from investment in improving environment, a high rate of investment is necessary only for improving the quality of HEP alone. Additionally, environmental projects would incur operating and maintenance costs. South Asia, which is crippled with lower income and indolent economic growth, the dearth of investment pose general concern on the feasibility as well as sustainability of IREM. However, one should not overemphasize these constraints against the overriding need and positive pay-offs from improved environment in the region. Regional management of environmental priorities would render access over broader regional resources and eventually would augment the availability of necessary investments than isolated national efforts. Also financing from regional funds would provide higher sustainability of environmental investments. Collective position of the South Asian countries would also enhance their access in global capital market and world financial resources[61]. Besides, returns accrued from improving environment would subsequently increase the investment availability and sustainability of investment programmes. Good environment policies often bring good economic returns. And many environmental investments begin to pay for themselves within a few years-either through improved productivity, as with soil conservation, or through improved health and welfare, as with investments in sanitation and water supply and several forms of industrial pollution control measures. However, accelerated economic growth and good economic governance in the member countries are critical for feasibility and ultimate sustainability of the proposed regional environment management. Especially, in the face of rapid population growth and increasing demands, faster urbanization and higher environmental degradation in South Asia, higher economic growth can ultimately

61. Bangladesh and Nepal individually attempted to build dams and barrages in their own territories. However, they could not manage external funding, since, India's opinions were not incorporated. See, B. G. Verghese, *Waters of Hope*, *op.cit.*, p. 335-393.

sustain regional environment governance. Enhanced economic cooperation coupled with integration of development activities among the countries and good economic governance in South Asian countries can significantly augment their growth potential. Moreover, South Asian countries can readily generate the investable funds for addressing environmental priorities by cutting various unproductive expenditures and resources wastages in the development process. Although not precisely quantified, but from various World Bank assessments it is known that public expenditures in unproductive sectors in South Asian countries are higher in comparison to economic and social sectors. For example, military expenditures in major South Asian countries are higher than developing countries and they are growing every year at disproportionately higher rates. Only a small reduction of this expenditure could generate significant investable surplus for improving environment[62]. Nevertheless, this is contingent upon resolving the mutual conflicts among the member countries. But in any case it justifies that availability of funds for addressing regional environmental priorities is not intrinsically a binding constraint.

In the face of general resource paucity in South Asian countries, cost minimization assumes utmost importance for sustainability of regional environmental programmes. Efficient use of productive resources and exploiting various environmental as well as productive linkages could yield handsome pay-offs in this regard. For example, female education compared to other areas requires less physical investment but yields higher positive benefits for both human and natural environment. Development of environment friendly technologies and production techniques in various economic sectors can reduce the recurrent costs involved and therefore augment the sustainability of regional environment programmes. Besides, appropriate resource management both at micro and macro level can potentially augment the efficiency, productivity, hence the sustainability of environmental

62. In 1994, defence budget in major South Asian countries had been: India, US$ 7.3 billion, Pakistan, US$ 3.4 billion, Sri Lanka, US$ 488 million, Bangladesh, US$ 402 million and, Nepal, US$ 42 million (*The Military Balance* 1994-1995).

investments. Participatory management in afforestation, soil conservation and in other environmental areas render better sustainability, cost effectiveness and more egalitarian management of environment. Similarly, access of poor and marginals to productive resources would augment environment sustainability and significantly reduce the cost of management. Also, effectively taxing the polluters would reduce the amount of investment and other expenditures. Removal of policy distortions that encourage environmental degradation would reduce investment and monitoring costs.

Another important issue on regional environment management in South Asia centres around how to share the costs for improving "environmental commons" among the members states[63]. Success of other regions in this area suggests that this is not a binding constraint. For example, Lesotho Highlands Water Project involved Lesotho and South Africa to share the costs associated with the project. Lesotho has undertaken to construct large works on the Senque river to supply water in South Africa. In return, South Africa is underwriting and servicing the debts incurred for the project. Lesotho benefits from the water royalties that South Africa pays, while South Africa reduced the costs of ensuring its water flow because Lesotho was a better place to construct the dam. Similarly, in Indus basin management, India contributed of US$ 179 million to Pakistan for sharing the cost of the project. Similar effective arrangements like Danube basin management, Black sea environment program and also many others reveal that mode of cost sharing is not a stringent condition[64].

From feasibility as well as sustainability point of view, another relevant query is whether there is any intrinsic conflict between

63. Currently, India and Nepal are facing problem concerning the cost sharing of jointly-built water control projects. Experts opine that the problem is more political rather than techno-economic.

64. World Bank, "Mainstreaming the Environment", *The World Bank Group and the Environment Since Rio Earth Summit : Fiscal 1995*, IBRD/World Bank, Washington, D.C., 1995, p. 54-80.

national vs. regional policies concerning environmental priorities. Also, is there any trade-off between economic growth and environmental policies ? On the former question, in general, good national environment policies are also good for regional environment. Soil conservation efforts in Nepal beyond doubt would have beneficial impacts on environment of the other countries and regional environment. Similarly, pollution control in the upstream would be good for down stream countries. Coastal environment improvement efforts in any of the South Asian countries would result in external economies for the neighboring countries of the region. Improvement of HEP in a particular country would have positive economies on the regional environment. So, there is no intrinsic conflict between national interests and regional environmental concerns. However, as discussed earlier, uncoordinated development activities of the individual countries may impede productive activities of the other countries and degrade environment of the region. But these conflicts are not irreconcilable. Rather, regional environment management coupled with economic cooperation provide best means for resolving such conflicts. On to the second question, development ponders advocate strong "win-win" opportunities between policies for economic growth and environment. The most important of these relates to improvement of HEP and alleviation of poverty in particular. Eradication of abject poverty not only critical for attaining accelerated growth but also it is essential for environmental stewardship. Reorganizing tenure system, giving poor farmers property rights not only augment development potential but also lead to environment sustainability and improvement. Removing anti-women bias in the development process not only augments country's growth capacity but also enhances environmental improvement. However, due to uncoordinated national efforts, market imperfections and other structural rigidities there may be some unavoidable trade-offs between economic gains vs. environmental concerns. But evidences indicate that the gains from protecting the environment are often high and that the costs in forgone income are modest if appropriate policies are adopted. In

fact, strong environmental policies complement and reinforce growth potential. Good environmental policies are also good economic policies and vice versa. More importantly, if the objec-tive of the South Asian countries is to achieve sustainable development in that case there is no room for ignoring intrinsic complementarity between sustainable environment and economic development.

Technological Feasibility

Sustainability of integrated regional environment management in South Asia is also critically contingent upon the technology vector. Improvements in productivity and efficiency are essential to making continued economic growth, possible at a time of growing populations, urbanization, industrialization and an increasing rate of natural resource base depletion. Cost effective as well as environment friendly technologies are utmost necessary for sustaining regional environment management. Prevailing technological stagnation and inappropriateness in South Asia largely erode the feasibility of a comprehensive environ-mental programme in the region. In this context, collective efforts should be maximized to develop indigenous, cost effective, efficiency augmenting, and environment friendly technologies. For example, integrated pest management (IPM) is one of the best example of "win-win" technology in agriculture. In industry sector, introduction of 'clean' technologies can improve environment and augment dynamic comparative advantage. However, both intra-regional and international technology transfer are necessary for this purpose. In energy sector, a wide range of both supply and demand side technologies can improve efficiency and cost effectiveness. South Asia's heavy reliance on solid fuels and biomass prioritizes the need for "win-win" techno-logies in energy sector. Similarly, cost effective sewage system is pivotal for improving urban environment. In transport sector, environ-ment friendly technologies coupled with effective regulatory mecha-nisms can better sustain IREM. In South Asian context, technological issues in the green sectors, have an extremely high priority. New farming practices and technologies are essential to

maintaining the momentum of intensification in the crop sector with negative environmental impacts. Although, currently, there is a technological gap in South Asia, but it does not necessarily frustrates the feasibility of an IREM in the region. Rather, in the face of structural rigidities, market failures, and resource paucity, South Asia's collective action could widen its technological frontier.

Inter- and Intra-State Conflicts

Ironically, in terms of both intra and inter-state conflicts, South Asia is one of the most vulnerable regions of the world. Since the independence of major countries of the region, South Asia is impregnated with multi-dimensional conflicts and tensions. The paradox of sustained conflicts amidst enormity of imperatives for cooperation has long been a striking feature in relations between the countries of this region. The sources of conflict in South Asia are more of structural than ephemeral nature and have their roots in its history, geopolitics, economics and ecology[65]. The same features and values of historical, ethnic, linguistic, cultural, and religious nature that bind the nations together also contribute to the mutual mistrusts, perennial tensions and occasional hostilities[66]. Conflicts and dissensions have largely overshadowed the imperatives for cooperation in the region. Divergences in security perception of the states continue to loom large as threats to territorial integrity and political stability are often perceived to be fueled by neighbours. Border disputes, dispersion of ethno-religious and other societal groups defying political boundaries, issues related to exploitation and management of shared resources and problems rooted in respective processes of nation-building and economic development continue to accentuate the conflict syndrome. Besides, challenges of governance including failures in achieving sustainable

65. Iftekharuzzaman, "South Asia at the Crossroads: Conflict and Cooperation", *op.cit.*

66. For a detailed analysis on the nature of South Asian conflicts, see, Abdur Rob Khan, "Contemporary International Conflicts in South Asia: A Compendium", in *biiss journal*, vol.14, no.3, 1993.

accommodation between various sections of the societal groups also crop up internal as well as regional conflicts. The crisis in governance in South Asian countries resulted in various contentious internal conflicts in South Asian countries. The prevailing muti-dimensional interstate conflicts among South Asian countries in tandem with various internal conflicts may seriously impinge upon the feasibility and sustainability of regional environment governance. However, in the face of new global order, there are also fresh imperatives for enhancing mutual cooperation. Uptil now, South Asian countries had the mind set to prioritize the conflicts and differences, but in the new world order, it is the time to collectively combat the ultimate threat to the security--the dwindling environment.

Market Failures and Policy Distortions

South Asia is severely inflicted with structural rigidities which resulted in market imperfections and market failures. Concurrently, there are numerous policy distortions which can seriously impede the feasibility and viability of IREM in the region. Due to the absence of markets or market imperfections, the prevailing pricing systems fail to reflect full economic and social costs of environmental problems. Similarly, economic gains from environmental investments are undermined in the market calculus. For example, there is no pricing mechanism for bringing the industries that spew solid, liquid and gaseous effluents in to the cost matrix. Similarly, there is no pricing system for water pollution, over use of lands, excessive use of pesticides, etc. Moreover, in South Asian countries there are also policy distortions which tend to degrade environment at an increasing scale. For example, the prevailing input subsidy policy and resource management system in South Asian countries frequently encourage to degrade the environment. The daunting task of IREM would be effectively combating the market failures and policy distortions. However, there are ample evidences that these constraints could be

minimized with appropriate policy reforms and implementation mechanism[67].

Institutional Constraints

Absence of appropriate institutional capabilities and mechanisms could pose one of the most daunting challenges for a successful implementation of IREM in South Asia. Appropriate institutions are necessary for formulating, implementing and enforcing IREM. Moreover, it is also necessary for distributing the costs and benefits among the members. In South Asia, weak institutional capability is further weakened by jurisdictional and lack of broader participation. Current studies indicate that institutional constraints are a pervasive problem and take many forms. For example, eventual impacts of environmental policies on farm households might be influenced by intervening institutional factors (which are themselves determined by cultural, economic and political factors)-- especially, those affecting access and use rights over natural resources such as land and water. For an effective IREM appropriate institutions should be developed at regional, national and local level. Particularly, local level institutions should be integrated with the regional institutions. The lack of user participation usually results in inadequate support for IREM. However, a multiplicity of actors (local, national and regional) with overlapping, uncoordinated, or poorly defined responsibilities might induce institutional weakness and hamper the implementation of a broader IREM. Another probable institutional problem relates not to the rules and regulations themselves, rather the region's capacity to establish and enforce such rules. A comprehensive IREM also have to address the "free-rider" problems. However, appropriate indirect monitoring mechanisms and pricing policies would more effectively monitor and enforce IREM in the region.

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67. Mohan Munasinghe and Wilfrido Cruz, *Economywide Policies and the Environment: Lessons from Experience*, *op.cit.*, pp. 23-28.

IV. CONCLUSION

Throughout the forgoing discussion, the current paper attempted to draw the attention to the overriding need for a viable means for addressing the environmental concerns in the South Asian region. In this context, it attempted to explore why isolated national efforts could be ineffective compared to an IREM as a preferred means of option. Prior to choosing IREM as the preferred means, one must admit that there is a crucial need for quantifying both the static and dynamic costs-benefits, associated with IREM, within an appropriate general equilibrium framework. However, the costs emanating from socio-political milieus or institutional fabrics are arduous to be quantified. As an essential element in an immediate action plan matrix, the paper calls for undertaking rigorous studies in this regard. On the feasibility and sustainability nexus, the paper attempted to explore some of the constraints that might impinge upon IREM's effective implementation. In South Asian context, there could be a range of factors that potentially might weaken the feasibility as well as sustainability of IREM. Especially, the oscillating mutual relationship among the South Asian countries, nourished by assiduously propagated myths and mistrusts, might crop up on the issues like, priority setting, reorganization of individual development programmes, mode of environment governance and sharing the costs and benefits of IREM among the members. Many opine that the techno-econo constraints might not be the ultimate binding for an IREM in South Asia. Rather, the politico-institutional bottlenecks are the constraints that might cause an early demise of IREM in the region. Against this backdrop, a workable solution could be not to start with grandiose programmes that involve extensive reorganization of productive resources or programmes with spatially extensive consequences. A modest beginning would be to start with confidence building areas. South Asian development practitioners could identify some priorities among the regional commons like, female education, child mortality, sanitation, deforestation, coastal management, etc., which are politically less sensitive areas.

Other success stories, in this regard suggest that actions can precede elaborate regional treaties, coordinated research and monitoring, planning, and administrative and budgetary support. Exchange of information coupled with developing a comprehensive data base merits priority in the immediate action agenda. At this stage, it might not be feasible for the members to undertaking lumpy investments. Also, it might not be feasible to start with a comprehensive form of IREM. Instead, the member countries should concentrate on investments with maximum linkages and least reorganization of productive resources. Concurrently, they must begin with the daunting task of developing the institutional capacity and removal of policy distortions. However, institutional development is a continuous process, an action plan matrix should identify the dynamic actors of the region at various levels and integrate them into the IREM. Under the umbrella of SAARC, the South Asian countries could start with the project of setting up the priorities, identifying the mutual linkages, developing impact assessment matrix, determining the pollution standards and designing the regulatory mechanisms. However, at this juncture, the priority is to formulate both an immediate action plan matrix and an integrated intertemporal planning framework. It should be borne in mind that even if IREM starts with the least comprehensive integration, ultimately it has to transform into a comprehensive programme in order to optimize the basic objective function. Opportunity cost of delay is very high in this regard.

In the South Asian context, one must admit that the feasibility and sustainability of even a nascent form of IREM is contingent upon effective cooperation among the members. Amid myriad of rigidities and bottlenecks, cooperation is the only panacea for eliminating the regional evils and developing the common goods through IREM. However, in South Asian context, this seems to be the most scarce productive resource. But against the centrifugal forces, there are many centripetal factors that unite the South Asian countries in a unified springboard. Few regions in the world display such deep environ-

mental coherence and inter-relatedness as South Asia. The diversity of its echo-niches, its shared history and culture, similar economic imperatives and challenges, similar structural bottlenecks, and homogeneous HEP, coupled with new forces of modernization and the unsatiated quest for development, inevitably put them in a common development path. Above all, there is the ultimate threat to the security, creeping through the degradation of environment in the region. In fact, this provides the ultimate rationale for maximizing cooperation through an IREM in South Asia.

Table 1: Human Environment Profile (HEP) of South Asian Countries

Bangladesh HE indicators	Measuring unit	1980-85	1988-93	Low-income Countries	India HE Indicators	Measuring unit	1980-85	1988-93	Low-Income countries
Life expectancy	years	50	56	62	Life expentancy	years	55	61	62
GNP per capita	in US $ per annum	150	220	380	GNP per capita	in US per annum	280	300	380
Upper poverty line	% of population	79	48	19	Upper poverty line	% Of population	n.a	25	19
Infant mortality	per 000 live births	128	105.6	63.1	Infant mortality	per 000 live births	106.0	80	63.1
Under 5 mortality	" " "	n.a	122.0	101.4	Under 5 mortality	" " "	n.a	122.0	101.4
Maternal mortality	" 100,000 " "	3000	600	n.a	Maternal mortality	"100,000	460	420	n.a
Child malnutrition (under-5)	%age group	70.1	68.0	40.3	Child malnutrition (under-5)	% age group	n. a	6.3.0	40.3
Female advantage	years	-0.8	0.0	2.1	Female advantage	years	-0.3	0.1	2.1
Access to safe water (rural)	% of population	43.0	89.5	62.0	Access to safe water (rural)	% of population	50	73	62.0
Access to safe water (urban)	" " "	24.0	38.5	78.7	Access to safe water (urban)	" " "	76	79	78.7
Access to health care	" " "	45.0	74.0	n.a	Access to health care	" " "	75	100	n.a
Access t o sanitation (rural)	" " "	1*	4**	77***	Access to sanitation (rural)	" " "	1*	3**	77***
Access to sanitation (urban)	" " "	21*	40**		Access to sanitation (urban)	" " "	27*	44**	
Primary enrollment in school	" " school age "	60.0	77	108	Primary enrollment in school	" " school age"	96	106	108
Female enrollment rate	" " "	50	71	101	Female enrollment rate	" " "	80	93	101

Table 1: Conted.

Napal HE indicators	Measuring unit	1980-85	1988-93	Low-income Countries	Pakistan HE Indicators	Measuring unit	1980-85	1988-93	Low-Income countries
Life expentancy	years	48	54	62	Life expentancy	years	56	62	62
GNP per capita	in US$ per annum	160	190	380	GNP per capita	in US $ per annum	360	430	380
Upper poverty line	% of population	n. a	n.a	19	Upper poverty line	% of population	31	34	19
Infant mortality	per 000 live births	122.0	96.4	63.1	Infant mortality	per 000 live births	120.0	87.6	63.1
Under 5 mortality	" " "	n.a	128.0	101.4	Under 5 mortality	" " "	n. a	13.70	101.4
Maternal mortality	" 100,000""	n.a	n.a	n.a	Maternal mortality	" 100,000" "	600	270	n.a
Child malnutrition (under-5)	% age group	n.a	50	40.3	Child malnutrition (under 5)	% age group	n.a	40.4	40.3
Female advantage	years	-1.5	-0.8	2.1	Female advantage	years	1.3	2.0	2.1
Access to safe water (rural)	% of population	25.0	38.0	62.0	Access to safe water (rural)	% of population	28.0	38.0	62.0
Access to safe water (urban)	" " "	71.0	62.0	78.7	Access to safe water (urban)	" " "	84.0	84.0	78.7
Access to health care	" " "	10.0	n.a	n.a	Access to health care	" " "	64.0	85.0	n.a
Access to sanitation (rural)	" " "	1*	3**	77**	Access to sanitation (rural)	" " "	2*	12**	77**
Access to sanitation (urban)	" " "	16*	34**		Access to sanitation (urban)	" " "	428	53**	
Primary enrollment in school	" " School age '	82	102.0	108	Primary enrollment in school	" " school age'	45.0	46.0	108
Fermal enrollment rate	" " "	51.0	82.0	101	Female enrollment rate	" " "	31.0	31.0	101

Table 1: Conted.

Sri Lanka HE indicators	Measuring unit	1980-85	1988-93	Low-income Countries	Sri Lanka HE Indicators	Measuring unit	1980-85	1988-93	Low-Income countries
Life expentancy	years	69	72	62	Female advantage	years	4.5	4.5	2.1
GNP per capita	in US $ per annum	370	600	380	Access to safe water (rural)	% of population	29.0	54.8	62.0
Upper poverty line	% of population	n.a	22.0	19	Access to safe water (urban)	" " "	82.0	79.8	78.7
Infant mortality	per 000 live birtis	35.0	17.4	63.1	Access to helth care	" " "	90.0	90.0	n.a
Under 5 mortality	" " "	n.a	19.0	101.4	Access to sanitation (rural)	" " "	63*	45**	77***
Maternal mortality	" 100,000" "	90	n.a	n.a	Access to sanitation (ubarn)	" " "	80*	68**	
Child malnutrition	% age group	47.5	n.a	40.3	Primary enrollment in school	School age	103	107	108
					Female enrollment rate	" " "	101	105	101

*** = applies only for 1980 ** = applies for only 1990 *** Asia average for all population;**
Source: World Bank, 1995.

Table -2 : Population and Urbanization Profile in South Asian countries

	Total Population (thousands)				Average Annual Growth Rate (%)		Urban Population (thousands)				Average Annual Growth Rate (%)	
Country/ Period	1960	1990	2000	2025	1960-90	1990-2025	1960	1990	2000	2025	1960-90	1990-2025
Bangladesh	51419	115593	150589	234987	2.7	2.0	2644	19005	34548	99078	6.8	4.8
India	442344	853094	1041543	1442386	2.2	1.5	79413	230269	336542	737155	3.6	3.4
Napal	9404	19143	24084	34973	2.4	1.7	292	1837	3446	10695	6.3	5.2
Pakistan	49955	122626	162409	267112	3.0	2.2	11042	39250	61477	151529	4.3	3.9
Sri lanka	9889	17217	19416	24572	1.9	1.0	1772	3679	4701	10465	2.5	3.0

	Urban Population as % of Total Population			Population of Urban Areas with 4 million or More Inhabitants in 1990 (thousands)						Average Annual Growth Rate (%)		
Country/ Period	1960	1990	2025	Cities	1950	1970	1980	1990	2000	1970-80	1980-90	1990-2000
Bangladesh	5.1	16.4	42.2	Dhaka	420	1503	3290	6616	12162	8.1	7.2	6.3
India	18.0	27.0	51.1	Bangalore	764	1616	2812	4993	8219	5.7	5.9	5.1
Nepal	3.1	9.6	30.6	Bombay	2901	5812	8067	11169	15381	3.3	3.3	3.3
Pakistan	22.1	32.0	56.7	Calcutta	4446	6912	9030	11835	15680	2.7	2.7	2.9
Sri Lanka	17.9	21.4	42.6	Delhi	1391	3531	5559	8766	13240	4.6	4.7	4.2
				Madras	1397	3030	4203	5702	7773	3.3	3.1	3.1
				Karchi	1028	3119	4946	7702	11658	4.7	4.5	4.2
				Lahore	826	1964	2850	4092	5954	3.8	3.7	3.8

Source : World Bank, 1992

Table-3 : Freshwater Resources and Withdrawals in South Asian Countries

	Annual Renewable Resources	Internal Water	Annual River Flows			Annual	Withdrawals		Sectorl		Withdrawals (percent)
	Total (cubic km)	1992 per capita (000 cm)	From other countries (cm)	To other countries (cm)	Year of data	Total (cubic cm)	% of water resources	per capita (cm)	Domestic	Industry	Agriculture
Bangladesh	1357.00	11.38	100.00	×	1987	22.50	1	212	3	1	96
India	1850.00	13.23	×	×	1975	380.00	18	612	3	4	93
Nepal	170.00	8.26	×	×	1987	2.68	2	148	4	1	95
Pakistan	298.00	2.39	170.00	×	1975	153.40	33	2053	1	1	98
Sri Lanka	43.20	2.45	0.0	0.0	1970	6.30	15	503	2	2	96

Source : World Resources, 1994-95

Table -4 : Selected Water Quality Indicators forVarious Rivers of South Asia

			Dissolved Oxygen Annual Mean Concentration (miligrams per liter)			Average Annual Growth	Fecal Coliform Annual Mean Concentration (no. per 100-mililiter sample)			Average Annual Growth
Country	River	City	1979-82	1983-86	1987-90	(%)	1979-82	1983-86	1987-90	(%)
Bangladesh	Karnaphuli	Chittagong	5.7	6.1	×	-1.1	×	×	×	×
Bangladesh	Meghna	Chandpur	6.5	7.0	×	2.6	3133	700	×	-35.1
India	Cauveri	Satyagalam	7.0	7.3	7.5	1.1	10	648	920	121.8
India	Godavari	Dhalegaon	6.5	6.6	6.7	0.3	×	×	×	×
India	Godavari	Mancherial	8.0	8.0	7.3	-1.1	5	5	8	19.7
India	Godavari	Polavaram	7.2	7.2	6.9	0.0	4	2	4	-3.8
India	Sabarmati	Dharoi	9.4	9.1	8.9	0.0	248	222	220	-15.4
India	Subernarekha	Jamshedpur	8.0	7.9	7.5	-0.2	659	4513	2800	89.0
India	Subernarekha	Ranchi	6.7	4.0	5.3	-6.2	1239	7988	3100	70.5
India	Tapti	Burhanpur	7.5	6.9	6.1	-2.3	×	110	130	-23.2
India	Tapti	Nepanagar	7.2	7.0	7.0	-0.6	×	19	163	76.0
Pakistan	Chenab	Gujra Branch	6.2	6.8	7.1	1.8	436	463	446	-1.7
Pakistan	Indus	Kotri	7.6	7.2	2.6	-13.6	105	121	78	-3.8
Pakistan	Ravi	d/s from Lahore	6.8	5.7	6.3	-1.4	378	746	555	-2.4
Pakistan	Ravi	u/s from Lahore	7.2	6.7	7.0	-0.8	275	392	249	-6.6

Source : World Bank, 1992

Table -5 : CO_2 Emmissions from Industrial Process, 1991 in South Asian Countries

	Carbon dioxide Emmission (000 merric tons)						Per capita CO_2 Emmissions (000 metric tons)	Bunker Fuels (metric tons)
	Solid	Liquid	Gas	Gas Flaring	Cement Manufacture	Total		
Bangladesh	311	5910	9057	0	165	15444	0.15	0
India	496545	151583	19540	10968	24915	703550	0.81	2689
Nepal	180	692	0	0	50	923	0.04	0
Pakistan	8424	32492	21640	2342	3587	68487	0.55	0
Sri Lanka	7	3961	0	0	199	4166	0.26	0

Source : World Resources, 1994-95

Table - 6 : Other Greenhouse Gas Emmissions, 1991 in South Asian countries

	CO_2 Emmissions from Land Use Change	Methane from Anthropogenic Sources (000 metric tons)						Chlorofluro-carbons
	(000 mt)	Solid Waste	Coal Mining	Oil & Gas Production	Wet Rice Agriculture	Livestock	Total	(000 mt)
Bangladesh	6800	160	×	73	5000	960	6200	×
India	21000	480	82	720	5100	650	7100	1
Nepal	7600	16	×	×	560	400	980	×
Pakistan	9700	41	2	170	1100	1900	3200	4
Sri Lanka	3700	24	×	×	460	110	600	0

Source : World Resources, 1994-95

Table -7 : Selected Ambient Air Quality Indicators for Various Cities of South Asia

Country	City	Sulfur Dioxide Annual Mean Concentration (miligrams per liter) 1979-82	1983-86	1987-90	Average Annual Growth (%)	Suspended Particutate Matter Annual Mean Concentration (no. per 100-mililiter sample) 1979-82	1983-86	1987-90	Average Annual Growth (%)
India	Bombay	23	23	×	1.8	154	140	×	–1.1
India	Calcutta	71	54	×	4.6	410	393	×	–1.0
India	Calcutta	36	36	×	8.9	468	310	×	0.5
India	Delhi	42	86	×	12.0	460	460	×	–0.3
India	Delhi	16	33	×	23.9	312	301	×	-1.3
Pakistan	Lahore	×	×	×	×	745	×	496	-5.1

Source : World Bank, 1992

Table - 8 : Land Use In South Asian Countries, 1971-91

				Land Use (000 hectares)							
				Cropland		Permanent Pasture		Forest & Woodland		Other Land	
	Land Area (ooo hectares)	Population Density 1993 (per 1000h)	Arable Land as a % of Total Land	1989-91	% charnge Since 1979-81	1989-91	% charnge Since 1979-81	1989-91	% charnge Since 1979-81	1989-91	% change Since 1979-81
Bangladesh	13017	3150	58	8054	0.0	30000	0.0	1900	0.0	25255	0.0
India	297319	3016	61	169594	0.7	11782	2.6	67011	0.7	48932	1.0
Nepql	13680	1541	34	2651	14.3	2000	6.0	2480	0.0	6549	6.4
Pakistan	77088	1661	34	21107	4.0	5000	0.0	3430	19.7	47551	2.8
Sri Lanka	6463	2769	36	1901	1.5	439	0.0	2075	17.9	2048	14.3

Source : World Resources, 1994-95

Table - 9 : Area Expansion and Yield Effects of Cereal Production, 1961-63 & 1988-90 in South Asian Countries

	Production (million tons)		Harvested Area (milion tons)		Yield (tons per hectare)		Growth of Output Area	
	1961-63	1988-90	1961-63	1988-90	1961-63	1988-90	Expansion	Yield
Bangladesh	14.66	27.88	8.89	11.04	1.65	2.53	26.8	73.2
India	88.34	190.68	93.22	104.27	0.95	1.83	10.2	89.8
Nepal	3.17	5.53	1.72	2.98	1.84	1.86	98.3	1.7
Pakistan	6.96	20.67	8.05	11.66	0.86	1.77	22.7	77.3
Sri Lanka	1.03	2.29	0.56	0.80	1.83	2.88	33.8	66.2

Source: World Bank, 1992

Table -10 : Agricultural Input Use Pattern in South Asian Countries, 1979-91

	Cropland				Average Annual Fertilizer Use		Pesticide	Tractors		Harvesters	
	Total (000 hec)	Hectares Per Capita	Irrigated Land as a % of Crop Land		(kg per hectare crop land)		Use (metric tons)	Average Number	% Change Since	Average Number	%Change Since
	1991	1991	1979-81	1989-91	1979-81	1989-91	1989	1989-91	1979-81	1989-91	1979-81
Bangladesh	9137	0.08	17	31	45	101	×	5200	24	×	×
India	169700	0.20	23	27	33	73	×	971145	147	2950	102
Nepal	2659	0.13	22	38	10	27	×	4367	87	×	×
Pakistan	21140	0.17	73	80	52	89	×	260544	163	1500	200
Sri Lanka	1903	0.11	28	27	81	98	×	31470	33	6	89

Source : World Resources, 1994-95

Table - 11 : Forest Resources in South Asian Countries, 1980-90

	Extent of Forest Land			Annual Deforestation Total Forst			Annual Logging of Closed Broadleaf Forest, 1981-90			Plantations (000 ha)	
	1990 Natural Forest	1980 Natural Forest	1981-90 Extent (000 ha)	(%)	1981-85 Extent (000 ha)	Extent (000 ha)	Closed Forest	Primary Forest	Extent 1990	Annual Change 1981-90	Protected Forest (000 ha)
Bangladesh	769	1145	3.8	3.3	8	15	2.5	7	335	18	74
India	51729	55119	339	0.6	147	42	0.1	18	18900	1441	2266
Nepal	5023	5567	55	1.0	84	×	×	×	80	6	×
Pakistan	1855	2623	77	2.9	9	×	×	×	240	6	×
Sri Lanka	1746	2015	27	1.3	58	3	0.2	3	198	9	631

Source : World Resources, 1994-95

Table-12 : Tropical Forest Extent and Loss by Ecosystem in South Asian Countries

	Forest Ecosystem Type													
	Total Forest		Rain		Moist Deciduous		Hill and Montane		Dry Deciduous		Very Dry		Desert	
	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90	1990 Extent (000 ha)	Percent Annual Change 1981-90
Bangladesh	769	3.3	572	3.6	197	2.1	0	0.0	0	00	0	0.0	0	0.0
India	51729	0.6	8246	0.6	7042	0.5	8917	0.4	26242	0.8	0	0.0	1283	0.2
Nepal	5023	1.0	609	0.6	1300	0.6	2361	1.2	37	0.5	0	0.0	716	1.1
Pakistan	1855	2.9	0	0.0	11	3.1	1423	2.9	4	3.3	37	2.9	380	2.9
Sri Lanka	1746	1.3	247	0.6	605	1.4	57	0.0	836	1.5	0	0.0	0	0.0

Source : World Resources, 1994-95

Table -13 : Habitat Extent and Loss in South Asian Countries, 1980s

	Habitat Types													
	All forests Current		Dry forests Current		Moist Forests Current		Savannah/ Grassland Current		Desert/ Scrub Current		Wetlands/ Marsh Current		Mangroves Current	
	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost	Extent (000 ha)	% Lost
Bangladesh	482	96	0	0	482	96	0	0	0	0	68	96	191	73
India	49926	78	35785	81	14144	56	0	0	8527	88	941	79	189	85
Nepal	5381	54	882	16	4499	58	0	0	0	0	291	×	0	0
Pakistan	764	86	184	96	580	27	0	0	2811	69	320	74	154	78
Sri Lanka	610	86	446	76	163	94	0	0	495	75	512	×	120	×

Source : World Resources, 1994-95

Table -14 : Threatened Species : Mammals, Birds in South Asian Countries

	Mammals				Birds				Higher Plants			
	Total Number of Known Species			No. of Species per 10,000	Total Number of Known Species			No. of Species per 10,000	Total Number of Known Species			No. of Species per 10,000
	All Species	Endemic Species	Threat-ened Species	Square km	All Species	Endemic Species	Threat-ened Species	Square Km	Allm Species	Endemic Species	Threat-ened Species	Square Km
Bangladesh	109	0	15	45	354	0	27	147	5000	×	34	2074
India	317	38	39	47	969	69	72	143	16000	5000	1331	2363
Nepal	167	1	22	70	629	1	20	263	6973	315	33	2913
Pakistan	151	3	15	36	476	0	25	112	4950	372	16	1168
Sir Lanka	86	12	7	46	221	21	8	119	3314	879-900	224	1781

Source : World Resources, 1994-95