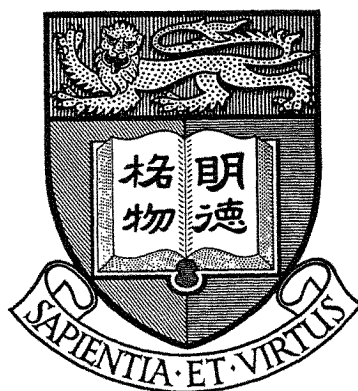




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# ASIAN

## *Journal of Environmental Management*

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Vol 2 No 1 May 1994

Special Issue: Community-Based Urban Environmental Management

Guest Editors: Michael Douglass, Yok-shiu F. Lee and Kem Lowry

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## From the Editor

The general approach of the *Asian Journal of Environmental Management (AJEM)* is to include within a single issue articles on a variety of environmental topics from authors representing different professional perspectives. In some situations, however, it is also useful to provide a series of articles focused on a single topic with a range of geographical perspectives. As its third issue (Vol 2, No 1, May 1994) and first 'Special Issue', *AJEM* presents papers by authors from across the region, each addressing the topic of community-based environmental management.

The papers presented here were selected and edited by the Guest Editors Drs Michael Douglass and Kem Lowry of the University of Hawaii and Dr

Yok-shiu F. Lee of the East-West Center. These papers are condensed forms of those presented at the Second International Workshop on Community-Based Environmental Management in Asia, held in Hong Kong, 6–10 September 1993. The proceedings from the workshop will be published by the Program on Population of the East-West Center, Honolulu, Hawaii.

The Fourth Issue of *AJEM* (Fall 1994) will return to the normal format of articles dealing with a range of topics related to the environment. In keeping with the basic purposes of *AJEM*, all articles — including those in this Special Issue — deal in part with the matter of how to manage the environmental problems the region faces.

Bill Barron  
Editor

# Call for Papers

The *Asian Journal of Environmental Management* (*AJEM*) invites articles on practical aspects of environmental management in Asia. Priority is given to papers involving (1) descriptions of efforts (or specific proposals) to *manage* problems associated with pollution or nature conservation, and (2) matters of concern to organizations involved in environmental management or public awareness (for example, environmental data, management tools, institutional developments).

The manuscript should be clear and concise. Where some of the material presented is highly specialized in nature, the text should include explanatory statements which convey its importance to a readership from different professional backgrounds. Submissions will be refereed by an international panel of experts in the field, and the referees will determine if the submitted papers are to be published as received, published following specific requests for revision, or not published. In keeping with *AJEM*'s goal of facilitating information exchanges, comments on published articles are invited and these will be published. Comments and rejoinders should be between 50 and 800 words.

Submission of a manuscript will be taken to imply that the material is original and no similar paper has been published or currently submitted for publication elsewhere.

The manuscript should be between 3000 and 8000 words and the cover page must include the title (less than 15 words), the author's correspondence

address, fax or telephone numbers, an abstract of 100 to 200 words, and a list of up to 10 key words. The typescript must be submitted along with a photocopy of original illustrations (for example, photographs, drawings). Indications of appropriate style for references, and other points of style, may be taken from the articles in this issue. Manuscripts must be submitted double spaced with wide margins on all sides along with a copy on a computer disk, preferably in Word Perfect 5.1. (If requested, *AJEM* will return computer disks or printed material to the author.)

Copyright of papers will be held by the publishers. Twenty-five reprints of each published paper will be provided free to authors with additional copies or alternative arrangements for reproduction to be worked out in consultation with the Editor.

Manuscripts submitted for consideration for publication in *AJEM* as well as comments on published papers should be sent to

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Prospective authors are recommended to use existing issues of *AJEM* for guidance on format, or they may write to the Editor for further information.



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# Introduction to the Special Issue on Community-Based Urban Environmental Management in Asia

Mike Douglass, Yok-shiu F. Lee and Kem Lowry  
SPECIAL ISSUE GUEST EDITORS

## NEEDS FOR COMMUNITY-BASED RESEARCH ON ENVIRONMENTAL MANAGEMENT IN ASIA

Cities throughout Asia are experiencing tremendous environmental stress. In most cases, the urban poor must bear the most debilitating impact of untreated waste, inadequate and contaminated water supplies, and air and land pollution accompanying the rapid urban transition occurring in the region. As the magnitude of the problems stemming from the reinforcing interaction between poverty and environmental deterioration increases, there is a manifest need to assess current conditions and to direct concerted efforts toward integrating environmental management and poverty issues into urban policy and planning.

In an effort to begin to address urban poverty and environment issues, teams of researchers and community-level practitioners have been involved in participatory action research on urban environmental management in low-income neighbourhoods. This Special Issue of *Asian Journal of Environmental Management* draws on papers presented at the Second International Workshop on Community-Based Environmental Management, Hong Kong, 6–10 September 1993. Papers included deal with Bangkok, Bandung, Bombay, Hong Kong and Seoul. The project, which was initiated in 1991, is concerned with improving the capacity for environmental management in low-income urban communities in Asia.

A major problem preventing the amelioration of the growing environmental problems in the cities

of Asia has been the ineffectiveness of existing institutional arrangements in coping with the combined stress of urban population growth, accelerating energy and natural resource demands, intensified land development and land use conflicts typical of expanding urban regions, and the impacts of rapid technological change. The spatial concentration of these factors, particularly in very large metropolitan regions, is not only putting longer-term national development potential at risk; the exposure to them of very large proportions of urban populations who live in slum and squatter settlements is in many instances life endangering.

Three major directions are currently being pursued to improve institutional capacities to manage the environmental consequences of urbanization. One is to strengthen local governments by decentralizing policy, planning, and implementation authority to municipal and metropolitan regional levels. Another champions privatization and the role of the private sector in meeting the challenges of environmental deterioration through the market. A third path calls for increasing the capacity of community-based organizations to improve daily habitats through co-operative association and action.

Each of these approaches has its own strengths and weaknesses, but all must eventually address the issue of how to reach and improve the environmental quality of the habitats of the urban poor. In the large cities of Asia, from one-fifth to three-quarters of the citizenry live in substandard settlements and have levels of income that, by conventional indicators, fall below levels of consumption required to

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sustain minimal conditions of human life. In the past, as the evidence for most countries indicates, neither government nor the market has been able to make a substantial contribution toward reversing the declining environmental quality of life in poor communities. Local organizations have also suffered from the reluctance of governments to recognize the legitimacy of slum dwellers, from absentee control over land and other assets, and from the daily struggles of making subsistence incomes.

As the magnitude of the problems stemming from the reinforcing interaction between poverty and environmental deterioration increases in many Asian cities, there is an equally growing need to assess both the past performance and the potential of each of these three approaches toward improving the institutional capacity for environmental management in poor urban communities. Although much work has been accomplished in terms of technically measuring and documenting the types environmental stress facing large cities, much remains to be done in evaluating both the effectiveness of public policies and the role of the private sector in managing this stress. Even less has been done at the neighbourhood and household level, particularly with regard to understanding the ways in which the poor manage environmental concerns either on an individual household basis or through co-operation in their communities.

The research project on community-based urban environmental management that brings together the papers in this volume has two major objectives: (1) to improve the understanding of the problems of and potentials for better environmental management in poor urban communities in Asia, and (2) to facilitate the development of the institutional capacity for environmental management in and with these communities. In meeting these objectives, the significance of the research will be manifested in at least four ways. First, it will be one of the first collaborative projects to link together two critical aspects of development processes in Asia: urban poverty and environmental management. Much research and literature exists on each aspect as a separate topic, but very little has been done on the relationships between them. Urban poverty studies have principally focused on income, housing and infrastructure, and although the environment is receiving increasing attention in developing countries, the vast majority of research and interest in this topic remains in rural regions and forest preserves. By the early years of

the next century, most Asian countries will have half or more of their populations living in cities. To the extent that urban poverty is also expected to persist as the urbanization process accelerates, the importance of understanding how to assist low-income households to improve the effectiveness of their efforts to managing environmental problems will also increase.

Second, the research seeks to evaluate existing programmes and recommend improvements in government policy and planning approaches toward community-level environmental management in poor areas. In so doing, it also seeks to develop a framework for monitoring and evaluating these programmes as they are implemented. The gap between objective statements about the quality of the environment and the actual impacts of environmental management policies remains wide. Yet, only by making these linkages through a carefully designed monitoring and evaluation framework can it be narrowed. The intention of the community-level research is to make the monitoring of environmental conditions accessible to the community itself through the development of low-cost evaluation techniques.

Third, the research is directed toward increasing the understanding of the environmental coping and management strategies of poor households. Further, by focusing on co-operative arrangements between households in poor communities, it seeks to identify potential avenues for improving institutional capacities for environmental management at the household and community scale. Poor households expend considerable amounts of physical, economic and social energies for maintaining access to usable environmental resources, particularly water, land and fuel, and managing these resources in a way which minimizes negative impacts of their use on household members. Understanding how the poor perceive environmental resources and problems is crucial to efforts directed toward improving the capacity for self-management at the community scale.

Fourth, and most important, the research programme is designed in a manner which treats poor households and communities as partners in the research and planning process. Its intentions are not to collect data for analysis by academics or government agencies alone, but to share knowledge and to build internal community capacity for self-management. Given the scale of poverty and environmental issues confronting Asian cities, building this capacity will be a crucial component of any effort to

improve environmental conditions not only of poor households, but for the city as a whole. The project thus has an explicit action-oriented component which, through sustained interaction between research teams and communities, seeks to learn from the community while empowering its members to improve the environmental quality of their households and neighbourhoods through co-operative action.

## RESEARCH IN FIVE ASIAN CITIES

The research project is designed as an international collaborative study and recognizes that no single city can be used to cover the complexities of urban poverty-environment relationships in Asia. The inclusion of five cities is intended to encompass a wide variation in national and local contexts, and thereby demonstrate the necessity for an equally wide variety of localized, innovative responses to problems of environmental management, while at the same time concentrating funding resources on a limited number of rapidly growing metropolitan regions in Asia to allow for greater in-depth research at the community level. The similarities and contrasts are brought out in the papers included in this edition of the journal.

The situation in Seoul is a complex outcome of rapid urban-industrial growth and intense competition for access to land and housing in what is becoming one of the world's largest metropolitan regions. Seoul continues to face a number of severe environmental problems. The level of pollution in main upstream water plants serving the city is higher than official standards. Untreated sewage flows directly into the Han River, which runs through the core of the metropolis, and its tributaries, which have become increasingly polluted by industrial effluents, including heavy metals. Air pollution is at a critical level, with indicators showing that it is detrimental to health in one out of every two or three days.

Ik-Ki Kim, Kwang-Hee Jun and Yoon-Chul Jung bring these larger metropolitan issues to bear for a squatter area in Seoul. Studies show that the levels of air pollution to be more than four times higher in and around poor communities than in higher income areas. This is due in part to the use of harmful anthracite coal briquettes as household heating and cooking fuel plus the absence of well-equipped pollution-preventing infrastructure and facilities, such as sewerage, in poor neighbourhoods. Intensive

crowding of many families into a single dwelling also puts tremendous stress on normal household functioning.

In the case of Hong Kong, Cecilia Chan observes that in contrast to its 'newly industrializing economy' status and rapid improvements in material welfare over the past three decades it has serious environmental problems, including an estimated 1.5 to 5.8 million of its residents having experienced deterioration of their health due to air pollution. In 1989 the Hong Kong government found that at least half of the territory's waste water receives no treatment before being discharged into the sea, and between 75 to 90% of Hong Kong's factories are illegally dumping liquid wastes into the territory's waters.

Environmental stress is particularly evident in the older urban districts in central Kowloon. Two squatter areas in this area, Diamond Hill New Village and Sheung Yuen Ling Village, which have been selected for research are situated in the midst of a long-established industrial and residential area. Huts are illegally constructed along steep slopes on government land, and the environmental problems faced by these communities are substantial. Lack of drainage and access roads result in high susceptibility to flooding, fires, sewage overflows and contamination, poor emergency access and other life-threatening problems. Strong choking, suffocating smells and gaseous emissions are generated from the dyeing factories located at the upper end of the water streams which pass through the residential units of the squatter area, adding to the heavily polluted air of the community. The poor conditions of the drainage system create foul smell, breed mosquitoes and lead to skin diseases, particularly among children, a large number of whom are reported to have coughs and respiratory problems, including chronic respiratory tract infections. The two settlements have been targeted for government assistance in the form of minimal public water taps, drains and refuse collection services, active participation, but residents still encounter legislative indifference and difficulty in sustaining grassroots mobilization to improve environmental conditions.

Concerning Bombay, Chandan Sengupta describes the situation there as being among the most severe in the world. About half of the city's population lives in slum areas, with an additional 400 000 people residing in deteriorating tenements and another 200 000 living on pavements. The low-income population of Bombay is increasing more rapidly

than the population of the city as a whole; from 1961 to 1981 when the urban population of India doubled, the slum and squatter population in Bombay increased tenfold from 400 000 to 4 million. Data from the late 1970s show that one-third of the housed and more than half of the unhoused received incomes insufficient to purchase food to meet minimum calorie intake requirements to sustain life. The vast majority of the very poor report that their situations have remained unchanged or even worsened in recent years.

Bombay is beset by chronic environmental problems related to water supply and sanitation, and in terms of air quality and industrial wastes, it is considered to be one of the most polluted cities in the world. The water system is antiquated and contaminated from sewerage. Most of the rapidly expanding suburbs have no proper sewerage system at all. High incidence of typhoid, malaria, tuberculosis, bronchitis and asthma are found to be related to environmental deterioration and pollution. Communicable diseases, such as typhoid fever, caused by unsanitary conditions and poor quality of water are endemic among slum and squatter settlement dwellers.

The article by Indira Dharmapatni explores the experience of kampung in Bandung. As Indonesia's third largest city and capital of West Java, Bandung is one of the fastest growing metropolitan regions in the nation. From 1980 to 1990 its population grew at an annual rate of 4.5% to reach a size of 2 million people. With about three-quarters of the city's housing built outside the formal land and housing sector, the slum population continues to expand in absolute numbers even though ten years of implementation of the Kampung Improvement Program (KIP) has reduced the relative share of slums in the total area of the city. The areas in which the poor are concentrated experience the highest levels of environmental stress and pollution. The city's antiquated sewerage system, which was constructed during colonial times, covers only 40% of the city. In the kampung a single canal generally serves as both drainage and sewerage system, with rivers and streams clogged by uncollected garbage and inadequate drainage resulting in periodic flooding of many kampung. About half of the population meets water needs from unprotected shallow wells and rivers. The intensity of demand under expanding population is resulting in a continuous lowering of the water table at a rate of 4.2 m per year.

Among government efforts to improve environ-

mental conditions in poor communities, the KIP has received the most attention and has been credited with achieving substantial success in improving community infrastructure. Several of the kampung that have had the KIP report that more than half of their households are now connected to sewerage, drainage and municipal water services. Yet a large proportion still utilizes heavily polluted rivers for their water use and waste disposal, and the services which have been provided are reported to be poorly maintained. About 2600 ha of slum areas have not yet received KIP attention, and many of these are still in very poor condition and are also expanding rapidly. Major health problems persist as a consequence of competition for and use of environmental resources, poor sanitation and inadequacies in basic urban services. These include diarrhoea, dengue fever, skin diseases, and illnesses caused by ingestion of industrial waste.

The situation in low-income communities in Bangkok that is described by Orathai Ard-am and Kusol Soonthorndhada is as precarious as that of the kampung in Bandung, but with contrasting sets of problems. Bangkok is beset by a combination of chronic environmental problems and the impacts of new construction and urban expansion associated with the nation's rapid economic growth rate in recent years. Groundwater abstraction rates are higher than replenishment, resulting in land subsidence, widespread flooding, and seepage of saline water into freshwater aquifers. Only 2% of Bangkok's population is connected to the city's antiquated sewer network. Major sections of the Chao Phraya River are no longer able to support life. The Bangkok Metropolitan Authority remains without sufficient funds to adequately improve the city's water and sewage system, and the National Environmental Board has found the average daily level of air pollution to be more than twice the acceptable level and has rated the capital's atmosphere as 'dangerous'.

Bangkok is dotted with slum formations that account for one-third of its population, and despite high levels of economic growth, the proportion of people with below basic needs poverty line incomes in the late 1980s was about the same as it was a decade earlier. Most slums exist on government land or on the holdings of large landlords who charge rent to slum dwellers to live on the land. There are thus few squatter settlements, but slum dwellers are nevertheless subject to removal as economic growth turns formerly neglected areas into prime commer-

cial development sites. Since many slums are situated on private land, they cannot qualify for routine government housing or other community improvement schemes.

## PRELIMINARY OBSERVATIONS

The on-going research brought together in this special issue is oriented toward linking theory with practice. In this regard, preliminary results from the project has led to six key propositions that will serve to guide the next phase of research:

- Community-based environmental management involves a shift in analytic and strategic emphasis away from conventional analyses of urban environmental management, which is largely based on allocative and regulatory roles of government, toward an emphasis on enhancing local practices at the community scale.
- An understanding community level environmental management can best begin with a focus on household practices.
- Co-operation among households to manage environmental resources is common. The conditions that foster co-operation are highly contingent. Co-operative efforts vary in the degree of success.
- The degree of state presence in community-level environmental management varies from country to country (and within countries).
- Government strategies for improving conditions at the community level also vary.
- External agents are important actors in many community-level organizing efforts.

### Shift in Analytic and Strategic Emphasis

Conventional analyses of urban environmental management focus on government strategies to allocate resources and to mitigate impacts at the urban scale. The strategic emphasis in these analyses is on developing a set of reforms for improving the technical basis for environmental management. This includes improved data analysis and strengthening government management institutions by means of decentralization, training of management officials, greater regulatory authority, improved strategies for cost recovery for new facilities and services and related initiatives. A recent trend in this mode of planning involves improving the efficiency of gov-

ernment programmes by minimizing government disturbances of market forces and greater reliance on cost-recovery programs. Neither the conventional approach nor the shift toward greater private sector involvement tends to give a significant role to community-level co-operative environmental management efforts.

In the context of this research, however, environmental management in slums and squatter settlements refers to the constellation of household, community and government activities undertaken both to improve access to water supplies, solid waste disposal sites and sanitary facilities and minimizing the health and convenience impacts of poor drainage, polluted streams, unsanitary wastes and polluted air. While government has a critical role to play in managing environmental conditions, the concept of community-based environmental management connotes a particular emphasis on both household practices to improve environmental conditions and inter-household collective efforts to increase access to resources and minimize health risks. Community-based environmental management draws attention to the ways in which households and community groups interact with government agencies and local and international aid agencies to define environmental problems, design projects, fund, build and maintain facilities and services.

What emerges from this community-based focus is a recognition of the wide variety of household practices and inter-household collective efforts to manage environmental conditions in slums and squatter settlements that are taking place even when government programmes are minimal. The efforts by poor communities to generate collective management efforts vary widely in scope and quality, but the successes in some communities are striking. The degree of government involvement in providing, funding, and maintaining facilities and services also varies widely both across cities and within cities. What emerges from the initial research is a more complex image of the conditions that foster the development of community-level institutions to engage in collective activities to improve environmental conditions.

### Household Practices

The household is of course one of the smallest social units. Community-based environmental management can be better understood by focusing

first on how households cope with basic livelihood and environmental improvement decisions. Central to understanding environmental management at the household level is the identification and allocation of household management tasks. Traditional allocations are age and gender-based, with women tending to have most responsibilities for collecting household garbage, collecting and storing water, and cleaning toilets and other facilities, and men frequently charged with larger-scale tasks such as hauling waste, building toilets, digging wells, and constructing drainage ditches.

Changes in environmental awareness and in community conditions are resulting in new household practices and more permeable boundaries around traditional roles. As collective community efforts to manage the environment increase, there are frequently increased demands for household contributions of labour to dig trenches for sewage lines, maintain drainage ditches, clean community common areas and related tasks. This is resulting in increasing participation of men in environmental management projects. At the same time, the divisions of household labour for participating in community meetings, organizing community work, or meeting with public officials are not necessarily based on gender. Collective efforts also involve the development of community institutions to allocate resources or tasks, such as schedules for allocating water among households sharing a single under-capacity water line. The increasing participation of women in wage work or trading activities outside the household makes traditional role patterns even more problematic. These factors combine to make the household — as a 'micro' division of labour and basic unit for pooling income and resources — an important analytic focus for describing and understanding the environmental management behaviour of the urban poor.

### **Inter-household Co-operation to Improve Environmental Conditions**

One of the major observations of the research covered in this special issue of the *Asian Journal of Environmental Management* is that households do co-operate to improve environmental conditions. In the Bombay case, collective efforts to clean latrines, gutters and wells are established practices. In Wat Chonglom (Bangkok) collective efforts to construct walkways, clean drains, collect garbage, and develop

a community water system are all part of a highly organized pattern of inter-household co-operation. In Cibangkong (Bandung) collective efforts to clean toilets and water facilities, clear drainage canals, collect solid waste and maintain facilities are common. Moreover, in Cibangkong residents are much more willing to participate in cleaning than in construction and repair activities, partially because the latter activities frequently require greater household contributions of labour, money and land.

The collective activities and the community capacities for collective action are, however, contingent upon a number of localized conditions and, as noted above, take different forms in different contexts. The Bangkok case suggests, for example, that one reason why Wat Chonglom is so much better organized for environmental management than the nearby settlement of Yen-ar-kard II is that the former community is much more 'developed' in terms of virtually every indicator ranging from income to education. In Cibangkong (Bandung), on the other hand, some of the poorer neighbourhoods are more active than more improved neighbourhoods in terms of their willingness to contribute labour, money and land to community improvement. These and other examples suggest that the level of development is simply one of several factors associated with the capacity to engage in collective action.

The factors that foster and sustain co-operation are also highly contingent. All the cases suggest that a degree of perceived community permanence and stability is a crucial factor. Land tenure and security, higher proportions of long-term residents, relatively better economic conditions of the majority of the households and religious and ethnic homogeneity appear to contribute to making co-operation more likely, but these conditions do not insure such co-operation will occur or be sustained. Community leadership, whether provided by appointed community officials as was the case in Cibangkong or emerging from the community as happened in Wat Chonglom and Hong Kong, appears to be an obvious ingredient. In Cibangkong, government direction and support and perceived community needs appeared to have been important factors in fostering collective action. Each of these factors offer partial explanations of successful collective efforts to improve environmental conditions, but they may not be sufficient in the face of the most wretched environmental and economic circumstances. Each context must ultimately be addressed in its own terms.



### State Presence in Communities

The notion of state 'presence' refers to the degree to which the local state seeks to cultivate and integrate community power structures in order to implement state policy. The degree of state presence can be located on a continuum. Bandung and Hong Kong represent the 'extensive involvement' end of the continuum of state presence. In Hong Kong government social workers help organize community residents and assist in identifying community needs and representing community interests before government environmental management agencies. In Bandung, the presence of the state at the community level is even more pervasive. A network of elected and appointed officials reaches all the way down to the neighbourhood level. Government officials encourage community and neighbourhood representatives to enlist the support of their constituents to contribute labour, land and money to government projects to improve environmental conditions.

State presence in the poor settlements of Seoul, Bombay and Bangkok appears to be much more episodic. In many of these settlements, government services are minimal. In Bombay, and to a lesser extent in Bangkok, the state is often identified with representatives of political parties who, in their efforts to garner the substantial votes of the urban poor, make promises of environment-related infrastructure and services as part of political campaigns near election time.

What is not yet clear are the relationships between heavy state presence at the community level, the community capacity to engage in collective action, and the ultimate quality of environmental services and facilities at the community level. Judged just by a limited set of outcomes in Hong Kong and Bandung, extensive state involvement has led to relatively better environmental facilities and conditions. But at least in the case of Bandung, extensive state involvement also appears to have led to increased passivity among residents of some neighbourhoods who preferred to wait for government-provided projects rather than organize themselves. What remains to be determined is the impact of state presence on the sustainability of the institutions of collective action at the community level.

### Government Strategies

Government policies and strategies towards slums and squatter settlements have taken different ap-

proaches in Asian cities, and the approaches themselves have tended to change significantly over time. Many governments initially dealt with the urban poor in slums and squatter settlements by neglecting them or, in some cases, forcibly relocating them. In the 1950s and early 1960s 'illegal' slums and squatter settlements were generally regarded as a transitory problem that would disappear as development progressed. Later, slum eradication, in the name of city beautification, preparation for international events, to prepare sites for public works and crime prevention, became common. It is only fairly recently that governments have begun to recognize that poor people are not only productively engaged in the urban economy, but that improving the conditions of slums and squatter settlements is crucial to sustaining the social and environmental conditions of the city as the future habitat for the majority of humankind.

Current government strategies for improving environmental conditions at the community level are based on a mix of ideas. These include, a growing recognition of the legal right of those living in illegal settlements to be there; increasing willingness to provide government assistance in providing infrastructure; a relaxation of building codes in some cities; and new initiatives to strengthen local governments to manage infrastructure provision. Most of the contemporary programmes involve some form of settlement upgrading by providing water, sanitation, solid waste disposal facilities and other services. Settlement upgrading programmes take a variety of forms. The critical differences among programmes have to do with the sources of funding, community participation in major program decisions, the number of services provided, the number of government agencies involved and the degree to which programmes deal with land tenure arrangements. Such upgrading programmes compensate somewhat for previous low investment in basic infrastructure and service. A key question for further analysis is whether they will make a positive contribution to the long-term capacity of local government and community organizations to provide operation and maintenance of environment-related infrastructure and services on a sustainable basis.

### External Agents

External agents include government representatives who interact with communities on a regular basis, representatives of NGOs and private entrepreneurs.

External agents can provide leadership and technical expertise. They may have knowledge of or access to funding that the community can use to support organizing efforts or specific services. In Bombay, the external agents are primarily political party representatives. They tend to operate on a patron-client basis to promise particular services in exchange for votes and support. In contrast, Hong Kong government social workers help organize community residents and represent communities working with government agencies. In Wat Chonglom, leadership has been provided by private social workers operating in a personal capacity. NGOs are active throughout the region, but have not been instrumental in any of the communities outlined in this special issue.

The non-governmental external agents with the largest impact on communities have been international aid agencies such as UNICEF. Urban projects funded by UNICEF and other aid agencies have been critical in some cities. For the longer term, the increasing activism of indigenous non-governmental organizations in mobilizing community collective efforts represents a significant source of outside support. Local non-governmental organizations can facilitate the successful implementation of a community-based effort through an empowering strategy for the poor and their communities by improving their access to important environmental resources, particularly land, infrastructure and services necessary for environmental management. Several principal tasks relating to such an empowering strategy can be performed by local non-governmental organizations and other external support organizations: Building and enhancing the viability, cohesiveness, and effectiveness of community organizations through innovative participatory tools and methods; provision of technical inputs related to management and accounting skills, information, monitoring and evaluation; and coalition building to create linkages between communities and wider political processes.

## FUTURE RESEARCH

The work summarized in this special issue is entering a more intensive phase of interaction with communities, government planning agencies and non-government organizations. Within the community, efforts will increasingly be directed toward understanding household and community dynamics

related to environmental management. This will be accomplished through combinations of household surveys and open meetings with community members and organizations. The principal objectives are to further understand current environmental management practices with regard to water, solid waste disposal, and sanitation; how capacities and organizational approaches have been changing over time; and what types of support would best facilitate improvements at the community level.

Evaluation of government policies and programmes related to environmental conditions and management in poor communities will focus on the impacts of programs initiated by governments to improve environmental conditions in slums and squatter settlements and on the effectiveness of government efforts to encourage community collective action. In addition, the development and evolution of new community institutions responding to community environmental conditions will be assessed.

Evaluations of NGO activities will be designed to deepen the understanding of the nature, scope, processes and outcomes of local NGO interventions in community-based urban environmental initiatives. The principal research questions include: how do NGOs define and evaluate their working relationships with communities and their organizations, government and other NGOs; and how do communities and governmental officials perceive and evaluate their relationships with local NGOs. Interviews and focus group discussions will be conducted to discuss and explore these initiatives.

From this stage of research, the programme will move into a further cycle of working with the communities and interested government and non-government agencies to interpret the findings and, where needed, to explore alternative approaches toward improving the capacity for community-level environmental management. The purposes of the project at this later stage will be more closely focused on: (i) facilitation of institution-building within poor communities for managing environmental problems; (ii) recommendations to host governments on issues and policy directions; (iii) initiation of workshops and meetings by the respective institutions of the in-country research teams to foster the translation of research outcomes into practical approaches and methods of enhancing community-level environmental management; and (iv) dissemination of information and research findings to wider national and international audiences.

# The Urban Poor and Environmental Management in Korea: A Case Study of Wolgoksa-Dong, Seoul

*Ik-Ki Kim, Kwang-Hee Jun and Yoon-Chul Jung*

## ABSTRACT

Poor indoor and outdoor air quality, limited access to solid waste disposal services, excessive noise and vibration, limited sanitary services and bad smells are among the environmental characteristics of Wolgoksa-Dong, a poor settlement in Seoul, Korea. Residents perceive environmental conditions as serious, but not as serious as economic conditions, housing and crime. In response to settlement conditions, the evidence suggests that most households have sought to relocate to other parts of the city rather than to engage in collective efforts to improve environmental conditions or to participate in social protest movements.

**Keywords:** *Korea, urban environmental, low-income populations*

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## INTRODUCTION

Rapid urbanization and industrialization in the Seoul metropolitan area have exacerbated overcrowding and environmental degradation in Korea's national capital. In Korea, as in other developing nations, low-income residents frequently live in urban fringe areas in settlements intermingled with manufacturing and processing industries (Hwang 1989). Urban squatter settlements are likely to be located on or near hills, flooded plains, garbage or waste processing plants, sewage treatment facilities, and other areas prone to adverse environmental conditions. Urban squatter residents may build or rent their residences without fear of government expulsion. Standards of housing construction may not be strictly enforced in these poor communities. Construction work is carried out without definite planning and the supply of

urban basic infrastructure services, particularly water supply and sewage systems, is minimal.

This study, which was supported by the Korean Research Foundation, examines environmental conditions faced by the Korean urban poor by focusing on one community, Wolgoksa-Dong in Seoul. In this analysis, environmental conditions and perceptions and behaviour regarding air quality, solid waste management, water supply and sanitation are examined. Available published data on environmental conditions in the community are supplemented by a survey and interviews with community residents. Questionnaires were administered to about 300 respondents in the community. Questions focused on (i) general awareness of environmental problems, (ii) environmental management practice, (iii) garbage and solid waste management, (iv) living conditions and neighbourhood relations, and (v) socio-demographic variables of the respondents.

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## THE WOLGOKSA-DONG COMMUNITY

Wolgoksa-Dong is a community located about seven kilometres northeast of the Seoul Municipal Hall, the centre of Seoul metropolitan area. The community is situated on a hilly site of about .22 km<sup>2</sup>. The population density is about 3.5 times that of Seoul as a whole (Kim 1991). Major community facilities include a community hall, a room for the aged, a child care facility, a children's playground, a neighbourhood park, a parking lot, three public latrines, student study room and community depositories. Sixteen real estate agencies, seven *yontan* (briquette) sales shops, and thirteen grain sales shops are also located in the community.

This community is one of the poorest in the Seoul metropolitan area. The term 'urban poor' usually refers to people who are below a poverty line which allows for the minimal costs of physical maintenance and social life. In Korea, however, urban poverty should be interpreted in relative terms given the country's high economic growth rate. According to survey results, household incomes are somewhat skewed. Just over half the households had monthly incomes of one million won or more (US\$1282). Fifteen percent earned less than 590 000 won per month (US\$756). While relatively high by developing country standards these incomes in the present context of Korea development and costs of living are relatively low. In Wolgoksa-Dong, one-third of the households are dependent on husbands alone for income, while 28% of the households had incomes from both husbands and wives. Fourteen percent of the households had incomes from both spouses and children. The relatively high proportion of households in which husbands, wives and children contribute to household income indicates the lengths to which households are going to make ends meet.

Wolgoksa-Dong has steadily lost population since 1988. According to the 1990 census the population was 14 400 (about 1.3% of the Seoul population), while the 1992 survey revealed a population of only 11 866. The community has 3307 households, less than half of whom own their homes. Eighty percent of those owning their homes had building permits. Of the survey respondents, 68% had lived in the community more than five years and 24% had lived there for 20 years or more. About a third of the survey respondents had immediate plans to move from Wolgoksa-Dong. Those who are seeking to move cited the need for better housing (33%)

and maturity of lease (40%) as the primary motivations for leaving. None of the respondents cited environmental conditions as a significant reason for moving.

The Seoul municipal government is represented in Wolgoksa-Dong by the *dong* office. This unit of municipal government has undertaken three main tasks of environmental management. The first is the collection and management of solid waste. Recycling is designed to reduce the volume of waste by 10% and to create an integrative spirit by helping the poor neighbourhoods with receipts from the sale of recycled material. Recycling was initiated by a community-based organization. Items such as papers, empty bottles, steel articles and other reusable materials are being collected.

The second task of the *dong* office is implementation of government policies for income support of the urban poor. The major components consist of maintaining the community workstation programme and constructing building complexes for community welfare. The workstation programme includes the provision of new community scholarships (26 people totalling US\$3400) and a neighbourhood assistance plan (US\$2600 twice per annum), coal briquet supply, and support to homes for the elderly. A community hall building complex (financially supported by Lucky-Goldstar Corporation) is being built at a cost of US\$1.4 million.

The third task of the *dong* office is organizing a community-level environmental movement for new 'order and life'. This involves the procurement of parking spaces distributed throughout the hills of this community. This effort was originally initiated by new community movement leaders working voluntarily for this community. When field observations were made, the *dong* office was attempting to broaden the streets around a neighbouring university campus (Dongduk Women's University) and to improve community level environmental spaces by broadening narrow alleys in front of the community hall.

## ENVIRONMENTAL CONDITIONS IN WOLGOKSA-DONG

Poor residents in Wolgoksa-Dong confront problems of air pollution, water contamination, noise and vibration, soil contamination, and ground subsidence.

## Air Pollution

The problem of air pollution in Seoul — as monitored by the Pollutants Standard Index (PSI) — is critical (Kim 1991; Yoon 1993). The index indicates that air pollution is detrimental to health once in every two or three days. Air pollution exceeds the maximum point of the index (500) several days a year, especially when the weather is bad.

The air quality of the community was examined by comparing the results from nearby measuring points located at Kilum-Dong with those from six other measuring points located in the national capital. The five items of comparison include SO<sub>2</sub>, Total Suspended Particulates (TSP), CO, NO<sub>2</sub> and O<sub>3</sub>. Hydrocarbons were excluded for lack of adequate data. The annual average of concentration for sulphur dioxide (SO<sub>2</sub>), is 0.052 ppm, which is much higher than the concentration in other residential communities (0.042 ppm). SO<sub>2</sub> levels are highest for winter (January to December), and lowest, at 0.025 ppm, for summer (June to September). The urban poor of the Wolgoksa-Dong community are also likely to be suffering from adverse indoor air quality, particularly during the winter season, because of indoor coal briquet heating systems.

## Water Contamination

The urban expansion of Seoul has resulted in increasing demand for water supply facilities. Old pipes in the central areas of Seoul have not been replaced on a timely basis. Unplanned construction of new

water pipes in the rapidly expanding fringe areas can cause health problems. Disruptions in water supply can be caused by the lower pressure in water pipes as well as penetration of ground water into old portions of the pipes.

The tap water supplied for the Wolgoksa-Dong community is taken from the Kueui Reservoir, which is 9 km away from the Han River. Table 1 shows the quality of water from the Han River and six households sampled in the community. Test materials were taken from water taps from Wolgoksa-Dong. Ion chromatographs were used for nitrate nitrogen and chloric ion, atomic absorption speedometer for iron, and gas chromatographer for trihalomethane. An ECD (electron capture detector) was used to check the quality of tap water supplied for the households in this community.

As Table 1 indicates, the acid-base level was measured at 6.6–6.7 pH, which is below that of the source reservoirs and the upper tolerance limit (the Korean standard ranges between 5.80 and 8.50 pH). Iron was detected at the source reservoir of the Han River and six sample households, ranging between 0.09 and 0.25 mg/L below the tolerance limit of 0.30 mg/L. For the sample households, chloric ion ranges from 9.6 to 11.4 ppm, which is nearly identical to the source reservoirs. For the sample households, colitis germs were not detected, but 1–6/cm<sup>3</sup> was detected for other germs. Municipal water supply departments should pay particular attention to increasing chloride density in the process of purifying tap water at the Kueui Reservoir of the Han River. According to Cho (1981), the number of germs

Table 1  
Sources of the Han River and the Wolgoksa-Dong Water Quality Survey, 1993

Place	pH	iron (mg/L)	nitric nitrogen (mg/L)	chloride Cl <sup>-</sup> (mg/L)	total bacteria (no./mL)	THM (mg/L)
Korean Standard	5.80 8.50	0.30	10.00	150.00	1000	0.100
Han River Water Reservoir	7.00	0.13	6.63	11.40	740	0.005
Wolgoksa-Dong						
1	6.60	0.13	6.63	11.19	4	0.002
2	6.59	0.13	7.03	10.22	1	0.002
3	6.61	0.09	6.71	9.56	3	0.002
4	6.67	0.09	7.11	11.06	6	0.002
5	6.67	0.25	7.00	11.44	4	0.002
6	6.67	0.06	7.22	11.00	4	0.002

tend to decrease with the density of chloride remaining in tap water ( $r = -0.441$   $p = 0.001$ ). In his analysis, THMs, which is a cancer-causing mass appearing as a result of chloride depoisoning at the presence of large organic particles, such as humic acids, showed a low density of 0.002 ppm, which is viewed as significantly below the Korean standard of 0.100 ppm.

## PERCEPTION OF ENVIRONMENTAL CONDITIONS

Table 2 reveals the perception of respondents regarding a variety of social problems, including environmental degradation. Policy makers and environmental scientists often indicate that environmental deterioration has come to the forefront as one of the most serious social problems in Korean society. In this community, however, environmental concerns were viewed as not as important as prices, crime, and housing problems, but more important than politics, education, and transportation. These results are not entirely different from Kim's (1991) analysis of a national survey: price problems ranked highest; political problems were ranked least important, and environmental degradation ranked fifth.

Table 3 indicates how dissatisfied the community respondents are with the current environmental conditions. The proportion of those who are moderately or greatly dissatisfied with environmental conditions are respectively 36% for air quality, 43% for drinking water, 38% for noise and vibration, and 47% for bad odours. This clearly indicates that the community residents are more negative about odours and drinking water than air quality and noise/vibration. They also appear to conceive of synthetic detergents (39%) and the waste of foods (23%) as

the chief culprits of the environmental degradation within the Korean setting. Considering that about 70% of the respondents are attempting to reduce the use of synthetic detergents, it might be natural to conclude that private efforts are seen as being of critical significance for the prevention of environmental degradation with their own residential community as well as in the Korean society as a whole.

As shown in Table 4, about half of the respondents answered that government, private individuals, and businesses are equally responsible for the low quality of air, drinking water, landscape degradation, and pollution from waste and garbage. Private individuals were viewed as less responsible for air pollution than business enterprises, while the opposite was true for the degradation of natural landscapes and environmental contamination coming from garbage and solid wastes. According to Kim (1991), both the general public and business elites answered that business operations were largely responsible for the worsening quality of air (64% and 50%), while the general public cited the government more frequently than business elites as one of the most responsible parties for environmental degradation.<sup>1</sup> With respect to the contamination of drinking water, the general public criticized businesses, while business elites attributed responsibility to the government. Finally, with respect to the garbage and solid waste pollution, the survey of the general public indicates that private individuals are those who should be blamed, while the business elites survey indicates that business, private individuals, and government are all parties which should be held responsible for that type of pollution.

In this community, respondents cited both air and water contamination as the major sources of environmental degradation which are in urgent need

Table 2  
Degree of Interest in Social Problems for Wolgoksa-Dong Community Residents, 1992

<i>Social Problems/ Interests</i>	<i>None %</i>	<i>A Little %</i>	<i>Fairly Great %</i>	<i>Very Great %</i>	<i>No Response %</i>
Env. Pollution	1.4	8.6	54.0	35.0	1.0
Price Problem	0.7	4.5	20.6	73.9	0.3
Crime	1.0	7.6	31.3	59.8	0.3
Housing	0.3	7.9	25.4	66.0	0.3
Transportation	0.3	17.9	29.2	52.1	1.0
Education	1.4	14.4	33.3	49.5	1.4
Politics	7.3	32.3	34.0	25.4	1.0

**Table 3**  
**Degree of Dissatisfaction with the Environmental Condition.**  
**Wolgoksa-Dong Community Residents, 1992**

<i>Environmental Conditions</i>	<i>Air %</i>	<i>Water %</i>	<i>Noise/Vibration %</i>	<i>Bad Smell %</i>
Satisfied	8.6	11.0	8.6	9.6
Largely Satisfied	44.3	44.7	42.3	42.3
A Little Dissatisfied	28.2	31.3	28.2	30.9
Largely Dissatisfied	17.9	11.3	19.6	15.8
No Response	1.0	1.7	1.4	1.4
Total	100.0	100.0	100.0	100.0

**Table 4**  
**Identification of Responsible Parties According to Types of Pollution.**  
**Wolgoksa-Dong Community Residents, 1992**

<i>Types/Party</i>	<i>Air Pollution %</i>	<i>Water Pollution %</i>	<i>Landscape Pollution %</i>	<i>Garbage/Waste Pollution %</i>
Private Individuals	9.6	13.4	23.4	24.1
Business	30.6	18.9	11.0	9.3
Government	12.7	14.4	11.3	11.4
All of Them	44.0	50.5	50.5	50.9
No Response	3.1	2.8	3.4	4.2
Total	100.0	100.0	100.0	100.0

of further improvement. This community relies on yontan briquet boilers as a means of indoor heating during winter and the resultant *yontan* gases and the high density of the population in the narrow residential spaces can cause extremely unhealthy air quality conditions in the squatter settlements. Along with air quality, the residents have severe problems with drinking water because of the lack of adequate attention by the municipal government. These conditions are also found in other slums and squatter settlements in the Seoul metropolitan area.

Residents were asked about their personal environmental management efforts. About 75 to 85% of the respondents attempt to save electricity, to reduce the use of synthetic detergents, to prevent the volume of noises and vibration, and to refrain from throwing night soil out of their residences. According to a national sample (National Statistics Office 1992), about 85% of large city residents answered that they made moderate or great personal efforts to improve their environmental conditions. The most frequently cited were: (i) reduced use of the syn-

thetic detergents (74%); (ii) avoiding illegal dumping of wastes (56%); (iii) separation of solid wastes (49%); (iv) avoiding throwing night soils into streams, rivers, and oceans (47%); (v) reducing the volume of noise and vibration (40%); and (vi) reduced use of vinyl wrapping (21%).

### Solid Waste Management

Even among the urban poor, solid wastes — materials discarded in solid form from homes, stores, and schools — are the end product of many interacting factors, including low product durability, a lack of recycling, and a lack of personal and governmental commitment to reduce waste.

Solid waste has become a serious problem because local people as well as business enterprises and the national government have neglected the problem. In the Seoul metropolitan area the search for new landfills has led to local conflicts with those who do not want wastes dumped in their community.

The topographical characteristics of urban squatter settlements such as Wolgoksa-Dong make easy access to mass transportation and other urban basic infrastructure services such as sewage and garbage collection difficult (Chang 1991). There are severe complaints about the absence of emergency roads for fire engines, poor sewage systems, and lack of waste collection. In Seoul, the municipal government is responsible for collecting garbage and solid waste for about 56% of the poor households in squatter settlements. For other squatter households private companies are responsible for the disposal or removal of garbage and solid wastes. This contrasted sharply with the Seoul metropolitan area as a whole in which the municipal government is responsible for collecting wastes from 90% of the total households.

In Table 5, nine out of ten respondents answered that they separated and collected indoor home waste, but those having done so completely constituted only 10% of the total. Those who dumped waste without any treatment constituted about 15% of the total. About 72% of those responsible for collecting home garbage after resorting were wives. This suggests that Korean men and husbands do not provide much active support to their wives' domestic work. The reasons for not separating and collecting solid wastes include: (i) the absence of solid waste which can be separated into reusables and non-reusables (13%); (ii) habit (20%); and (iii) drudgery (20%).

Wolgoksa-Dong has 11 garbage collectors who work for each zone. About 95% of the wastes and

garbage is taken to landfills. Sorting of such wastes increases the volume of reusables. However, some of the community residents complained that when they did separate their wastes and garbage, community waste collectors often collected them in a single container thus remixing them.

According to the interviews, the waste reuse programme was not carried out effectively. In this community, the collection of garbage itself was found to be extremely difficult, particularly during winter when there is snow on the hilly areas. Many garbage collectors said that they would quit their jobs if other profitable jobs were available to them. They had little pride in their work. Most of them are between 40 and 50 years of age and visit the municipal office to participate in a retraining programme.

In the interviews, residents were asked whether they had problems with the treatment of garbage and solid waste produced indoors. They complained that solid waste collectors take small wastes only, but large ones, such as used refrigerators and laundry machines were not taken away for one or two months unless residents were willing to pay extra collection expenses. In our focus groups, several participants had serious complaints about the attitude of waste collectors, particularly with regard to the spirit of service for the community. If waste collectors were not paid extra money, they were not willing to cooperate with the disposal of garbage and solid wastes. Inevitably, those living in poor conditions pay enough to buy waste collectors packs of cigarettes when

**Table 5**  
**Attitude and Practice of Garbage/Soil Waste Treatment among**  
**the Wolgoksa-Dong Community Residents**

<i>Variables</i>	<i>Number</i>	<i>Percent (%)</i>
<b>Waste Treatment Methods</b>		
Complete separation/collection	29	10.0
Partial separation/collection	216	74.5
No particular treatment	43	14.8
Others	2	0.7
Total	290	100.0
<b>Reasons for No Separation/Collection</b>		
Nothing for separation/collection	23	12.7
No experience	37	20.4
Tedious and burdensome	38	21.0
Mix-up during collection	4	2.2
No reutilization facilities	2	1.1
Others	77	42.5
Total	181	100.0



they visit their households during festive days, such as Korean New Year's Day or Korean Thanksgiving Day.

### Water Quality

According to the sample of water quality, the supply of tap water was evaluated as 'excellent', or at least 'good', for those living in this community. The share of the households having access to tap water was 95%, but the share of those relying on community water facilities was 29%. For all poor regions in the Seoul metropolitan area, the supply rate of tap water was 98%, and the percentage of the households using village facilities was 12%, which was much lower than for Taegu (55%) and Masan (52%). However, the lack of pressurization facilities and the erosion of water pipes pose serious problems with the supply of drinking water in the poor areas located on hilly slopes. While the sampling of water quality indicates that drinking water in this area did not have any pollutants, the respondents regarded the drinking water as contaminated.

About 13% indicated that drinking water has a bad smell, while about 20% noted that dregs were deposited at the bottom of the tap water. Only 11% said that water quality was clean. A little more than half regarded it as just 'fair'. Only 5% used tap water without any treatment for the purpose of drinking, and three-fourths boiled the water before using. This situation appears not to be greatly different from the general situation of the entire nation. In Korea, about 70% boil tap water before using it for drinking purposes, while 20% use other mineral water instead of tap water (National Statistical Office 1993: 286). Those who use water purifiers are more urbanized, educated and younger.

### Sanitation

Latrine facilities are one of the important problems urban poor face in their living arrangements. The share of the poor households having private latrines is only 28%. According to a national survey in 1989, the share of the total households having latrine facilities shared by two or more households is 43%, and the share of what might be called 'public latrines' is 29%. In Seoul, however, the corresponding shares were 40% and 28%, respectively.

Our research indicates that there is a relationship between the type of latrine and perceptions of

sanitary conditions. Traditional latrines were rated 'bad' by 56% of the respondents, but only 8% perceived flush toilets to be 'bad'. Three-fourths of the community latrines are of the traditional type.

Community residents do not appear to have problems with the night soil treatment of their latrines. This community has two public latrines. Downhill residents complained that access to the facilities located uphill is difficult. In the focus group, participants said that they could not afford flush-type latrines because of the problem of narrow housing spaces. They could not dig widely or deeply enough to bury a septic tank. Because they also could not afford the cost of the modern type of latrines, some participants felt there was no choice but using the existing types of latrines.

**Table 6**  
**Latrine Status of the Wolgoksa-Dong**  
**Community Residents, 1993**

<i>Variables</i>	<i>Number</i>	<i>Percent (%)</i>
<b>Latrine Types</b>		
Conventional	218	74.9
Flush toilet	65	22.3
Public toilet	8	2.7
Total	288	100.0
<b>Latrine Sanitation</b>		
Very bad	45	15.4
Bad	87	29.9
Neutral	90	30.9
Fair	69	23.7
Total	290	100.0

### Noise and Vibration

Noise and vibration resulting from the development of various transportation services, including high-speed railway trains and supersonic aeroplanes, is increasingly emerging as a critical social issue in this community. Even though residents have been voicing their complaints, the government has found few means of dealing with the problems.

### Air Quality

Dust from the incomplete combustion of heating oils during the winter, the stockpiling of used briquets on streets and narrow alleys, and particles from the

process of disposal at the pollution-producing enterprises add to air quality problems. The health conditions of the urban poor are presumably affected by the dust levels observed frequently in the community environment. As indicated earlier, the conditions in this Wolgoksa-Dong community are known to be above the tolerance limit, to the extent that the PSI index is above 100 and readings above 300 were observed for two or three days in the community.

For the poor areas like the Wolgoksa-Dong community, the quality of indoor air during winter directly affects the health and safety conditions of the resident population. Various types of heaters can, when located in closed small spaces, expose people to gases which cause respiratory diseases, headaches, and anaemia. According to the residents, the best times to open windows to let in fresh air are around ten o'clock in the mornings and three to four o'clock in the afternoons when air is less polluted outdoors.

Air pollution contributes to adverse health conditions as perceived by the resident population. Many residents in this community have bronchitis problems, which can be attributed in part to the concentration of sulphurous acid gas. The short-term environmental standard of sulphurous acid gas is set at an average of 0.15 ppm per day so as to prevent environment-induced diseases. In cases above the tolerance limit, the Ministry of Environment indicates that even an hour of outdoor exercise can cause lung malfunctions and asthmatic conditions. Contamination from carbon monoxide is said to increase the possibility that the urban poor of this community suffer from stricture of the heart. The carbon monoxide, known as 'briquet gas', is discharged from the yontan (briquet) boilers as well as emission from automobiles on the streets neighbouring community. The degree of hazards arising from this polluting mass was highest for Sangmoon-Dong community in 1987 immediately before the Olympic Games took place. Although air quality has improved since then, as shown earlier, Wolgoksa-Dong still has a fairly high degree of risks in terms of safety and health conditions.

## CONCLUSION

In Wolgoksa-Dong the resident population appear to view environmental problems as one of a number of sensitive social issues directly related not only to

quality of life but to the reliability of the government. The residents tend to have suspicions, although sometimes unfounded, about the quality of the air they inhale and the water they drink. These suspicions tend to be strengthened by occasional tap water contamination accidents or by press reports of serious air pollution in certain districts of cities like Seoul, Pusan, or Ulsan.

A large majority of the Wolgoksa-Dong community residents appear to be dissatisfied with the government's failure to provide adequate waste disposal services, one of the basic jobs that the municipal government is required to carry out for its citizens. As a result of a long lack of concern and investment in this field, the recycling and hygienic treatment of wastes are still at low levels in Korea, causing particularly significant problems for the urban poor in slums and squatter settlements. During the past several decades, the environmental problems have continued to accumulate. Today, they call for urgent solutions or at least the prevention of further degradation.

The new civilian government appears intent to do its best to provide clean tap water to households. Since the 1989 controversy over heavy metal contamination of piped water, apparently strong measures have been implemented to prevent the quality of water in reservoirs from deteriorating. Although the municipal government maintains that tap water supplied to ordinary households is safe, public disbelief persists. To address this problem, the government has to develop measures that can fundamentally improve the water supply processes from reservoir management to purification and supply through pipes. The implementation of these measures calls for a streamlined management of tap water supply which is now dispersed among several related government agencies in the Republic of Korea.

In this community, it should be noted that the environmental improvement movement has not escalated into a citizen's movement or any protest-oriented social movement. This community has not been very successful in mobilizing the resident population for the purpose of environmental protection and betterment of welfare levels.

Korea's rapid economic growth has improved economic conditions for many, but the environmental costs have not yet received the attention they deserve. Because improving economic conditions have increased social and economic mobility for

some, the environmental conditions of those among the urban poor who cannot relocate have been largely ignored. Taking the environmental conditions of the urban poor more seriously requires greater stand-

ardization of research methods, increased government intervention and greater mobilization of poor communities to engage in collective improvement efforts.

## NOTE

- 1 Caution should be taken in comparing the results of these two surveys because Kim's earlier analysis did not include the category of 'all of them' as one of the choices made by the respondents.

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# Dynamics of Community Participation in Environmental Management in Low-Income Communities in Hong Kong

*Cecilia Chan, Fiona Chang and Regina Cheung*

## ABSTRACT

A survey study in two low-income communities shows that past participation experience was an important factor that influences whether or not residents participate in neighbourhood environmental management activities. Grassroots workers need to identify and highlight positive past participation experiences among the residents in order to enhance the likelihood of their future participation. The majority of the respondents in the study explained that their key motivation in participation was to improve the environmental problems, while most of them also thought that the problems have improved a lot since their collective action. Nearly all the participants reported improvements in their social and psychological competence after participation in community activities. These findings help ascertain the function of community work in achieving empowerment for the people.

**Keywords:** *community participation, gender roles, grassroots mobilization, Hong Kong*

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## INTRODUCTION

In the past two years, we have engaged in two action-oriented projects to organize two low-income communities — Sham Tseng and Diamond Hill — respectively to deal with local environmental problems. We have systematically documented the progress of the two projects and have recently conducted a survey study on the level and pattern of participation of the residents in these two communities. The objectives of the survey study are (1) to examine the pattern, causes and effects of participation of squatter residents, with particular consideration given to gender differences, and (2) to ascertain the implications of participation on

community-based urban environmental management efforts. Focusing on the dynamics of community participation allows us to re-examine some conventional thinking on grassroots participation in general and gender differences in participation in particular.

## URBAN CONTEXT

Hong Kong is producing 12 500 tonnes of solid waste and 16 tonnes of floating refuse per day, as well as 100 000 tonnes of chemical waste per year and two million tonnes of sewage and industrial wastewater every day (EPD 1990). With over 20 000 tonnes of

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solid and semi-solid waste generated by our community every day, the landfills in Hong Kong are being filled at a very rapid rate. The Environmental Protection Department has difficulty in identifying sufficient sites for landfills. Floating refuse is a public eye-sore to the 'Pearl of the Orient'. Passing untreated sewage into the harbour is potentially hazardous to public health. Water pollution blackspots include typhoon shelters and bathing beaches contaminated by sewage. Outdoor air is polluted by sulphur dioxide and nitrogen oxide. Noise is a major nuisance that was ranked by residents in Hong Kong at the top of the list of environmental pollution problems.

By far the most important sources of pollution and environmental destruction are caused by irresponsible handling of discharges and toxic waste from industrial production. The most polluting industries are small-scale leather tanning and chemical production. The pollution problem in Hong Kong has been succinctly described by Hills and Barron (1990): 'Many streams are thick with industrial chemical wastes, residential areas are exposed to noxious factory smoke from short stacks, waterways carry untreated sewage, and industries often blatantly disregard existing environmental regulations.' These sources were not controlled until 1989 when the government began to take active steps in environmental protection.

### **Environmental Problems in Low-income Communities**

Despite the affluence in terms of GDP (US\$12 069 per capita in 1990), there are pockets of low-income communities poorly serviced by infrastructure. The incidence of tuberculosis and viral hepatitis is still high which reflects problems with nutrition and hygiene in the living environment. The poor can be found concentrated in temporary housing areas, squatter areas and urban slums. According to the 1986 bi-annual census, there were 101 724 households living in temporary structures such as squatter huts and temporary housing areas, 23 520 households living in cockloft and bedspaces, 8344 households living in roof top squatter huts, and 162 554 households living in room/cubicle accommodation (CSD 1990). On the whole, 20.48% of the total number of households in Hong Kong are living in sub-standard housing without self-contained facilities.

As a result of uncoordinated construction, squatter huts are usually constructed along steep slopes without drainage systems and proper access roads. Water and electricity supply, refuse and waste water disposal, hygiene and access are all problematic. Temporary housing areas, managed by the Hong Kong Housing Authority for low-income families who lose their squatter homes to fire, are situated in reclaimed land or newly developed suburbs far away from employment centres and community facilities. Most of these temporary housing areas are located below flyovers or in the midst of industrial buildings. Residents of temporary housing areas have to tolerate high levels of environmental pollution caused by noise, dust, and gaseous emissions from vehicular traffic and nearby factories.

### **Sham Tseng**

Sham Tseng is one of the oldest communities in Hong Kong. It is located in the western part of the New Territories, midway along Castle Peak Road which links up Tsuen Wan and Tuen Mun. Since the 1960s, an increasing number of factories have been built in Sham Tseng because of the availability of new transportation facilities. These factories included Garden Company Limited, San Miguel Brewery Limited, Kowloon Textile Industries Limited and Union Carbide Asia Limited. The industrialization of Sham Tseng and the associated increase in employment opportunities led to an influx of workers into the community from other parts of Hong Kong.

To provide for the catering needs of the factory workers, many restaurants were opened by Sham Tseng residents who specialized in selling roast duck. Nowadays, there are eight roast duck shops in Sham Tseng. On one hand, Sham Tseng residents welcome the growth of industrial and commercial activities because they bring new job opportunities and other economic benefits. On the other hand, the wastes discharged from nearby factories, restaurants and squatter settlements are contaminating the Sham Tseng nullah.

According to figures prepared by the Census and Statistics Department (1991), the population size in Sham Tseng was 2069. There were 602 households, most of which were nuclear families, and the average household size were three to four persons. Most of the squatter residents in Sham Tseng were working class and their average monthly

household income was below HK\$8000 (Community Survey Committee 1992), whereas the median household income in Hong Kong was about HK\$9964.

In 1988, the Housing Department launched the Squatter Area Improvement Scheme in Sham Tseng and many basic facilities such as street lamps, piped water, electricity supply and fire hydrants were installed in the community. This scheme was terminated in 1990, however, and these facilities began to deteriorate due to poor management and insufficient maintenance. Nowadays, the Sham Tseng community suffers from environmental problems such as the lack of adequate sanitation facilities, insufficient refuse collection services, contaminated water supply, pollution of surface water in Sham Tseng nullah, and the risk of landslides. For example, while 60% of the households have installed private toilets, the rest of the residents have to rely on only four public lavatories. Moreover, almost all of the private toilets drain their waste untreated directly into surface water bodies within the community.

### **Diamond Hill**

Diamond Hill Village and Sheung Yuen Village are two squatter areas in Diamond Hill, an old urban neighbourhood located in Kowloon, Hong Kong. The squatter huts, illegal but tolerated by the government, are constructed along steep slopes and surrounded by industrial plants. The residents are mostly unskilled manual labourers, construction and factory workers, drivers and elderly persons.

The major problems in these two squatter areas are industrial pollution and the lack of community hygiene. In the former village, air and water pollution is generated from untreated waste discharged by the dyeing factories located upstream of the Chi Lin Stream which flows through the community situated downstream. In the latter, drainage is the major environmental problem. Because many households do not have access to proper sanitation facilities, human waste is deposited directly into the community drainage system. The quality of community hygiene and community health suffers greatly because the uncovered drainage system is often blocked by solid waste discarded by the residents. Other major community environmental problems include animal wastes, insufficient solid waste collection services, and the lack of basic infrastructure such as street lamps and fire prevention facilities.

## **STUDY ON GRASSROOTS PARTICIPATION IN ENVIRONMENTAL MANAGEMENT**

Working in these two communities for two years, we find a general apathy in grassroots participation. Not too many residents are willing to take part in collective action for environmental improvement. From a detail analysis of the participants in the environmental concern groups among Sham Tseng village and Diamond Hill squatter areas, it is apparent that most of the active members are middle-aged women. In order to develop a better understanding of the pattern of grassroots participation in environmental studies in the two squatter areas, we have conducted a study to investigate the dynamics of and gender differences in grassroots participation.

### **Dynamics of Grassroots Participation**

The objective of community mobilization is to raise the social consciousness of the residents so that they can be empowered to tackle their own problems and situations. Community workers will try to enhance the level of self-confidence, self-image, sense of efficacy and critical thinking among the residents so that they can take up the local leadership in bringing about change in the community. It is believed that the participation is an essential mechanism for empowerment, whereby the individual gain experience in organizing people, identifying resources, developing strategies for goal attainment and achieving a higher level of self-esteem and confidence. This study will investigate the level of participation among the various sectors of the population and try to find out the dynamics of community participation among the squatter population in the two squatter areas.

### **Gender Issues in Participation**

As women in squatter areas stay in the community most of their time, they are exposed to environmental problems, lack of basic facilities and fire risks. Therefore, it is logical to expect them to participate actively in community affairs. On the other hand, Chinese women are supposed to be submissive and non-confrontational. They are expected to tolerate all undesirable conditions in silence. This study will study the extent of women's participation in environmental management in the two squatter areas.

## METHODOLOGY

Structured interviews were conducted in these communities by social workers or volunteers in July and August 1993. Respondents were asked about their personal experience in community participation, their gains and losses during participation, the effect of participation on their family, and their reasons for participation or non-participation. The respondents were also asked to advise the community project team on approaches to invite and support residents' participation.

The sample — one hundred respondents from each project area — was randomly selected in the two communities. The sample was stratified into participants and non-participants. Participants refer to those who have been engaged in community environmental concern group activities for half a year or more. Non-participants refer to those who have never engaged in community environmental concern group activities.

An analytical framework was constructed to examine the nature of residents' participation and its implications for community-based environmental management efforts. Five set of variables were identified as contextual determinants of residents' participation in environmental management: past community involvement, perception of community problems, relationship among neighbours, sense of community, women's involvement.

First, residents who have past experience in participation are more likely to participate in neighbourhood activities. Those with positive and active participation experience will usually participate more. Information on the level of involvement, the frequency of participation, the personal experience of participation will all influence the individual's response to community problems.

Second, the subjective interpretation of the community's problems by an individual will influence that individual's decision to participate or not. Perceived problems on the part of community members may elicit their participation toward solving those problems (Douglas and Florins 1990). The way residents interpret the consequences of their own action as well as the perceived efficacy of collective action will affect their motivation in collective participation in the future.

Third, residents' participation may be influenced by the relationships among neighbours and their sense of community. Positive relationships with

neighbours including social contacts, greeting each other, informal mutual assistance and other neighbourly behaviour enable residents to become better acquainted and discuss common problems and may provide an impetus toward collective problem solving (Unger and Wandersman 1982).

Fourth, a sense of community can lead to individual-level participation. A sense of community is defined as a sense of belonging, fellowship, 'witness', common identity etc., experienced in the context of a functional group or geographically based collective (Buckner 1988). It can be measured by residents' degree of attraction to live and remain in the neighbourhood and residents' sense of community felt within the context of the neighbourhood. Residents participate more in a community that they value. An atmosphere of togetherness promotes greater collective participation.

Fifth, gender is an interesting variable in community participation. Women spend the greatest amount of their time at home and in the community. As a result, they are more easily affected by the environmental problems and in time of community crisis. Therefore, women are more concerned with environmental issues especially those issues relating to the health and safety of their children.

Finally, in addition to the above predicting variables, gains and losses during or after participation will also influence the further participation of the residents. According to social exchange theory and political economy theory, whether or not individuals participate depends on the benefits and costs of participation. Whether the residents do gain from participation is an important factor to determine whether they will participate or not. Thus, it is necessary to provide relevant materials and information, praise and offer emotional satisfaction to the participants, as well as providing training and resources them. In order to enhance participation, one must also decrease participatory costs, such as reducing the duration and frequency of meetings and choosing a schedule that is convenient to the residents. Facilitation of incentive/cost management efforts will contribute to residents' participation (Chan 1984).

## RESULTS

First, most participants had previous experience in participating in local residents' organizations and



NGOs. Forty-seven percent of those who are involved in environmental management activities have had past experience in social and community participation. Second, whereas 52% of the participants considered community problems as 'serious,' only 38% of the non-participants shared that feeling. Third, participants in general displayed more frequent mutual assistance behaviour than non-participants (Table 1). The more frequently cited mutual assistance behaviour includes lending daily necessities to neighbours, visiting neighbours' homes, and discussing community problems with neighbours.

Fourth, there is a strong relationship between the resident's intention to continue to live in the community and the likelihood of his or her participation in environmental management activities. A higher proportion of non-participants than participants plan to move out of the communities in the coming three years, supporting the view that non-participants usually do not have a strong sense of community and thus have less incentive to participate. Fifth, while non-participants tended to think that males were more suitable for community participation and dealing with government officials, most participants believed that there was no major difference between the role of men and that of women in community participation.

Sixth, non-participants often cited the following reasons for their non-participation: 'no time' (59%), 'lack of knowledge' (11%), and 'health problems' (10%). Participants agreed that 'no time' was a major reason (47%) why their neighbours did not participate in community activities. The key motivations for the participants included both their desire to serve the community (34%) and to alleviate the community environmental problems (33%). Finally, most of the participants (83%) revealed that they would continue

their efforts in community participation because they have gained personal growth from participating in community environmental management activities. Such personal improvements included 'respecting others' (72%), 'developing more concern in social policies and public affairs' (71%), 'developing a stronger sense of community-belonging' (65%), 'improving neighbourhood relationships' (59%), and 'enhancing problem solving ability' (55%).

## CONCLUSION

The research findings showed that past experience was an important factor that influences whether or not residents participate in neighbourhood environmental management activities. Hence, grassroots organizers need to identify and highlight positive past participation experiences among the residents in order to enhance the likelihood of their future participation. In our study, the majority of the respondents explained that their key motivation in participation was to improve the environmental problems, while most of them also thought that the problems have improved a lot since their collective action.

The main reason for those who do not participate in community environmental improvement activities was lack of time. Community workers therefore should be particularly sensitive to time management issues during meetings as well as in scheduling community meetings. In addition, low educational level was also identified as a factor that hindered residents' participation. Perhaps increased community education programmes should be offered to increase the residents' confidence and practical

**Table 1**  
**Frequent Mutual Assistance Behaviour by Participants and Non-participants**

<i>Frequent Mutual Assistance Behaviour</i>	<i>Participants</i>	<i>Non-participants</i>
Lend daily necessities to neighbours	15 (13.4%)	12 (1.8%)
Visit neighbours' homes	11 (9.8%)	16 (14.3%)
Help neighbours to look after their children/house	9 (8.0%)	1 (0.9%)
Discuss community problems with neighbours	18 (16.1%)	6 (5.4%)
Discuss family/personal problems with neighbours	10 (8.9%)	4 (3.6%)
Go out with neighbours	7 (6.3%)	6 (5.4%)
Lend money to neighbours	5 (4.5%)	2 (1.8%)

knowledge. While it is not realistic to expect full participation in every community activity, it is important for the community's longer term objectives to make sure that residents are well informed of the collective actions even if they do not or cannot participate.

From the data obtained through our observations and interviews, two points relating to the effect of participation on the family can be drawn. First, there was not much negative effect on the family due to participation by a family member. In fact, some positive effects such as information sharing was produced. Second, some of the respondents said that their participation did not have any effect on their family because their families were indifferent to their participation. These two points together suggest that community workers should invest more effort in understanding the effect of family support on grassroots participation. It is necessary for grassroots workers to facilitate the participants and their family members to become aware of and reinforce the positive effects of participation while at the same

time, provide supportive work for those who do not enjoy positive relationships with family members.

With regard to the gender issue, the participants in general agreed that there should be no difference between men and women in community participation. The experience in the two communities demonstrated that women also had the ability to take up leadership roles and meet with officials. This showed that the actual participation activity could raise the residents' consciousness on gender roles and individual efficacy.

Overall, participation in community projects produced positive effects on the residents and for the community as a whole. Nearly all the participants reported improvements in their social and psychological competence after participating in community activities, their social awareness raised, their relationship with neighbours and family members enhanced, and their sense of belonging in the community increased. These findings help ascertain the function of community work in achieving empowerment for the people.

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# Empowerment of Urban Poor for Environmental Management: The Case of Bombay

Chandan Sengupta

## ABSTRACT

With the failure of state and privatized approaches towards improving the environmental conditions in low-income urban neighbourhoods, community-based collective action appears to be the only viable option for environmental management for the poor. Empowering communities for this purpose cannot be viewed in isolation from these processes and dynamics, but must be seen as a function of wider social processes as well as community and household dynamics. The study of environmental management in Shivneri and Prayagnagar, two low-income communities in Bombay, is utilized to examine the relationship between the household economy and various spheres of social, political and economic organization that affect the capacity for managing environmental resources. Although households and communities have potential for coping with the environmental stress resulting from the reinforcing interaction between poverty and environmental degradation in the urban context, successes are nonetheless dependent upon improving the facilitative roles played by outside agencies, namely, government, political parties, private sector, and NGOs.

*Keywords:* community-based environmental management, urban poverty, household economy, slum and squatter settlements, Bombay, India

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## INTRODUCTION

The degraded environmental conditions in low-income communities of most Asian cities are more often the symptoms than the causes of their wider socio-economic and environmental problems at the city-scale. Therefore, the point of departure for an analysis of community-based initiatives in response to deteriorating environmental conditions is the broader urban context of the problems of environment and levels of poverty. From this perspective, an analysis of the community dynamics related to environmental management and the analysis of the relationship between the household economy and environmental management in selected

low-income communities can be best understood. The specific research questions examined in this paper are: (1) What are the key environmental issues facing the city? (2) What are the trends in levels of poverty in the city? (3) What are the general socio-economic and environmental conditions of the selected communities? (4) What is the relationship between household economy and environmental management in these communities? and (5) what are the roles of the private sector, national/local state and the NGOs in the environmental management in the selected communities?

Using primary and secondary data, two communities have been selected from one of the twenty-three municipal wards (i.e. small electoral

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districts) of Bombay, Ward M, which is located in the north-eastern suburb of Bombay.<sup>1</sup> Ward M is selected not only because it is one of the most polluted, but also because it is rapidly growing and has a large slum population. The two communities, Shivneri and Prayagnagar, are selected for study to provide a contrast of size, type (particularly in terms of socio-cultural heterogeneity and homogeneity), and land ownership.

## URBAN CONTEXT

### Key Environmental Issues Facing Bombay

Known as the commercial and industrial capital of India, Bombay is the largest of all the metropolises of India. Currently about 10 million people live in this city which has an area of 603 km<sup>2</sup> within the boundary of a single municipal corporation. It is also the capital of the most urbanized and one of the richest Indian states, the state of Maharashtra. Although Bombay's strong economic base has enhanced better economic opportunities for its residents, the city continues to face serious consequence of accelerating rates of urbanization resulting in the increasing deterioration of environmental sustainability of the social and economic lives of the city-dwellers, especially the poor communities. Problems related to environmental degradation in Bombay are many, but the key issues facing the city and its poor communities relate to the problems of adequate, safe, and protected water supply, drainage, sanitation and air pollution.

In the area of water supply, there are problems with both quantity as well as quality of water. In 1991 the total quantity of water available for supply in Bombay was 2475 mld as against the total demand of 3400 mld (Gokhale 1993). In poorer areas access to water is extremely limited as most poor households have to depend upon inadequate supply of water through public standpipes. The existing water system is around 40 years old and is contaminated from the sewerage system. Recently, mud and worms from the taps have been reported from certain localities in the city (TOI 1993). Underground sewer lines are also antiquated. All the slums and most rapidly growing suburbs have no proper sewerage system at all. As far as air quality is concerned, Bombay is considered one of the most polluted cities in the world. Indoor pollution in slums is high. High

incidences of typhoid, malaria, pulmonary tuberculosis, bronchitis, asthma and dysentery are found to be caused by polluted air and water (MCGB 1986).

### Levels of Poverty

A large body of literature has grown on urban poverty and its various aspects. But knowledge about the trends and levels of urban poverty over time is limited. Moreover, the percentage of people living below the officially defined poverty line unfolds only one dimension of poverty. Access to basic services is another crucial dimension of poverty. This dimension of poverty is of crucial significance for Bombay as the number of people lacking access to these resources is increasing almost in an incredible proportion.

The trends of the levels of absolute poverty in Bombay are not clear as the comparable data on poverty over time are difficult to find. However, available figures indicate that while the percentage of people below the poverty line has actually increased by less than 2% during almost a decade, the absolute figure of poverty in Bombay remained high (Deshpande and Deshpande 1991; BMRDA 1992). Converting the percentage share of households below the poverty line (14%) in 1991 into absolute numbers, about 1.3 million persons in Bombay lived below the poverty line at that time.<sup>2</sup>

Apart from income needed to buy the essential food items to sustain life, living conditions in slums and squatter settlements reflect another significant dimension of urban poverty. In 1981 about 3.7 million persons, or 45% of Bombay's population, lived in slums, and about 100 000 persons lived on pavements (GOM 1981). Recent estimates show that about 57% of Bombay's population or 5.7 million people live in various slums, about 200 000 persons live on pavements, and about 400 000 persons reside in about 20 000 deteriorating tenements (Deshpande and Deshpande 1991; UN 1986). The proportion of slum population increased from 12% in 1961 to 45% in 1981. In absolute numbers the growth has been phenomenal: from 400 000 to 4 million. During 1961-81 Bombay's population had actually doubled, but the slum population showed a ten-fold increase from 400 000 to 4 million. If Bombay's population reaches the estimated figure of 15 million by the year 2001, and if the current proportion of more than 57% slum population continues, the city will

have an estimated slum population of more than 8 million at the turn of this century.

It is true that not all those who live in slums and squatter settlements live below the poverty line. The latest available survey results showed that about 36% of the slum population and about 70% of pavement dwellers in Bombay lived below the poverty line in 1989 (BMRDA 1989). However, living below or above the poverty line does not necessarily make any difference in the living conditions in Indian slums. A recent survey on urban poverty conducted in twenty urban centres of major Indian provinces shows that in low-income neighbourhoods about 60% of the families above the poverty line suffered from the same forms of environmental degradation as families living below it. As the findings of the survey suggest, 'the household income concept of poverty thus misses the environmental and shelter characteristics of neighbourhoods which constitute the crux of physical poverty for those above and below the poverty line alike' (NCU 1988:8). An increase in the number of people living in slums in a city would, therefore, indicate an increase in the number of those lacking access to basic services. Thus, one can say that, compared to the level of absolute poverty, poverty in terms of inequality in access to basic services has increased substantially in Bombay over the past decades.

### PROFILES OF SHIVNERI AND PRAYAGNAGAR

The general pattern of growth of many slums in Bombay is that initially only very few families arrive at large vacant places and build their habitations. Later, many families come and start living. Very often the newcomers have to pay rent to the original settlers either for occupying just a place without a structure or as a tenant of a structure owned by one of the original settlers. Shivneri also came into existence in similar way about 25 years ago. The majority of the families in Shivneri have migrated from rural districts of Maharashtra State, of which Bombay is the capital. Others come from various parts of Bombay city itself.

Shivneri has 200 households and, with an average of six persons per household, there are about 1200 people living in this community. It is largely a homogeneous community with more than 80% of

the people having the same linguistic and religious background, which is Marathi Hindu. While Shivneri is basically a low-income community, the majority of the families live above the poverty line. Only 29% of the households live below the poverty line. The income per household in most cases ranges between Rs 1000 and 2000 (US\$35-70 in 1993) per month. While most of the adult males in the community work in small and medium manufacturing units nearby as permanent and casual labourers, the majority of the females are housewives. A few families have grocery businesses and women from some 25 households work as housemaids in upper class apartment buildings.

The environmental conditions in Shivneri are no better than any other slum in Bombay. On the question of the impact of environment on health, almost 50% of the respondents have reported that the main causes of their falling sick are environment and malnutrition.<sup>3</sup> Between environment and malnutrition, environment-related diseases have been identified as the dominant causes of health problems in the community. Asthma, pulmonary (lung diseases) problems and skin diseases are some of the environment-related health conditions which are found to be prevalent in the community. Although specific water-borne diseases were reported to be negligible, some residents did complain about stomach ailments due to contaminated water.

Most Shivneri people could define their environment in terms of key environmental characteristics of their habitation: water, sanitation and refuse disposal rather than air pollution. In response to the question on their perception of the magnitude of the environmental problems, none seemed to be aware of the seriousness of the environmental problems facing the community. They knew about the lack of basic services but were unable to highlight the magnitude of environmental problems in the community. On the question 'whom would they hold responsible for their living conditions?' most respondents felt that both the municipal authority and the slum dwellers themselves should be held responsible for their conditions. This is in sharp contrast to the findings of a perception study on environment conducted in Taipei, but is partly similar to the findings of a perception study on environment conducted in Calcutta. In the study on Taipei, the respondents held the policy of industrial development responsible for environmental problems. In Calcutta, people's careless attitude was

mentioned as one of the main causes of environmental problems (Karan and Chao 1989). Shivneri people partly blame themselves for their conditions and think that the municipality carries equal responsibility for the improvement of their conditions.

Prayagnagar is situated on private land. The landlord has not yet fully given up his case, but according to the municipal officials, he will not be able to reclaim the land because the area far exceeds the limit prescribed under Urban Land Ceiling regulations. The municipal corporation has provided the general basic amenities such as water taps and latrines even though the slum is located on private land. This is because the area has been officially classified as a slum area.

Although the average length of stay of the residents is 15 years, some respondents claim that they have been living in this community for 45–50 years, and on this basis Prayagnagar can be said to be much older than Shivneri.

Prayagnagar has a total population of 1250–3000 living in 250–300 households with an average of 5 members per household. This community is a heterogeneous one. All are migrants with various ethnic backgrounds. There are Hindus, Muslims and Buddhists speaking Marathi, Hindi and Urdu, Tamil and Telugu languages. Occupationally the community is also diversified. A large number work as helpers or operators in medium-sized manufacturing industries, some are autorickshaw or bus drivers, or conductors, and a few are small businessmen or are unemployed. While most women are housewives, about 30 women work as housemaids in apartment buildings. Most adult males have gone to school up to a certain level. The majority of children go to school. A large number of women are illiterate. The average monthly income of a household is Rs 1500 (US\$50 in 1993). However, there is a great variation in the income per household. In the sample, 9 out of 25 households had a monthly income between Rs 600–900 (US\$20–30). If Rs 1290 is taken as the poverty income in 1991, nearly 36% of Prayagnagar people will be living much below the absolute poverty level of Bombay.

The common environment-related diseases in Prayagnagar are coughs, colds and pulmonary tuberculosis and stomach ailments. Many of them are air-borne diseases. In Shivneri most people were also found to suffer from these diseases, but Shivneri

people were not able to attribute them to air pollution. Like Shivneri, in Prayagnagar only a few residents had some idea about the magnitude of environmental problems, and the rest were not able to say anything. However, unlike Shivneri, Prayagnagar respondents had some idea of the environment and included the sphere of social interaction as an important component in their definition of environment: 'Our social interaction is good, but the physical environment, particularly the air, is very polluted.'

Surprisingly, the key habitat-related environmental factors such as water and sanitation did not figure as the main criteria of their definition of environment.

## HOUSEHOLD ECONOMY AND ENVIRONMENTAL MANAGEMENT

The household is the basic decision-making unit in a community. However, a household participates in a host of other spheres to sustain strategies for its survival. Friedmann (1992) has identified five such specific spheres in which a low-income household participates for potential action. These include (1) the sphere of the household itself; (2) civil society or various neighbourhood assemblies or communal exchange; (3) the state; (4) the market, and (5) the sphere of the political community. In the context of environmental management in Shivneri and Prayagnagar an attempt was made to examine these specific spheres in which the low-income communities participate for potential action.

### Household Sphere

At the household level, internal divisions of labour and mobilization of resources provide the essential means through which environmental management is generally carried out. Concerning the division of labour in both the selected communities there is a clear division of labour, particularly between men and women members of a household, with regard to the tasks having implications for environmental management. Cooking is exclusively the women's job, as is cleaning, in a typical slum household. In almost all the households, cleaning of almost everything is done by women and female children. In a few cases a woman's cleaning skills are not used for their own domestic purposes only, but the skills are also sold in the market as these women

work in apartment buildings nearby as maids. Although the working conditions of the maids are not protected by any law, the money earned from such jobs is an important additional resource to the household.

There are two other key environmental tasks which are also mostly performed by women in a low-income community: collection, filling and storage of water, and collection of fuel for cooking and heating. Apart from all these tasks, the Shivneri and Prayagnagar women in general, and the adult females in particular, perform a host of other household chores such as looking after the children, teaching or socializing them and taking care of the sick members in the family. All these consume enormous time and it has been observed that in Shivneri and Prayagnagar women work almost 16–17 hours a day. The total time spent includes the time spent on environment-related tasks, other household chores as well as time spent on working in middle and upper class households as maids. The men and other adult male members of a typical Shivneri and Prayagnagar household do only the wage-earning jobs. In most households the working men spend about 8–10 hours in their work places. Except for gutter or pipe cleaning and house repair, men do not seem to have any other environment-related activities.

### Resource Mobilization

Household income is the basic resource to a household. However, in a low income household the financial resource is so meagre that various strategies need to be adopted to mobilize additional financial and non-financial resources in order to cope with the increasing stress resulting from the interaction between poverty and deterioration of living conditions. In Shivneri some households mobilize the additional financial resources from incomes earned by the housewives and other female adults or female children who work as domestic maids in apartment buildings. In Shivneri most of the women who earn this way earn about one-third of the total household income.

Of all that is earned by a household, the major proportion (about 75%) is spent on food. Clothing, medical and educational expenses constitute the second priority. They also spend on shelter-related activities such as house repair and buying of waterproof materials during rains. But these are

contingent expenses for which generally no prior budget is made. Thus, in a low-income community like Shivneri or Prayagnagar, the scope for mobilization of financial resources, particularly for environmental management purposes at the household level, appears to be very limited. This, however, does not mean that there is absolutely no scope for mobilization of resources. When conceptualized in non-financial term, mobilization of resources at the household level in communities like Shivneri and Prayagnagar would essentially mean the labour time that is used for carrying out environment-related household chores by the members, particularly the women.

### Communal Exchange Networks

In Bombay, community-based activities of the poor operate at three levels: (1) at the slum level with households having common cultural traits, (2) at the inter-slum level representing the specific slum locality, and (3) at the area level involving more than one slum pocket. In Shivneri the inter-household network is represented by a 17-member committee elected by the members of the community for a three-year term. Prayagnagar also has an internal community organization usually known as the 'Society' that operates through an elected 'committee' comprising 11 members who serve in the committee for three years. These committees' activities are not restricted only to environmental issues. They undertake activities ranging from organizing festivals to motivating the community members to form housing societies. The committee itself does not have any specific environmental programme as such, except that it looks after the cleaning of the latrines which is done by a hired sweeper. Realistically speaking, in communities like Shivneri or Prayagnagar, the communal exchange network actions on environmental issues are presently confined to the activities of cleaning the latrines, gutters and sometimes the wells. The wells are also dug by the community itself. Apart from this 'cleaning' drive of the environmental community-network, the Shivneri and Prayagnagar communities have also undertaken programmes of road building and construction of borewells or latrines in the communities.

But such activities are generally undertaken in collaboration with the local politician; whereas cleaning activities and digging wells are done

exclusively on their own initiatives. Other areas of activities in which the whole community is actively involved relate mainly to non-environmental functions. It was noticed that in Shivneri and Prayagnagar, like in most low-income communities in Bombay, the people always reveal the fullest expression of their communal exchange network in organizing recreational, cultural or religious functions or festivals. Such enthusiasm and energies were found lacking in their concerns over environmental issues.

Water is another area in which slum communities like Shivneri and Prayagnagar may be expected to form an inter-household network in managing this key community resource. But as a general case, water management in Bombay's slum communities does not bear testimony to an ideal pattern of communal network. In Shivneri and Prayagnagar also there is an inequity in the access to the water supply, with the members of the water co-operatives getting more water than others since they pay for their metered supply. In Prayagnagar, problems regarding use and maintenance of these co-operatives have often resulted in conflict and clashes between the households. However, such conflicts are quickly resolved by the 'society' which calls the parties involved and discusses problems and eventually settle the issue.

An inquiry into the inter-household network in water management in a low-income community like Shivneri and Prayagnagar also calls for a gender specific perspective as women and children, particularly female children, are directly involved in the collection, use and storage of water resources in these communities. In a neighbourhood of Kanpur in India, the women have organized themselves not only to manage access to water but also to form a neighbourhood committee which takes decisions on matters related to the site selection for hand pumps (Schenk-Sanderger 1987). In Shivneri and Prayagnagar, while most male residents were involved in technical and physical aspects of the water management works such as those related to the formation of 'societies' and selection of sites, women spent most of the time and energy in the use and actual management of water.

### Political Community

In India involvement of political parties in slum affairs is well-established. But such involvement is mostly manifested in the form of patron-client

relationships rather than in the form of mobilization of the poor in the enhancement of political power of the slum community. About 75% of Shivneri people are with a regional party with nativist political ideology namely, Shiv Sena. This party is the largest single opposition party in the Maharashtra State Assembly. The borewell at the main entrance to Prayagnagar symbolizes the local party leader's contribution to the community. The Congress (I) and Shiva Sena are the two dominant parties in the community. The members of the community are also almost equally divided in giving their support to these two parties. The Congress (I) is the ruling party both at national as well as Maharashtra State level. As the interest of the political party is essentially political, it is natural that the politician will not be seen visiting the community during non-election times. On the question, 'Does the local politician visit your community often?' 50% of the respondents in both Shivneri and Prayagnagar answered negative. 'It is during election time that the politicians are seen in the community', answered many. At the community level, residents generally do not directly approach the concerned politician. 'For any kind of problem we first approach our committee/society and they do the needful' was the reply from many. The committee does go to the local politician for help. It is through the politician that two additional latrines could recently be built in Shivneri.

Given the competitive nature of Indian politics today, it is obvious that there will be many competing claims on the vote-banks of the slum communities in the country. This may often create divisions among the members of a community, which may have an adverse impact on the communal network.<sup>4</sup> In Shivneri, this somehow did not happen. However, in Prayagnagar, there have been incidents of internal conflicts over the functioning of the working group in the community's elected committee. Recently, this conflict has taken a political turn in that members belonging to one particular ethnic group, namely the Maharashtrians, have formed their own committee while those from Uttar Pradesh have remained with the old committee. Although the respondents categorically denied that this bifurcation of the committee was done at the behest of a political party, it is unlikely that the local political parties will leave the situation as it is, particularly when the division among the Prayagnagar residents has been along ethnic lines and the use of communal arithmetic has



been an effective means of political mobilization in India's pluralistic democracy.

### Private Sector

Realistically speaking, the private sector in this city of big business and trade is doing absolutely nothing for the improvement of the environment of the poor communities. In response to the hue and cry against the non-conformist polluting industries not only in Bombay but all over the world, some industries have undertaken a few beautification programmes of planting trees, and lawns. Patches and tracts of such beautification drives are visible in some of the city's relatively better zones, but certainly not in and around the poor communities. Recently, a few industrialists have initiated some environment-related programmes in poor localities, but they are mostly doing these either on an individual basis or as members or patrons of one of the existing NGOs. However, due to the recent government pressure and mounting public protests, most industrial units are now forced to adopt anti-pollution measures. At this stage expecting any significant involvement from them in the environmental management in low-income communities is unrealistic.

In Shivneri and Prayagnagar, no private sector organization or agency was found to be involved in any community-based environmental management programme. The community has also not shown any interest directly or indirectly in approaching a private facilitator for any help. It is only during the religious festivals that some small industries and shop owners nearby are approached for monetary contributions.

Looking from another perspective, a degraded environment itself may become a source of entrepreneurship, business and income for the poor.<sup>5</sup> A large section of poor in Bombay eke out their sources of livelihood from the degraded environment itself. Within the slums, water delivery provides such a source of income for many. This happens in the case of those slums which are located on hills where the water taps are conveniently located. The carriers or suppliers are paid at a per pot rate. Scavenging or lavatory cleaning in the low-income communities also provide other sources of income for the poor in Bombay, but in most cases these scavengers and cleaners are not members of the community in which they work. They are hired by the community which needs them. These jobs are done by a particular group of people who belong to a particular caste-

defined occupational group and who form their own communities in which to live. In Shivneri and Prayagnagar no case of a paid water delivery system was reported by the communities. The work related to cleaning of latrines is done by a person who is employed for this job. This person does not live in the community.

### The Local State

As Shivneri is a censured slum located on municipal land, the local state or the municipality is responsible for the provision of all environmental services in the community. Although Prayagnagar is located on private land, the municipality provides some services as the area is notified as a slum area. The condition of the services in these communities are similar to those that exist in other slums on municipal or private land. Insufficient services, irregular visits of sanitation workers, bureaucratic dilly-dallying in handling problems related to the issue of photo passes are some of the usual complaints of the people against the municipality.

### NGOs

NGOs have not raised the community-based environment management issues in Bombay in any serious manner. The existing NGOs in the city may be divided into two broad groups on the basis of their activities in the area of environment management. The first group is composed of high profile environmental action groups and other organizations (having related environmental activities) with very little or no community action component in their programmes. The second group essentially comprises community-based organizations with only a few environmental components in their community-based action programmes.

At the community level, environmental issues taken up by some community-based NGOs form part of their larger development programmes and empowerment strategies.<sup>6</sup> Moreover, it is only recently that these NGOs have taken up specific environmental problems facing the poor communities in Bombay. However, these NGOs have hardly any regular training programme for eliciting participation in environmental management at the community level, except for a few committees at the community level for water or sanitation. No NGO is found to be working either in Shivneri or in Prayagnagar. Only

the YWCA runs a *Balwadi* (pre-school centre) in Shivneri. The *balwadi* in Prayagnagar is run by a trust. But these organizations are not involved in any environmental programme in these communities.

## CONCLUSION

The results of the study show that environment-specific tasks and actions have not yet taken a concrete shape in the two selected communities. The households of the two communities show much potential for mobilization of non-financial resources for environmental management, but there is little scope for such potential being translated into action for two reasons: first, the capacities are household-bound and are therefore faced with such household-related problems as lack of time, insecurity of tenure; and, second, the potential exist more among women than among men. As the decision making process related to environmental issues in the communities is still dominated by men, this will further limit the use of these household potential possessed by women beyond the household scale. At the inter-household level, communal exchange networks related to environment-management have not risen above gutter or water pipe-cleaning jobs.

Among the external forces outside the household and community spheres, the private sector, the local state, the NGOs, and the political parties are considered potential agents of improvement in community conditions. No private sector actor has rendered any services to any environmental programmes in these communities. As is the case with other slums in Bombay, the involvement of the local state in environmental management, which essentially stems from its mere official duties, has only ended up with abysmally inadequate provision of water and sanitation facilities with equally inadequate attention to the maintenance of these services in Shivneri and Prayagnagar. Like almost all other slums in Bombay, Shivneri and Prayagnagar also stand outside the purview of both the high-profile

environmental action groups and community-based environmental NGOs. The local political parties are the only external agencies which have occasionally undertaken some environmental functions in Shivneri and Prayagnagar. Although the members of the two communities under study are divided among themselves along party and ethnic lines, the communities have so far remained unaffected by vested interests and clientelism. But the internal conflict between two ethnic groups in Prayagnagar over the functioning of the committee is likely to make the community susceptible to being used as pawns in the games the political parties may play in order to capture the large vote banks of the slums.

Given these dynamics, the only viable option left to the people of Shivneri and Prayagnagar for their empowerment for environmental management is to strengthen the communal exchange network among themselves. The existing inter-household network may largely be confined to non-environmental cultural social functions, but the mettle serving as the basis for such collective organization can be redirected for developmental tasks through effective mobilization. But who will mobilize and how? How could community-based NGOs credited with success stories elsewhere in the city leave out Shivneri and Prayagnagar? Does the magnitude of the problems far exceed the capacity of the existing NGOs or are the NGO exchange networks weak in themselves? Such questions are pertinent because nothing so far has been done in the more than 25-year history of the communities like Shivneri and Prayagnagar. This paper has only discussed the community and household dynamics in order to improve our understanding of the problems of environmental management in two selected communities of Bombay. More intensive research based on dialogue with the selected community, governmental agencies, NGOs and interested private sector and political institutions is needed to sharpen the knowledge of the potential for better environmental management in poor communities in Bombay.

## NOTES

- 1 The information related to primary research was collected mainly through open meetings with the community members using unobtrusive observations and discussions, and partly by conducting a household survey. For the household survey, the research heavily relied on informal discussion and participation. Given the absence of a sample frame and owing to factors like non-availability of respondents at scheduled times even when systematic sampling

- such as random sampling with replacement was used, the in-depth interview was conducted selecting the respondents in three ways: (a) 3–4 heads of households from each of the religious communities viz., Hindus, Muslims and others, whichever was applicable; (b) heads of 3–4 households from different economic strata, and (c) generally 2–3 from among men and women respondents. No claim is being made for representativeness of the sample. In all 10% (45) of the households (450–500) was covered in the sample survey of the households.
- 2 The cut-off monthly income per household for the poverty line in 1991 was worked out as Rs 1290 (US\$45) at 1991 prices.
  - 3 Wherever data obtained from respondents are presented, these refer to the sample survey.
  - 4 As noted by de Wit (1989) and Pendse (1990), political parties in Indian slums indulge in clientelism and politicking and divide the community for their own interests.
  - 5 As Douglass (1991) observes, 'In many instances, it is the poor who actually are the *de facto* caretakers of the environment through the types of jobs generated by environmental disregard on the part of the affluent and elite. Whether it is street cleaning for the government, rag picking for large-scale paper makers, or scavenging for materials to use for their own house construction, much of the economy is derived from the deteriorating environmental conditions in the cities of Asia.'
  - 6 SPARC (Society for Promotion of Area Resource Center), YUVA (Youth for Unity and Voluntary Action) and Yagruti Kendra are some of the well-known NGOs working among the low-income communities in Bombay with such development and empowerment strategies.

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# Community-Based Urban Environmental Management: A Bandung Case Study

*Ida Ayu Indira Dharmapatni and Hastu Prabatmodjo*

## ABSTRACT

The Indonesian government has sought to improve housing and environmental conditions in poor urban settlements by means of the Kampung Improvement Program, an ambitious, top-down planning and management initiative that makes extensive use of community and neighbourhood leadership. This case study of Cibangkong, a poor settlement in Bandung, suggests that although KIP has resulted in substantial improvement in community conditions, the types of collective efforts households engage in and the degree of community cooperation is highly variable. The type of community leadership, the types of community cooperation sought by government agencies and the types of services sought are among the factors affecting community collective efforts to improve environmental conditions.

*Keywords:* kampung, community-based, urban environmental conditions, community participation, Indonesia

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## BACKGROUND

Bandung, the capital of West Java and the third largest city in Indonesia, has a population of more than two million. Bandung's population density is as high as Jakarta, which reached more than 120 persons/ha in 1990. This figure is much higher than that of the other three large cities in the country, Surabaya, Medan and Semarang. It should be noted, however, that the population density in Bandung is unevenly distributed. While sub-districts in the eastern and central parts of the 'old' city have population densities of more than 200 persons/ha, the newly annexed 'expansion' area has densities of less than 100 persons/ha.

The condition and proliferation of settlements in the city have been closely related to its historical development. The northern part of the city consists

mostly of well-planned residential areas, since it was the residential area of the colonial Dutch. In contrast, other parts of the city consist of unplanned, dense, poorly-serviced neighbourhoods. Urban expansion has occurred to the south, east and west of the city. Plants for new industrial activities, including textiles, pharmaceutical and chemicals, are being developed along the east-west corridor. Kampung are intermingled with these industrial developments. Kampung development has also occurred in the northern, well-planned portion of the city. Cibangkong, the subject of this case, is an older kampung in Bandung.

Urban kampung (villages) in Indonesia are heterogeneous settlements frequently located on the urban fringe where a transition from rural to urban is occurring. They are unplanned settlements characterized by high population densities within a limited

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land area. Land tenure arrangements vary, but many kampung are located on government land. Because kampung houses are built by individuals and informal developers, housing conditions and amenities vary and many kampung contain a mix of housing types, commercial activities and urban services. Kampung should not be considered slums. According to Indonesian government standards, slums are settlements with densities of more than 600 persons/ha. Usually these slums are located within a kampung and are not served by access roads. Further, kampung and slums should be distinguished from illegal settlements (squatters) with very poor housing and environmental conditions occupying small parcels of land along river banks or railway lines.

The Indonesian government has sought to improve housing and environmental conditions in urban kampung by means of the Kampung Improvement Programme (KIP). Several types of Kampung Improvement Programmes have been implemented in Indonesian cities. These programmes vary in their comprehensiveness. Most KIP efforts focus on improving housing conditions, solid waste management, drainage, improved roads and lanes, sewers, and potable water. Other KIP programmes include health facilities, education, vocational training and other services.

The purpose of this paper is to describe social and environmental conditions and community responses to those conditions in Cibangkong, a kampung in Bandung, West Java, a settlement in which KIP projects have been implemented. Cibangkong is located in the eastern part of the old city. It lies on a flat site of 64 ha and is intersected by a stream. One hundred household surveys were conducted in Cibangkong to identify social-economic characteristics, environmental conditions and facilities, and participation in community practices in managing the environment. These surveys were supplemented by interviews with community leaders and government officials regarding policies, programmes and implementation mechanisms related to environmental improvements and evaluation of environmental projects.

## **SOCIO-ECONOMIC CHARACTERISTICS OF CIBANGKONG**

The household survey revealed that of Cibangkong's 1992 population of 17 622, 73% have lived in the kampung for more than twenty years. The survey also revealed that half the men and almost two-thirds

of the women had primary school education or less. The educational attainment of these kampung dwellers is somewhat better than the national average. However, in a big city such as Bandung, they are likely to be considered less educated and therefore have fewer economic opportunities and less power.

About three-fourths of the women do not work outside of the home. About 18% of the men are government employees, 23% are retired, and 14% work in construction labour. Nearly 12% were identified as 'entrepreneurs' and 8% as 'traders'. The mix of employment types may indicate a more heterogeneous community with different views and interests regarding common community problems.

The household survey indicates that 80% of the respondents own their houses although only 54% own the land on which their house sits. It is almost certain that not all of them who claim land ownership can support their claim with a land certificate. In addition, most of the houses were built without building permits. Lack of legal land titles and uncontrolled housing development in the kampung may hamper efforts to improve the community environment. Most of the respondents live in a house with a single household (61%), but 21% share their house with one other family and 18% share with two or more families. A large proportion of the residents cited kinship (54%) or proximity to the workplace (24%) as reasons for living in the kampung.

Average household monthly expenditures among the respondents ranged from Rs 57 500 (US\$28) to Rs 1 070 150 (US\$520) with average expenditures equal to Rs 210 003 (US\$102). Only about 15% of the kampung residents subsisted on less than the minimum monthly expenditure of Rs 105 000 identified by the Indonesian government as constituting the 'poverty level'. Although this percentage may seem small, the absolute number of poor people cannot be ignored. Moreover, household expenditures may not accurately reflect the quality of life since the cost of living in bigger cities is generally higher than in smaller urban centres. This standard does not differentiate among cities of different size or take local conditions into account.

## **COMMUNITY-LEVEL ENVIRONMENTAL CONDITIONS**

The KIP was initiated in Cibangkong in 1990. The programme was designed to construct and improve

local road paths, drainage, sewerage, public water supply, garbage collection service and public bathroom and toilet facilities. Field observations and interviews with residents reveal that the project has not yet reached all areas of the kampung because residents refused to give up some of their land for projects, because there was no land available, or because residents were encouraged to develop their own infrastructure. In general, those areas that have received KIP improvements have good environmental conditions. The environment is clean and odorless and flooding has been minimized. On the other hand, unimproved enclave areas within the kampung have unpaved roads, denser living conditions, and lack of drainage and sewage.

Drinking water continues to be a problem for some improved as well as unimproved areas. The close proximity of wells and septic tanks in some areas requires treatment of water to make it drinkable. Wastewater is channeled into the river by households in both improved and unimproved areas near the river. Garbage is also dumped into the river by some households which sometimes causes clogging during the dry season. These problems indicate the limited capacity of government to cope with all the environmental problems of a kampung and the necessity of community 'self-help' programmes.

Vacant parcels in two areas have been used as sites for dumping garbage and solid waste. The accumulated garbage is burned two or three times a week. Some of the nearby households have complained about bad odors from the site and have asked the head of the village to ban residents from using the site as a temporary garbage dump. The use of vacant parcels for dump sites reflects the limited economic and organizational capacity of kampung dwellers. Because of bad odors and the many other social conflicts associated with crowded conditions, living in a kampung requires extraordinary tolerance.

### NEED AND AVAILABILITY OF ENVIRONMENTAL SERVICES AND FACILITIES

In general, about half the households surveyed have access to solid waste disposal, sewers and drainage systems, public bathrooms and toilets, and clean water. Even for those areas to which KIP has extended sewage lines, most of the households build their own sewage system and channel the wastewater into the

nearby streams. This is also the case for the drainage system. On the other hand, public bathrooms, toilets and wells are not necessarily built by KIP, since some have been built by the communities with their own funds or with funding from UNICEF or the Municipal Health Office (*Dinas Kesehatan Kota—DKK*). All public water taps or hydrants are built by the Municipal Water Supply. 'Public' may have two meanings: one is privately owned, but used by the public (usually neighbours) and the other type is government-provided and used by the general public. The accessibility of a particular facility does not necessarily mean that every household effectively uses it. Most of the facilities do not function well and some households have their own facilities.

The household survey revealed that 72% of the households have solid waste collected from their homes by a person hired by the community, about 9% take waste to dump sites, 14% dump waste in the river and 4% burn it in their yard. The practice of dumping solid waste into the river or on vacant land is indicative of the lack of understanding among kampung dwellers of the environmental consequences of their actions. It also indicates a lack of community organization.

With regard to sewage, about 65% of the households surveyed have separate sewage and drainage systems, but 31% have sewage and drainage mixed in one gutter. Although sewage and drainage systems are generally working properly, some of the sewage systems are improperly designed and this results in discharges into the stream.

Living in a kampung requires a willingness to share private facilities such as toilets and bathrooms. As previously noted, it is sometimes difficult to distinguish between public and private facilities. Among the households surveyed, about 52% of the respondents have a private bathroom; 38% use a neighbour's bathroom and the rest use a public bathroom. Nineteen percent of the households surveyed have their own toilets with septic tank, 52% have non-septic tank toilets; 17% share a neighbour's toilet and 11% use public toilets. About 5% of those who have to use public bathrooms or toilets have at least a ten minute walk to these facilities.

About 71% of the households have a private water supply, whereas the rest have to obtain their water supply from public taps or from their neighbours. For those who have a private water supply, a twelve meter deep well is the primary source of the water. About 52% of the households with wells have

a hand-pump, while 26% of the well water is hand-drawn. Only 22% of the households obtain water from the public water supply. For those who have to obtain their water from the public water supply, about 79% share with their neighbours and 14% have to walk for ten minutes to reach the nearest public wells or taps. The rest of the households have no permanent water sources. Although most of the households have a private well, this does not reflect the actual problem regarding drinking water. The availability of groundwater is quite limited in the dry season. In addition, the quality of shallow groundwater in Bandung is widely recognized as poor, especially in kampung in which contamination from septic tanks or other sources often occurs.

In the case of households that do not have access to public facilities, the perceived needs for facilities varies according to the type of facility. Surprisingly, most of the households are not really sure whether they really want a public bathroom, public toilet or public water supply. They may want private facilities, but lack funds or space to build them. The availability of land for a public toilet or bathroom is already a constraint in some neighbourhoods. Some portions of Cibangkong are so crowded that new bathrooms or other facilities might require demolitions or at least remodeling of several houses.

Although Cibangkong is older, more settled and somewhat better off economically than those kampung at the urban fringe, it nevertheless presents some of the problems typical of kampung throughout Bandung. The KIP program has served some neighbourhoods, but not others. Environmental conditions vary across the kampung, but access to water and sanitation services is problematic for some residents. As the following sections indicate, collective community action to improve environmental conditions has occurred in some neighbourhoods, but not in others. Government activity has enhanced collective action in a few neighbourhoods, but not everywhere. The situation in Cibangkong demonstrates the complex web of interacting factors that shape community collective action.

### **CURRENT HOUSEHOLD AND COMMUNITY PRACTICES IN MANAGING THE ENVIRONMENT**

This section describes the present household and community practices in managing the environment.

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### **Solid Waste Management**

At the household level garbage and solid waste is most often collected by housewives or other women in the household. This daily morning activity includes putting garbage into plastic bags or bins and putting it in front of the house for pick-up. Those households which lack a pick-up service take their waste to a temporary site, burn it in their yard or dump it in the stream. At the community level, the task of solid waste management involves picking up household waste and taking it to a container assigned by the Municipal Cleansing Enterprise. Household pick-up is generally organized by the appointed community head. The community head invites the heads of neighbourhoods and informal leaders to a meeting at which collection is organized. The meeting assigns the persons who should manage waste pickup and decides on the household collection fee. Generally, the unemployed members of Karang Taruna (Local Youth Organization) are assigned this task and are paid the collection fees.

### **Water Supply**

As noted above, there are three sources of water: private wells, individual water connections and public taps. None of the households surveyed used the river for water supply. In general, water is available throughout the year, although some wells are dry in the dry season. Household members who obtain their water from neighbours or public water supply generally bathe, wash and use toilets at the same site. Water for cooking is brought to the house in a bucket. This activity is done in the morning or late afternoon in conjunction with bathing and washing. Those who obtain water from neighbours or public wells do not have to pay, but those who use public taps as a source pay Rp 25 per bucket. Usually, each private well which also serves other households is shared by four to eight households without charge. Each public well is shared by 10 to 20 households, and each public tap or hydrant is shared by 30–40 households each day.

### **Sewage and Drainage Systems**

Well-designed and poorly-designed sewage and drainage systems co-exist in Cibangkong. At the household level, many households do not have sewage and drainage systems, particularly those without yard space. Some households have only one drain which functions for both sewage and drainage. Even



though the KIP has built main sewage lines along the major improved roads, only a few households have connected their sewers to the main line. In fact, households in one neighbourhood use the sewage control pond to raise catfish. Interviews revealed that residents of Cibangkong are waiting for instructions from PDAM about when and what procedures they have to go through to connect to the sewers. In the meantime, households in both the KIP-improved areas and unimproved areas are channeling their sewers and drains to the stream or other water bodies. Field observations also reveal that some people wash and bathe their children near sewers and drains in front of their house, particularly when the households lack bathrooms or washing facilities.

### Using Bathrooms and Toilet Facilities

As noted above, about half of the households surveyed own bathrooms privately though they may share them with neighbours. When private bathrooms are shared with neighbours, generally the bathroom was built by the owner and is located outside the main house building or has an entrance door that can be reached by the neighbours easily. The same applies to private toilets that are shared with neighbours. Some private bathrooms and toilets are not equipped with water requiring users to bring their own water. In addition to private bathrooms and toilets, there are also public bathrooms and toilet facilities available in every neighbourhood including those available in some mosques. Anyone can use these facilities without charge, but users must bring their own buckets for flushing. Usually this kind of public bathroom and toilet is overused during the morning and early evening hours of each day. Housewives also use these facilities for dish washing and laundry, particularly after the morning peak hour. Field observations reveal that women clean the facilities after they do the washing and bathing. In general, maintenance of public bathrooms and toilets in Cibangkong is poor. Upgrading occurs only when they do not function properly.

### COMMUNITY RESPONSES TO GOVERNMENT ENVIRONMENTAL POLICIES AND PROGRAMMES

In order to give a better understanding of the bureaucratic context of environmental management

a brief description of the governmental structure is required. In the context of cities, a *kelurahan* is the smallest administrative unit. Under a *kelurahan*, there are *rukun warga* (RW) or communities and *rukun tetangga* (RT) or neighbourhoods. The head of a *kelurahan* (the *lurah*) is a paid government official, but the RWs and RTs are informal administrative units headed by unpaid appointed officials.

RWs and RTs are an extension of *kelurahan* government structure. The RW plays an important role in that it links the community with the lowest level of city administration. In many cases the RW functions as the direct implementing body of government-provided urban services at the community level and, at the same time, organizes community activities. In other words, the RW accommodates both top-down and bottom-up planning and management. The quality of community or neighbourhood collective activities depends heavily on the leadership of RWs and RTs.

In the late 1970s the government recognized the need for more community participation in development activities at the local level. Two semi-governmental organizations, the LKMD (Village Community Resilience Institution) and PKK (Family Welfare Movement), were activated. These organizations are intended to mobilize village leaders to motivate participation of the people in government programmes. Numerous government programmes have recently been successfully implemented with the help of persons who are usually members of the PKK. However, it is obvious that most of the successful programmes are achieved under command and control approaches which leads to increased dependence on external resources and leadership.

In addition to formal and semi-formal organizational units, Cibangkong has several informal community organizations. Interviews and observations reveal that each of these groups has a specific activity with informal institutional arrangements and most of its members join the group voluntarily. Most of these groups existed long before KIP was implemented. In Cibangkong there are religious groups, volleyball (or other sports) groups, co-operative enterprises, *becak* drivers, noodle traders and even gamblers' organizations. Religion-related activities are very prominent and influential in mobilizing community activities. Interestingly, information on non-religious activities are often conveyed through the meetings of religion-related activities. Quite often information or instructions

from the kelurahan office or head of the RW or RT are more effectively announced through the loudspeakers of the mosques or through religion-related meetings.

In Cibangkong, environment related projects have been undertaken by government agencies acting alone or with residents and by resident organizations. Most areas of Cibangkong benefited from KIPs completed in 1990. These projects included improvements and construction of roads, drainage, sewerage, clean water, public bathrooms and toilets. Field observations show that most of the areas reached by the project have received only one or some of these services. The project plan was fully designed by BUDP (a unit within the Department of Public Works responsible for implementing KIP in Bandung) including the construction design of services and facilities and the area coverage of the project. Beneficiaries were expected to participate only by providing land without compensation.

KIP project delivery required several steps. First, the BUDP called for a meeting with the *lurah* (village) of Cibangkong. In this meeting BUDP officials explained what the KIP project involved. Following this meeting, BUDP officials organized a meeting with the *lurah* and heads of the RWs and RTs as well as the head of LKMD and informal leaders. In this meeting the BUDP officials and the *lurah* explained the idea and objectives of the KIP project. A subsequent meeting was organized by the RT with residents whose property was likely to be affected by project activities. A fourth meeting, organized by the BUDP officials with the *lurah*, the heads of RWs and RTs, the head of LKMD and residents, was used to identify block areas to be improved, outline the project schedule and discuss types of participation expected of residents. This type of meeting was scheduled for residents of each block area for which improvement was planned. In some blocks several meetings were required because many residents were unwilling to give up some or most parts of their property without fair compensation. In the beginning it was difficult to convince the residents to participate in the project since no compensation was provided for any properties cleared for demolition or rehabilitation. Fair compensation was given only for those required to give up most of their property for the project. Those residents who resisted were visited by BUDP officials along with the heads of RWs and RTs and informal community leaders. In one neighbourhood, some

residents changed their minds after seeing project construction in neighbouring areas had resulted in improvement of environmental conditions. Nevertheless, the impacts of the residents' objections to giving up their property are obvious. In the KIP-improved areas incomplete and unconnected roads are visible as are unconnected sewerage and drainage systems. A public bathroom scheduled for one neighbourhood was never completed.

Interviews revealed that none of the local residents worked on KIP project construction. Instead, labour was mobilized from outside Cibangkong by contractors assigned by the BUDP. Outside contractors built roads, drainage, sewage systems, public taps and public bathrooms and toilets. Although construction activities have not resulted in any conflicts, many residents have ignored unfinished construction projects such as roads left in a state of disrepair after pipe installation and have paid little attention to maintenance needs of facilities such as major drainage and sewage facilities. This may reflect a common situation of accelerated development projects in which government has acted as both director and provider. One result is increased passivity regarding development projects among kampung residents.

Another government-sponsored project was the family toilet project. This project was intended as a collaborative project between the government and the local community. This project started in the early 1980s, but UNICEF funds for toilets, cement, bricks and other construction material were first made available in 1990. Every household which needed this assistance was required to apply to the *kelurahan* through the RW. Each year the *kelurahan* evaluated the eligibility of the applicants to receive this assistance. While the amount of materials given to each household was sufficient for toilet construction, households were required to contribute land, labour and a few supplementary materials. Assistance for public toilets was also made available on the same basis. Materials were provided, but the head of the RW organized the residents to provide land, labour and supplementary materials.

Provision of wells is another important government-supported project. This was also a collaborative project between government and the community. Hand pumps were provided by UNICEF. Communities were also provided with 12 m water pipes. Community residents were expected to provide land, labour and additional pipes and construction

materials. The role of the RWs was very important in supervising the construction work and insuring that wells were located far enough from toilet facilities. Maintenance and management of the wells has been left to the residents to provide.

In the case of public taps and hydrants, only the design and construction were carried out by the Municipal Water Supply Enterprise (PDAM). The community served by this facility is required to operate and maintain it. Operation and maintenance includes the collection of user fees and routine maintenance and repair. However, if the residents are unable to make repairs, the PDAM is notified through the RW and kelurahan office. Repairs are usually made quickly, but community residents are responsible for the costs.

Some communities manage the taps and hydrants very well. In one neighbourhood, about Rs 60 000 (US\$29) a month in user charges is collected. These charges are used to pay water bills to PDAM of about Rs 50 000 per month and to maintain the facility. Some of the money saved has been used to build a garbage cart. One of the neighbourhood taps did not work for the first three years after it was installed. After numerous community complaints to the PDAM through the RW and kelurahan, the tap was fixed.

Almost all of the garbage carts in each RW in Cibangkong were provided by UNICEF and distributed through the PDK. All of these carts were uniformly designed, but are too wide to pass through some of the narrow lanes. As a result, garbage collectors serving individual houses in some neighbourhoods have to leave the carts at the end of major roads and to carry waste from the houses back to the carts. Residents in one neighbourhood collected funds to buy a new cart since the existing cart was no longer adequate to carry all the waste.

As noted above, almost all of KIP's main sewer line remains unused. Community residents have reported this problem to the PDAM through RWs and the kelurahan office, but they have not yet been instructed on how and when they will be able to use it. Field observations reveal that a few households in one neighbourhood have tried to use it but failed because of leakage.

Some planting of greenery and flowers has been voluntarily initiated by individual households, particularly in the KIP-improved neighbourhoods. Government planting activities were initiated in 1990 after KIP was completed. Residents have responded

by stepping up their planting activities. The Municipal Park Office and Municipal Agriculture Office provide plants to locate along main roads, in front of houses and on vacant land.

Although co-operative efforts among community residents have declined since the initiation of KIP, some residents have been motivated to maintain facilities provided by KIP. Communities of the KIP-improved have improved their house quality and cleaned the roads and drains in front of their houses almost every day. In fact, in some unimproved areas residents have also sought to improve their living environment. This is particularly true of the neighbourhoods located next to the improved areas. Roads adjacent to the KIP-improved areas have been paved and new individual sewage and drainage systems have been constructed and connected to the improved drainage system. In addition, public taps and hydrants are generally well-maintained by the communities.

## COMMUNITY PARTICIPATION IN MANAGING THE ENVIRONMENT

In Cibangkong, household participation in the construction and maintenance of environmental-related facilities varies widely. The household survey revealed that two-thirds of the respondents said that the head of the household was the one who decides whether the family should participate. Construction or repair of household's wells, bathrooms and toilets are generally done by the head of the households with the assistance of the men in the households. This is also the case for repairing and constructing the household's sewer and drainage lines. In the case of projects that need skills such as digging wells and installing toilets, most of the households hired skilled neighbours or labourers. The payment system varies from daily wage to contract.

At the community level (RW), the extent of co-operation among households varies widely not only in terms of constructing, repairing, and maintaining the facilities, but also in terms of priorities assigned to each type of facility. Field observations and interviews with community leaders reveal that, in general, people are more willing to participate in the maintenance (cleaning) of the facilities than in construction and repair activities. This is because most people are more willing and able to provide their labour for cleaning and painting than to

contribute money, land or materials for construction and repair. Even when the government provides material, people are reluctant to participate in construction activities. For instance, despite community needs for more water and government offers of a hand pump, a well construction project was canceled because no one was willing to give up his land for the site of a public well.

Interviews indicate that participation in repair and construction activities is more likely to happen if one or more of the following conditions prevail: (1) the local government provides materials and instructions; (2) local leaders actively persuade residents to participate; and (3) the lack of a particular facility creates severe community impacts. Interviews and field observations also reveal that residents are more willing to participate in the management of solid waste, public bathrooms and toilets and to clean water facilities. Community participation is relatively lower in the construction and repair of community sewage, drainage and roads.

The level of community participation is not dependent on whether the area of the community has been improved by KIP or not. One neighbourhood in an unimproved area of Cibangkong is very active in the provision and maintenance of environmental-related facilities. Residents contribute money, labour and material. In contrast, some households in the improved areas are reluctant to organize themselves to repair poor road conditions following underground pipe installations which were part of the KIP project.

Although community participation in environmental management has been an enduring characteristic of Cibangkong since the beginning of the KIP project, participation seems more household-focused than community-focused. Individual households of the KIP-improved areas devote more of their resources to improving their own houses. *Kerja bakti* (voluntary labour service) has been decreasing since KIP was completed. In Cibangkong as a whole, *kerja bakti* is only undertaken if there is a site visit from government officials, for an independence day celebration or on instructions from the government. However, in some neighbourhoods, *kerja bakti*, in the form of cleaning water from rivers, sewers and drainage channels and repairing damaged roads, is done weekly.

The level of community participation in a neighbourhood also varies according to the socio-economic level of the community. In several neighbourhoods, higher income households located

along the main roads are more likely to be willing to contribute labour only for *kerja bakti* in their neighbourhood, but contribute money for *kerja bakti* in the larger community. In contrast, some poorer households are willing to do *kerja bakti* even in higher income areas rather than contribute money.

## FACTORS AFFECTING THE LEVEL OF COMMUNITY PARTICIPATION

At the kelurahan level, the head of the lurah is very influential in mobilizing people's participation in the management of environmental services and facilities. At the community level, the heads of RWs and RTs are potentially influential in mobilizing participation. Another factor that motivates participation is governmental mandates conveyed through RWs and RTs. *Kerja bakti* in preparation for independence day and for community planting are examples of such mandates. Participation is also motivated by urgently-felt community needs, positive achievements by other communities and, in a few cases, fear of punishment by community leaders.

Several forces act as constraints against participation. Interviews and field observations reveal that lack of strong community leadership to initiate projects is a key factor. High project costs, including direct cash payments and contribution of land or labour, is a second constraint. Lack of agreement among neighbouring households about their needs and the means to achieve them is another inhibiting factor. The perception that the project does not directly affect the community's needs is also a constraint. Finally, direct government provision of projects has not stimulated community participation in some cases. This can be seen in the unwillingness of community residents to connect their household sewer lines to KIP sewers or to repair roads after pipes have been installed under them without direct government involvement.

## PERCEPTION OF NEEDS FOR ENVIRONMENTAL SERVICES

In general, the perceived needs for environmental facilities vary widely according to the location of the house of the respondent, whether the house is located in the KIP-improved area or not, the quality of existing facilities and the perception of the

household respondents of their surrounding environment. In general, the household survey revealed that respondents perceived that new facilities are not urgently needed.

Many household respondents indicated that no new drainage lines are needed live in higher sites from which run off goes to lower sites. Households in the lower sites generally do not feel they need new drainage because they have never been flooded. Many of those who indicate that solid waste facilities are not needed are accustomed to a dirty environment. This is particularly true for those households living along the stream. These households also have no complaints about the stream clogged by garbage. The ability to ignore or adapt to such an unhealthy situation represents one of the impediments to greater community participation in environmental management.

As Table 1 indicates, most of the household respondents also do not feel that they need a sewage system because most of them already have connected their sewage systems to water bodies rather than to the KIP sewage line. Interviews reveal that many households are waiting to use the KIP sewage system.

The apparent insensitivity of kampung dwellers to environmental problems may result in low aspirations regarding improved conditions. Although respondents do not rate the provision of public bathrooms and toilets as urgent, field observations indicate that households in some neighbourhoods feel they need additions or improvements to existing bathrooms and toilets. Queuing is relatively long during peak hours, some bathrooms are uncomfortable and some are not equipped with water.

Some respondents rate a particular facility as not urgent because they simply think they cannot afford to give up land or contribute money to build a new facility. At this point, households generally try to accommodate themselves to available facilities. Adaptation to sub-standard conditions is one of the survival mechanisms for living in a kampung. The survey also revealed that most of the respondents have the impression that current co-operation among households in the construction and maintenance of environmental facilities is quite good. The survey revealed that 75% of the respondents agree that co-operation in construction is good and 59% perceive co-operation in maintenance is good.

**Table 1**  
**Respondents' Perception on the Maintenance and Construction of Environment-Related Facilities**

Type of Facility	% of Household Respondents' Assessment		
	Very Urgent	Urgent	Less Urgent
I. Maintenance			
1. Roads	13.0	22.0	65.0
2. Drainage	4.2	10.5	85.3
3. Sewage	7.0	11.0	82.0
4. Clean water	10.1	21.2	68.7
5. Solid waste	19.0	23.0	58.0
6. Public toilet	5.7	13.8	80.5
7. Public wells	7.2	8.4	84.3
8. Public hydrants	2.0	43.0	55.0
9. Public bathrooms	4.7	10.6	84.7
II. Construction of New Facilities			
1. Roads	7.1	10.1	82.8
2. Drainage	5.1	9.1	85.9
3. Sewage	3.1	12.2	84.7
4. Clean water	14.4	19.6	66.0
5. Solid waste	18.4	25.5	56.1
6. Public toilet	9.4	12.5	78.1
7. Public wells	5.2	13.5	81.3
8. Public hydrants	6.3	33.3	60.4
9. Public bathrooms	7.2	13.4	79.4

Source: Household Survey, 1993

## CONCLUSION

The case of Cibangkong is indicative of the difficulties in generalizing about community responses to environmental conditions and the need for further research. In spite of a highly institutionalized structure of governance linking government development agencies to the neighbourhood and a history of government provision of environmental facilities and services by means of the Kampung Improvement Programme, neighbourhood responses to environmental conditions and to government initiatives are highly variable.

Socio-economic conditions vary widely throughout the kampung. Relatively poor neighbourhoods with poor access to water and sanitation are inter-mingled with relatively more affluent neighbourhoods. Yet, according to household surveys, lack of access to services is not highly correlated with perceived needs for greater services. Indeed, some poorly-served neighbourhoods did not rank access to toilets and water as a high priority, in part because the costs of such facilities in terms of direct financial outlay or contributed land or labour seem prohibitive.

Nor did relative affluence seem to be highly correlated with collective efforts to improve environmental conditions. Some poor neighbourhoods were active in cleaning and maintaining facilities while others were not. The same was true of more

affluent areas. Government participation in terms of providing materials, consensus about needs, and strong community leadership seemed to be much more salient factors in promoting collective efforts.

Participation in government programmes also varied among neighbourhoods. Not surprisingly, ambivalence and even resistance to government programmes was highest in those neighbourhoods in which residents were expected to contribute relatively more labour or, in particular, land for facilities. Requirements that land be contributed for facilities is a particularly strong factor inhibiting participation.

All this suggests that efforts to generalize about 'the community' as a homogeneous whole are risky. Conditions vary among neighbourhoods within communities, as do perceived needs and efforts to engage in collective efforts. What the research also suggests is that strong leadership, consensus about perceived needs and environmental management costs that are perceived as both reasonable and fairly distributed are critical, if not sufficient conditions for insuring community collective actions. However, this case also makes clear the highly contingent nature of neighbourhood collective action. We are just beginning to understand the inter-play of environmental conditions, socio-economic factors, leadership and government initiatives that leads to sustainable efforts in managing the environment at the community level.

# Household Economy and Environmental Management in Bangkok: The Cases of Wat Chonglom and Yen-ar-kard

*Orathai Ard-am and Kusol Soonthorndhada*

## ABSTRACT

Household and community surveys in two low-income neighbourhoods in Bangkok show significant differences in environmental management behaviour and capacity, with the more developed community having a higher awareness and propensity for participation in community environment-related activities. The experience of Wat Chonglom indicates that households and communities can make impressive improvements in their environment. The findings show that divisions of labour in the household work to try to balance livelihood and habitat maintenance and that significant levels of energy and resources are given to environmental management activities. In confirming that the household is a key social unit in these activities, the surveys also reveal the vital roles played by women in both spheres of work and environmental management. They suggest that alleviating poverty and improving environmental conditions requires that women have a greater voice in decision-making processes at the household, community and higher levels of social, political and economic association.

*Keywords:* community participation, household economy, slum settlements, women and development, Bangkok, Thailand

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## INTRODUCTION

Environmental degradation has become one of Bangkok's most serious problems, and for people residing in the city's slum and squatter settlements, the negative impacts of ineffective efforts of public and private sector environmental management efforts are the most pronounced. Although improvements in the quality of life have been achieved by many residents of Bangkok, one-fifth of the population still subsists below acceptable levels of minimum human welfare. As recently as 1990, estimates show

that the Bangkok Metropolitan Region has from 1000 to 1400 slum and squatter areas with a total population of reaching in excess of one million people (Kaothien and Rachatanun 1991; Rojpruwong 1992; Yap 1992). Most of these settlements have only minimal public infrastructure and services, particularly those related to the management of environmental resources such as piped water, drainage, solid waste and other sanitation services. They continue to face serious environmental problems such as stagnant waste water, garbage, lack of potable water, lack of basic

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infrastructure and facilities, noise and air pollution, all of which directly affect both their chances to earn a livelihood and their quality of life (Douglass 1992, 1993).

Consequently, households in low-income communities have taken many environmental management tasks upon themselves by internally dividing these tasks among its members and by collectively organizing at the community level by establishing trash collection pick-up points and times, holding periodic community-wide clean-up campaigns, and hiring outside agents to pick-up waste products (Ard-am 1991). The degree to which a given community is able to carry out such tasks depends mainly on how households and its members perceive their own environment and, more demonstrably, how they are able to pool and allocate their own resources toward these ends. A major premise of the research underlying this report is that many environmental problems can be ameliorated and even solved at the community level if community and households are equipped with necessary resources, support and information.

However, there are still many questions pertaining to the degree of participation of household members in environmental management activities. What is the level of participation of the household members in the community? What kind of households are involved or, conversely, are not able to be involved or contribute? How do poor households manage their own environmental resources and impacts? What is the relationship between poverty and household/neighbourhood environmental conditions and management capacities? More generally, what are the relationships between the household economy and environmental management in low-income communities? Who has the power in household decision-making process? Who assumes the main responsibility in doing household activities? Are gender roles and dynamics involved in environmental management?

Answers to these questions will show that while almost all households make significant efforts toward improving the conditions of their immediate and surrounding environment, households in any given settlement are quite diverse in terms of the range of involvement and participation in such efforts. Furthermore, it can also be hypothesized that the degree of household participation will vary among different types of communities. Specifically, the level of participation and contribution of households in

what will be defined as the more developed settlements is expected to be higher than that of households in the less developed ones. Likewise, the proportion of households which is concerned about the quality of environment and environmental problems is expected to be higher in more developed settlements than in the less developed settlements. The comparison of households in two different types of communities described in the sections below addresses these hypotheses by comparing two low-income settlements in Bangkok. In using the household as a basic social unit, the discussion is directed toward providing a better understanding of the motivation and institutional practices related to the many tasks of environmental management in such communities.

## CONCEPTUAL FRAMEWORK

One of the main motivations for doing a survey on the household economy and environmental management in low-income communities comes from a concern for environmental problems in Bangkok and also for the welfare or well-being of low-income groups of the population. The urban poor or low-income urban communities are extremely vulnerable to deterioration in the environment and often have to live with it with no ways for improvement. Much of the theoretical literature on economic development is concerned with the notion that development proceeds unevenly in that wealth tends to be concentrated in a few hands, and that the poorest segment of society may actually become worse off. However, working experiences with many low-income communities during the past several years have confirmed that, although they are poor, these people are willing to do something about their deteriorated environment if they are facilitated, supported and motivated in the right ways.

Working experiences also confirm that there are various types of households in poor or low-income urban settlements. Thus, the understanding of household behaviour and other household matters will lead to better and more efficient environmental management both at the community and household levels. By extension, another major motivation for examining the economy of households setting in poor urban communities is to investigate how much it is associated with household and community environmental management. It is also of interest to



investigate how much theory is relevant to reality. Friedmann (1992) maintains that the household is the smallest unit of civil society, as both a polity and an economy, and as a unit for making decisions on a continuing and daily basis concerning the use of household resources and other matters. He further states that conflicts internal to households over questions of power — who does what, who controls what portion of whose income, whose voice should count 'in the last instance' — reveals the household to be an open and permeable unit. A central problem for households is how to allocate their scarce resources of time, skill, and money among their individual members as well as among the four domains — social, economic, communal and political — of social practice. Time allocation is central to the household economy, and traditional allocations give rise to gender and age divisions of labour (Norris 1988). In each of these aspects, a major role in the household economy is assigned to women who, normally central in the management of the household itself, are also increasingly visible in the wider spheres of community life and the informal sector (Friedmann 1992).

Environmental management will be thus better understood if it is viewed from a household perspective because 'household' includes many persons, many activities and many decisions that put this management into practice while also ensuring that basic livelihood questions are also attended to. In this regard, household income and other characteristics such as household structure and type, household size, work status of main household income earners, gender roles and conflicts in the household become significant determinants of the spectrum of activities and the ways in which environmental management questions become part of household strategies. The discussion below examines these household factors, or the so-called household economy, in relation to household environmental management in two different types of communities.

## STUDY SITES

This study uses primary data collected from two low-income communities in Bangkok — Wat Chonglom and Yen-ar-kard II.

The Wat Chonglom community is now well-organized and able to solve many basic problems

both in the household and community levels. However, no systematic household survey in terms of household economy and many other factors was done. A survey on basic needs of each family and also of the community had been conducted previously (Ard-am 1991). The results of this survey were used to develop the survey 'instrument' for community involvement and organization, intersectoral collaboration in support of development, individual and collective targets of development, problem identification, project management cycle and also for budget reallocation.

The two communities were selected in part because both Wat Chonglom and Yen-ar-kard II are medium-sized communities located relatively close to each other and are also situated in the same district, Yannawa. Since Yen-ar-kard II is a less-developed and less-organized community than Wat Chonglom, a comparative study of two types of communities will help to develop a better and clearer framework in analysing environmental management in low-income communities.

## HOUSEHOLD SURVEY AND FINDINGS

About 50% of the total households in each community were studied. This process resulted in a sample of 81 households in Wat Chonglom and 83 households in Yen-ar-kard II. The household questionnaire was administered to the head of each household. If the head of the household was not available, the wife or husband of the household head was interviewed instead. In case the household head was single and was absent on the day of the interview, we interviewed the one present who knew best about the household. The household questionnaire contained questions on the characteristics of income and average contribution to the household expenditures and on environmental management in the household as to its use of resources, garbage management, division of labour, gender roles and conflicts.

### Characteristics of the Samples

The characteristics of the two samples of households are shown in Table 1. As expected, nearly all measures of income and wealth show that households in Wat Chonglom, the more developed settlement, are better off than those in Yen-ar-kard II, the less developed one. Total household income is 14 099

**Table 1**  
**Characteristics of the Households of Two Communities in Bangkok**

<i>Household Characteristics</i>	<i>Wat Chonglom*</i>	<i>Yen-ar-kard II**</i>
Income and Expenditures		
Mean household monthly income (baht)	14099	10209
Mean per capita monthly income (baht)	2732	2066
Mean contributed income for household consumption (baht)	7763	6298
Mean savings per household (baht)	8182	5098
Mean debt per household (baht)	30746	9000
Mean Education Level of Household Head (years)	5.7	5.5
Household Type (percent households)		
Female-headed households	23.5	32.5
Single-headed households	17.3	31.3
Household Size (persons)		
Mean household size	5.16	4.94
Mean number of working adults age 16–59	2.67	2.43
Dependency ratio***	0.94	1.01
Percent Households Nuclear (vs. extended)	70.4	72.3
Mean Age of Household Head	43.1	44.2

\*n = 81 \*\*n = 83 \*\*\*Dependency Ratio = number of non-working members/working adults 16–59 US\$1 = 24 baht

baht for the Wat Chonglom sample and 10 209 baht for the Yen-ar-kard II sample, and per capita income is 2732 and 2066 baht, respectively. However, the mean debt of household in the Wat Chonglom sample is rather high or three times higher than the Yen-ar-kard II sample. But the mean education level of household head in both samples is not so much different (5.7 vs. 5.5 years).

An examination of household types shows that households in Yen-ar-kard II are more likely to be headed by women. Most significantly, the percentage of single-headed households in the less developed settlement is much higher than in the more developed settlement. Household size in both samples does not differ much however. While the mean household size of Wat Chonglom is a little bit bigger than Yen-ar-kard II (5.16 vs. 4.94), the dependency ratio is higher in Yen-ar-kard II, partly because households there have less adults age 16 to 59 and more adults age 60 or over than those in the more developed settlement. Thus while both communities typically have a nuclear rather than extended family structure, there appears to be much more stress on the Yen-ar-kard II households due to higher dependency ratios and greatly likelihood of having single and female-headed households.

The work status of household heads in these two different types of settlements are also significantly different (Table 2). Household heads in Wat Chonglom obtain more permanent or full-time work than those in Yen-ar-kard II (41% vs. 29%); whereas Yen-ar-kard II contains more of those who are working occasionally, part-time, or are unemployed. Although the percentage of household head being employees of firms is not so different between the two communities, Wat Chonglom contains more general labourers and hired hands but less vendors and small-scale enterprises (such as food stalls) than the Yen-ar-kard II sample (33% vs. 24% and 11% vs. 21%, respectively). Since women are more likely to be in vending and related activities, these differences may be reflective of the greater share of female-headed households in the latter community.

It is also of interest to know who is the main income earner of the household in the two samples. Table 2 indicates that husband is still the most important income earner in both settlements (51% and 41% in Wat Chonglom and Yen-ar-kard II, respectively). However, it is very noticeable that the wife as main income earner of the household has a very high share in the less developed settlement.

**Table 2**  
**Household Occupation and Income Profiles in Two Communities in Bangkok**

<i>Occupation/Income Status</i>	<i>Wat Chonglom*</i>	<i>Yen-ar-kard II**</i>
<b>Work Status of Household Head (percent households)</b>		
Permanent/full-time	40.7	28.9
Occasional/part-time	45.7	53.0
Unemployed/looking for work	13.6	18.1
Total	100.0	100.0
<b>Occupation of Household Head (percent households)</b>		
Employee of firms	35.8	32.5
General labourer	33.3	24.1
Vendors/food stalls/small-scale enterprises	11.1	20.5
Government/state enterprises	6.2	4.8
No occupation	13.6	18.1
Total	100.0	100.0
<b>Main Income Earner/Provider (percent households)</b>		
Husband	50.6	41.0
Wife	8.6	15.7
Husband and Wife	19.8	12.0
Grandparents	7.4	12.0
Daughter and/or son-in-law	6.2	12.0
Son	3.7	1.2
Son and daughter	1.2	4.8
Wife and daughter	1.2	1.2
Other (outside source)	1.2	—
Total	100.0	100.0
<b>Average Household Expenditure (in thousand baht)</b>		
	6.1	6.0
<b>Economic Status of Household (percent households)</b>		
Very good (income 20 000+)	3.7	2.4
Good (10 000–19 999)	22.2	16.9
Medium (7000–9999)	40.7	36.1
Rather poor (3000–6999)	32.1	39.8
Poor (3000–)	1.2	4.8
Total	100.0	100.0

\*n = 81 \*\*n = 83

The percentage of both husband and wife as main income providers is also rather high in both samples. Most significant is that grandparents and daughters (together with sons-in-law) in the less developed settlement play very important roles as income earners (12% for both categories). The data indicate that the households in Yen-ar-kard II must carry the same burden of expenditures as Wat Chonglom, but the mean household monthly income of Yen-ar-kard II is much lower than that of the households in Wat Chonglom (Table 1). Thus households in Yen-ar-kard II appear to be much less able to save or invest money for daily needs.

In sum, differences in household composition, incomes, expenditures and occupational profiles,

reveal many contrasts between the two communities that point toward the conclusion that the residents of Wat Chonglom have a generally more favourable situation than do those of Yen-ar-kard II. While these differences should not be taken too far — both are considered to be low-income 'slum' settlements — they do serve as a basis for comparing other differences between the two communities, namely those related to environmental management practices.

### **Comparison of Household Environmental Management in Two Communities**

Each household was asked many questions about how its members manage environmental resources

and impacts (Table 3). The first question asked about the main sources of fuel for cooking and food preparation. Responses indicate that a high percentage of households in both settlements still use charcoal and wood. Therefore, environmental problems created by these types of fuel such as smoke, suspended particulate matter (SPM) are still quite common in these two communities. Households in Yen-ar-kard II are, however, more affected by these problems than those in Wat Chonglom because the percentage of households using charcoal and wood is higher in the former community.

Concerning household drinking water, most of the urban poor households (almost 60% in Yen-ar-kard II) in the two samples drink unboiled piped-water. Only 21% of households in Wat Chonglom and 19% in Yen-ar-kard II boil water for drinking. As for water for general household use, a high percentage of households in the more developed settlement use piped-water from their own water meter, compared to only 56% of households in the less developed settlement. A high percentage of the households in Yen-ar-kard II (37%) use piped-water connected from their neighbour's house. The most interesting finding is that none of the households in Wat Chonglom buy water from mobile water sell-

ers, while 5% of the households in Yen-ar-kard II do so.

Each household was also asked if it had its own latrine and, if so, the type of latrine. The proportion of those who have such facilities is almost the same for both communities, but the percentage of households with their own or a separate latrine is higher in Wat Chonglom than in Yen-ar-kard II (85% vs. 77%). About one-quarter of the households in Yen-ar-kard II are sharing latrines with other house renters or lodgers.

Another set of questions dealt with environmental management practices (Table 4). Most of the households in both samples clean both the house and its surroundings everyday. This means that they are concerned very much about household cleanliness. Perhaps this is because their houses are not so big, and that their non-working members can take care of domestic work.

Table 4 also indicates that almost 90% of households in Wat Chonglom have some type of garbage bin or container; whereas only 70% of the households in Yen-ar-kard II have either. An examination of quality of garbage container shows that about 60% of the households in Wat Chonglom use plastic bins, which are usually bought; whereas only 30% of the

**Table 3**  
**Environmental Resources and Facilities in Two Communities in Bangkok (% Households)**

<i>Activity/Facility</i>	<i>Wat Chonglom*</i>	<i>Yen-ar-kard II**</i>
Main Sources of Fuel for Food Preparation		
Mixed/various types (gas/charcoal/electricity)	44.5	54.2
Gas	37.0	20.5
Charcoal	8.7	10.8
Others (wood, electricity, etc.)	9.8	14.5
Household Drinking Water		
Unboiled piped - water	46.9	57.8
Boiled piped - water	21.0	19.3
Others (water from filter, bottled)	32.1	22.9
Water for Household Use		
Piped water (owned meter)	75.3	56.6
Piped water connected from neighbours	24.7	37.3
Buying from mobile water sellers	—	6.1
Households with Latrine	96.3	96.4
Types of Latrines		
Own latrine/separate	85.2	77.1
Sharing latrine		
House renters (lodgers)	14.8	22.9

\*n = 81 \*\*n = 83

**Table 4**  
**Household Environmental Management in Two Communities in Bangkok (% Households)**

<i>Environmental Management</i>	<i>Wat Chonglom</i>	<i>Yen-ar-kard II</i>
House and/or Surroundings Cleaning (how often?)*		
Everyday	87.7	90.4
Every second day	4.9	4.8
Every third day	1.2	2.4
Once a week	2.5	2.4
Others	3.7	—
Household Has Garbage Bin/Garbage Disposal?*		
Yes	87.7	71.1
No	12.3	28.9
Type of Garbage Bin/Garbage Disposal?*		
Plastic bin (usually bought)	58.1	30.1
Aluminium bin/used materials (i.e. color container)	24.7	20.5
Basket (bamboo)	3.7	9.6
Plastic bag	1.2	10.8
If No Bin, Where is the Garbage Thrown?*		
Kept in small plastic bags and carried to the dumping site or community disposal	92.3	87.0
Under the house	7.7	4.3
Around and everywhere	—	8.7

\*n = 81, 83 \*\*n = 13, 23

households in Yen-ar-kard II are using this type of disposal. A much higher percentage of households in Yen-ar-kard II use big bamboo baskets, which are not durable materials, which, in turn, may be good for the environment because they can easily fall to pieces. For those who do not have a garbage container, they usually directly carry garbage away in small plastic bags to the dumping site or to the community disposal set up in each lane. However, there are still a few households in Wat Chonglom that are dumping garbage or other refuse under their houses — even though the community leaders guarantee that nobody does so. It is nevertheless good that none of the households in Wat Chonglom now throw their garbage around everywhere, but there are still a lot of households in Yen-ar-kard II doing so (9%).

We are also interested to know if or how much the urban poor households know about garbage sorting before throwing it away. Table 5 shows that about 32% of households in Wat Chonglom do sorting, but only 8% of the households in. For those who sort, we asked how the sorting is done and where (or from whom) they learned about it. About 72% of those households that sort their garbage in Wat Chonglom classify wet and dry garbage and the rest (28%) classify wet, dry and also sort out paper,

bottles, plastic, metals, and other materials. In Yen-ar-kard II, only 38% of the households are sorting garbage into wet and dry types and only 63% are reclassifying the types of dry garbage into paper, bottles and plastic. Finally, when asked if the household pays a garbage collection fee, Table 5 shows that almost all of the households in Wat Chonglom do so, but only 77% of the households in Yen-ar-kard II pay for this service. For those who pay, most in both communities say that the fee is suitable. None of the households in Wat Chonglom says that the fee is too high. In fact, to the contrary, about 25% say that the fee is too low.

Because garbage sorting as well as recycling of used materials are considered as very important strategies to cope with environmental problems, it is of interest to know from where these people or households learned about sorting and recycling. We found that quite a large percentage of households in Wat Chonglom learned from their neighbours and mass media. Apart from drawing from their own ideas or creation, residents say that government staff play an important role in this respect in both settlements. A significant percentage of households in both settlements — about half of the total households surveyed — recycle or reuse used

**Table 5**  
**Household Garbage Sorting in Two Communities in Bangkok (% Households)**

<i>Sorting Activity</i>	<i>Wat Chonglom</i>	<i>Yen-ar-kard II</i>
Garbage Sorted Before Thrown Away?*		
Not sorted	67.9	89.2
Sorted	32.1	8.4
No answer	—	2.4
How Is It Sorted? (if applicable)**		
Classify wet and dry	72.0	37.5
Classify wet and dry and reclassify into paper, plastic, glass, etc.	28.0	62.5
Where Did They Learn About Sorting? (sorters only)***		
Own creation	61.6	77.8
Neighbours	11.6	—
Governmental staff	7.7	11.1
Non-governmental staff	3.8	—
Mass media (t.v., newspapers)	11.5	—
Other (i.e. friends, relatives)	3.8	11.1
Household Pays For Garbage Collection/Disposal?*		
Yes	95.1	77.1
No	4.9	22.9
If Household Pays, The Amount Paid Is:*		
Suitable	70.4	63.2
Too low	24.7	12.7
Too high	—	1.2

\*n = 81, 83 \*\*n = 26, 9 \*\*\*n = 26, 9

materials with varying degrees of frequency. Table 6 shows that all types of used materials are recycled, particularly plastics and glass.

At the same time, more than three-quarters of the households in the two samples never think of garbage reduction. However, in this respect, the level of 22% of the households who think of reducing the quantity of garbage is considered quite substantial from our point of view. For those thinking of garbage reduction, we found that the idea came from women or wives more than from men or husbands or other household members. Table 6 shows that a high percentage of households in both settlements have actually initiated garbage reduction activities. Some of these households are recycling and some bring a basket to do the marketing.

### **Division of Labour and Gender Roles in Household Activities and Environmental Management**

The household survey included many questions on decision-making, division of labour, and gender roles

concerning household activities and environmental management. The husband is still the most powerful person in the households in both settlements; 46% of households in Wat Chonglom and 54% of households in Yen-ar-kard II answered that the husband has the power in decision-making for household activities. Only 11% of the households in Wat Chonglom and 16% in Yen-ar-kard II say that both wife and husband have equal power in making decision for household activities.

Further information on how the division of labour is made or who assumes the main responsibilities for various types of household activities is shown in Table 7.

Twelve types of household activities are examined. Women are found to be responsible for almost all of the household activities, except for only some activities such as garbage burning, house or household equipment repairing, and conflict solving. It is interesting to look into the details of some activities such as garbage collection, dumping, sorting, and burning and landfill. About 32% of households in Wat-Chonglom and 30% of those in

**Table 6**  
**Household Environmental Management Practices in Two Communities in Bangkok (% Households)**

<i>Environmental Management</i>	<i>Wat Chonglom*</i>	<i>Yen-ar-kard II**</i>
Does Household Ever Reuse or Recycle Materials?		
No	56.8	48.2
Yes	43.2	51.8
If So, What Materials Are Recycled?		
Paper	1.2	1.2
Plastic	19.8	33.7
Glass	13.6	15.7
Metal	—	1.2
Many kinds	8.6	2.4
Never recycle	56.8	45.8
Ever Consider Reducing The Quantity of Garbage?		
No	77.8	77.1
Yes	22.2	22.9
If So, Whose Idea?		
Household head/husband	6.2	8.4
Wife	16.0	14.5
Son/daughter/nephew	—	—
Husband and wife	—	—
What Specific Ideas?		
Bring basket to do marketing	6.2	3.7
Recycle	11.1	7.2
Something considered, but not done	4.9	12.0

\*n = 81 \*\*n = 83

Yen-ar-kard II say that everybody in the households is collecting or dumping garbage. However, the percentage of households with the wife doing garbage collection and dumping is still high for both communities. It is somewhat surprising that the wife does not have any responsibility in taking care of the aged in either community. In Thai society, every adult family member is supposed to take care of the aged. In this case, it may be possible that the wife is already overburdened with other household activities. It should be noted that the son has a very small role in almost every kind of household activities when compared with the daughter.

### **Household Participation and Contributions in Community Activities**

Households not only manage environmental resources on their own, but are also actively engaged with other households and in community-organized associations to address common environmental management problems. These community activities cover an array of tasks, including walkway construction,

cleaning and repair; community cleaning campaigns; drain cleaning; garbage collection; and, at a high level of investment and co-operation, the construction of community buildings. Households also join together to participate in major life-cycle events, including cremations and funerals, that reveal the sense of shared community and serve as a basis for many other forms of co-operation.

The participation of households in these types of community activities is shown in Table 8. The share of households participating every time or occasionally in direct environmental management activities is approximately half and as much as two-thirds in many activities. As expected, the percentage of households participating in community activities is slightly higher in Wat-Chonglom than in Yen-ar-kard II in every activity except drainage cleaning. The importance of this higher level of co-operation cannot be underestimated, for it is at this level of institution building that many of the most common problems, particularly that of the 'free riders' or non-participating households who benefit from the work of others, is minimized through combinations of

**Table 7**  
**Main Responsibility for Household Environmental Management in Bnagkok (% Households)**

<i>Household Activity</i>	<i>Wat Chonglom</i>	<i>Yen-ar-kard II</i>
Housekeeping/Cleaning/Sweeping <sup>1</sup>		
Wife	41.3	43.2
Everybody	26.3	19.8
Husband	11.3	19.8
Daughter	8.8	9.9
Son	3.8	2.5
Boiling Water for Drinking (if applicable) <sup>2</sup>		
Wife	45.2	47.2
Husband	16.1	41.7
Everybody	19.4	11.1
Daughter	9.7	–
Son	3.2	–
Garbage Collection/Garbage Dumping <sup>3</sup>		
Everybody	32.5	30.5
Wife	31.2	25.6
Husband	16.9	28.2
Daughter	10.4	2.6
Son	3.9	10.3
Garbage Sorting (if applicable) <sup>4</sup>		
Wife	44.8	50.0
Husband	20.7	25.0
Everybody	17.2	25.0
Daughter	13.8	–
Garbage Burning or for Landfill (if applicable) <sup>5</sup>		
Husband	57.1	75.0
Wife	14.3	25.0
Everybody	28.6	–
House Repairing/Household Equipment Repairing <sup>6</sup>		
Husband	62.7	58.7
Wife	15.3	20.6
Son	8.5	9.5
Everybody	8.5	6.3
Son and/or daughter-in-law	1.7	3.2

<sup>1</sup>n = 80, 81 (in Wat Chonglom and Yen-ar-kard II, respectively)   <sup>2</sup>n = 31, 36   <sup>3</sup>n = 77, 78   <sup>4</sup>n = 29, 8   <sup>5</sup>n = 29, 8   <sup>6</sup>n = 59, 63

heightened awareness and enthusiasm as well as social pressure on non-conforming members. Much of the work of the project carried out with the Wat Chonglom community was directed toward this level of participation.

## DISCUSSION

A comparison of households in the two communities reveal difference across an array of indicators,

including wealth and income, household type, and work status of the head of household. While they also share a number of similarities, including average household size and structure (nuclear or extended), mean age of the household head and average expenditures of the households, key indicators of livelihood and welfare suggest that Wat Chonglom is the more developed of the two. In Wat Chonglom, for example, the medium economic level is higher than in Yen-ar-kard II, which has a larger proportion of households at the lowest income levels.



**Table 8**  
**Household Participation\* in Community Environmental Activities in Bangkok (% Households)**

<i>Community Activity</i>	<i>Wat Chonglom**</i>	<i>Yen-ar-kard II***</i>
Walkway Construction/Repair		
Every time	47.0	36.1
Sometimes	27.1	30.0
Never/seldom	25.9	33.7
Walkway Cleaning		
Every time	48.1	42.2
Sometimes	22.3	26.5
Never/seldom	29.6	31.3
Community Cleaning		
Every time	39.5	32.5
Sometimes	27.1	30.1
Never/seldom	33.3	37.7
Drainage Cleaning/Garbage Collection		
Every time	38.2	42.1
Sometimes	14.8	18.0
Never/seldom	45.7	39.8
Construction of Community Buildings		
Every time	24.7	21.6
Sometimes	21.0	9.6
Never/seldom	54.3	67.5
Other Activities (traditional festivals, funerals, etc.)		
Every time	64.2	41.9
Sometimes	24.7	35.0
Never/seldom	11.1	22.9

\*including one or more of the following: labour, ideas, money, and/or food.

\*\*n = 81   \*\*\*n = 83

The question for further analysis is whether the differences between the profiles of households in the two communities can help to explain differences in levels of participation in environmental management. Although open to further analysis, the findings suggest that these differences are important in such key areas as fuel, water, latrine and garbage management. The findings show, for example, that a higher percentages of households in the more developed settlement pay for garbage collection and disposal system, recycle and attempt to reduce the quantity of refuse they produce. Although the impacts of the Basic Needs Project conducted in Wat Chonglom cannot be separated from other characteristics of that community in terms of explaining environmental management practices revealed by our survey, the findings are nevertheless consistent with the hypothesis that there are mutually causal relationships between livelihood, welfare and capacities for environmental management. In other

words, the household is intimately engaged in both income-earning and habitat managing activities, and advances in one sphere have positive spill-over effects in the other (Ard-am 1991; Douglass 1993).

In this context, the vital roles played by women in livelihood and household management activities calls for greater recognition. The examination of household decision-making power reveals that while the husband is still the most powerful member of the households in both communities, wives and other female members play the most important roles in household and community environmental management in both communities. It should be emphasized that women are also engaged in income-earning activities as well. The most direct implication of these findings is to call for greater involvement of women in decision-making processes, particularly if their experience and knowledge about livelihood and environmental management issues are to be given their due regard.

While there are clear differences in gender roles, most of the respondents say that they have not experienced significant conflict over the activities identified in the survey. Among the more prevalent issues identified by the survey respondents are those related to choosing a place to live and decisions about which occupation a family member will choose. On most issues, however, households do not consult or bring in others to solve their conflicts. When they do, they tend to involve either neighbours or relatives or respected persons living in the same community. Given the findings that show clear divisions of labour and tasks in the household, the management of intra-household conflict suggests that the necessity to manage both livelihood and habitat — including environmental management — are recognized as being fundamental to sustaining the welfare of everyone. This observation should not be used to minimize the observation that, in general, women are less powerful in intra-household decision making.

Finally, the investigation of various types of community activities shows a significant level of household involvement in both communities. This

participation reveals that people in lower-income communities not only engage in environmental management activities at the household level, but are also willing to commit time, energy, and money to co-operate at the community level to generate more systematic responses to environmental problems. As expected, the more developed community showed a significantly higher propensity for participation in community environment-related activities.

The findings from the household survey provide important insights into the understanding of how people in low-income communities perceive and become involved in environmental management. While much more research is needed to further explore the many aspects of environmental management at the community level, the study confirms that the household is a key social unit that plays a central role in this process. Although their efforts may not be sufficient to counter the more severe processes of environmental degradation, the experience of Wat Chonglom indicates that in at least some of the more developed communities, households and communities can make impressive improvements in their environment.

## NOTES

- 1 The household is defined as a residential group of persons living under the same roof and who commonly share food and the management and arrangement of household tasks, and income; in addition, they normally recognize one member as head of the household.
- 2 However, the proportion of households with the wife as the most powerful member is higher in Wat Chonglom than in Yen-ar-kard II (38% vs. 27%).

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## Network for Environmental Training at the Tertiary Level in Asia and the Pacific

### BACKGROUND

The Network for Environmental Training at the Tertiary Level in Asia and the Pacific (NETTLAP) developed out of recommendations from a regional meeting of experts held in Bangkok in 1985. These experts designed a programme of action to enhance and further environmental education and training at the tertiary level for the countries of Asia and the Pacific region. The United Nations Environment Programme (UNEP) served as the catalyst by providing support for the establishment and operation of a network on human resources development and institutional strengthening. As recognized in Agenda 21 and elsewhere, these are two of the key strategies in capacity-building required to equip developing countries with the ability to pursue their goals of social and economic development, while also protecting the environment and conserving natural resources.

The Network's basic strength is its institutional and individual members. These are supported at the regional level by Thematic Network Coordinators and at the national level by Specialist Focal Points, both of which are related to the three themes of NETTLAP: (i) coastal zone management, (ii) environmental economics, and (iii) toxic chemicals and hazardous wastes.

### 1993 — THE FIRST YEAR OF THE NETWORK

NETTLAP was launched in early 1993 with identification of National Focal Points (NFPs) which have responsibility for policy, major procedural decisions and financial resourcing at the national level. During 1993 NETTLAP's operational network grew rapidly. The current participants and activities are:

<i>Type of Participant/Activity</i>	<i>Current Number</i>
Participating Countries	33
National Focal Points	32
Thematic Networks	3
Specialist Focal Points	24
Institutional Members	124
Individual Members	1073

The rapid growth of NETTLAP is a consequence of the substantial need for strengthening tertiary institutions, for human resources development, and for a more effective flow of information from an intergovernmental organization into universities and other institutions of higher education and advanced training. Despite limited funding, during its first year NETTLAP has organized and supported three Resources Development Workshops, the preparation of a directory of institutions and individuals active in tertiary-level environmental training, and the development of curriculum guidelines and instructional resources and aids relevant to the three Network Themes. One of the key activities in NETTLAP is the Resources Development Workshop in which experienced educators and trainers join with experts from the UN and other agencies to develop a variety of resources. These include not only activities to directly enhance the knowledge and skills of workshop participants, but also curriculum guidelines, instructional resource materials, instructional aids (including computer-assisted learning software), and development of a self-sustaining network for the promotion and dissemination of the above products.

### CORE WORK PROGRAMME — RECOMMENDATIONS FOR 1994–95

At the Regional Consultative Meeting on Environmental Training at the Tertiary level in Asia

and the Pacific held in Bangkok 13–14 December 1993, representatives of the countries in the region and of international and regional organizations recommended, among other things that the NETTLAP work programme for 1994–95 include the following:

- use the National Focal Points, Specialist Focal Points and individuals and institutional network members to identify regional and sub-regional needs for strengthening tertiary institutions and their human resources for environmental education and training;
- identify requirements and capacities of cooperating organizations with respect to environmental training at the tertiary level and facilitate the availability of information and other inputs to the Resources Development Workshops and other activities of NETTLAP;
- establish procedures to ensure that all NETTLAP activities are consistent with the priority to ensure rapid and effective dissemination of environment and development-related information, methodologies and tools produced by the UN and other agencies into tertiary institutions and through them to into government and the private sector;
- conduct further Resources Development Workshops on priority environmental themes in order to develop curriculum guidelines and materials to support curriculum implementation in tertiary institutions;
- evaluate, reproduce, and disseminate curriculum guidelines, institutional materials and learning modules and systems to appropriate tertiary institutions in the region and provide assistance with their incorporation into formal and non-formal education and training programmes;
- develop and implement programmes to encourage and assist tertiary staff with responsibilities for environmental education and training to offer short courses targeted at decision-makers and senior level managers in both government and the private sectors;
- in response to official requests and where appropriate, conduct targeted in-country Resources Development Workshops to assist in the development of national-level environmental training networks and courses in conjunction with Capacity 21 and other UN initiatives; and

In addition to its current themes, the Regional Meeting recommended that NETTLAP broaden its activities to include such topics as environmental law, regional and global environmental change, and environmental information management.

#### FURTHER INFORMATION

Members of tertiary institutions active in the environmental education and training can join NETTLAP and be entered in the Directory by completing a form available from the NETTLAP Coordinator, UNEP/ROAP, UN Building, Rajadamnern Avenue, Bangkok, 10200, Thailand. Copies of NETTLAP publications, including *NETTLAP News*, are available from the Coordinator.

## Program on Environment at the East-West Center

The East-West Center was established to foster mutual understanding and co-operation among the governments and peoples of the Asia-Pacific region, including the United States. Principal funding for the Center comes from the US government, with additional support provided by private agencies, individuals and corporations and more than 20 Asian and Pacific governments.

The Program on Environment was established in October 1977 as a unit of the East-West Center. The Program engages in research to improve management of renewable resources and the environment in Asia and the Pacific. It seeks to understand how environmental factors influence human welfare, how human activities are changing the environment, how such environmental change can be controlled or mitigated, and how societies can best respond to unavoidable changes. Results of this research are intended to assist scientists and policymakers to deal with the ever more pressing resource and environmental problems confronting this region.

Research projects are carried out in diverse human habitats from the mountains of Nepal to the rice fields of Vietnam, from the slums of Bangkok to the coral atolls of the Pacific. The problems studied range from spatial scales of individuals (exposure of rural women to indoor air pollution) to villages and urban neighbourhoods (community resource management), to nations (water conflicts arising from urbanization), and to the entire globe (reduction of greenhouse gas emissions). These studies emphasize development of improved research methodologies

(e.g., spatial information systems, environmental impact assessment, individual pollution exposure assessment) suitable for use in Asian and Pacific countries.

In collaboration with the East-West Center's Program on Population, the Program on Environment is developing a new project to identify key research efforts and issues in the field of population and environment. The project will commission background papers identifying critical issues and problems and hold a planning workshop and international conference to assess needs and constraints of Asia-Pacific policymakers in dealing with the population-environment interface.

Current and on-going projects of the Program include: Sustainable Rural Development; Social Forestry; Mountain Development Strategies; Biodiversity and Protected Areas; Spatial Information Systems for Resource Management; Environment and Development in Indochina; Air Pollution (both outdoor and indoor); Hazardous Wastes and Toxic Chemicals; Global Warming From Greenhouse Gases; Environmental Governance; Water Management and Policy; and Urban Environmental Management.

For further information please contact:

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## INSTITUTIONAL PROFILE

# Department of Urban and Regional Planning at the University of Hawaii at Manoa

The University of Hawaii at Manoa is the major comprehensive graduate and research campus of the University's multi-campus system. Since its founding in 1907, the University has emphasized education, research and public service programs for Hawaii, Pacific islands and Asia, with more than 200 of the University's activities having an international dimension. The Manoa campus ranks among the leading American institutions of higher education in terms of numbers of foreign scholars on its staff and foreign student enrolment. It offers master's degrees in 84 fields of study and doctorates in 42. It is also one of the leading universities in the United States in receiving federal research grants and funding.

Since initiating graduate study in planning in 1969, the Department has awarded more than 200 Master of Urban and Regional Planning (MURP) degrees. Two certificates in planning are also regularly offered. The MURP degree, fully accredited by the Planning Accreditation Board, requires a minimum of 42 semester credit hours and offers four areas of specialization. The Community Planning specialization covers policy and programme evaluation, urban public services, housing, negotiation and mediation, alternative tourism, planning for indigenous people and native Hawaiians, and community-based development. The Environmental

and Natural Resource Planning specialization focuses on environmental policies, planning and management, energy planning, environmental law, environmental risks, cultural resource planning, coastal zone management, and environmental ethics. Land Use and Infrastructure Planning courses include methods of urban land use planning and management, urban form and infrastructure, transportation planning, neighbourhood planning, small town and rural planning, traditional cultures and subsistence life-styles. The fourth area, Development Planning in Asia and the Pacific, includes international comparative courses on urban and regional planning, urban design, environmental management, international-local relations, and rural planning in the Asia Pacific region. As a unit within the College of Social Sciences, the Department takes a multi-disciplinary approach toward professional planning education that links theory and methods with practice through teaching, applied research, and community service in support of non-government as well as public and private planning needs.

For further information, please write or fax to:

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# Centre for Social and Economic Research on the Global Environment

## BACKGROUND

The Centre for Social and Economic Research on the Global Environment (CSERGE — 'sea surge') is located at the School of environmental Sciences at the University of East Anglia (UEA) and the Department of Economics at the University College London (UCL). Its aim is to undertake research to inform policy-makers about the causes, consequences and policy implications of global environmental problems such as climate change, biodiversity and habitat loss, and other forms of transnational environmental degradation. Since October 1991, CSERGE has received core funding from the United Kingdom Economic and Social Research Council for an initial period of five years with the possibility of extension. In its first year, CSERGE more than doubled its seed money by establishing international collaborative and consultancy links with organizations such as the World Bank, the United Nations Environmental Programme, various British government departments, environmental research and regulation bodies in the United Kingdom and various overseas institutions such as the Swedish Interactional Development Agency and the Commission of the European Communities. Around 40 staff are now working on projects arising from these and other collaborative links.

## ACTIVITIES

Socio-economic research at the Centre has concentrated on three thematic areas: global warming, biodiversity loss, and institutional adaptation.

To date, research into climate change has concentrated on deriving monetary estimates of the potential damage costs of global warming, as well as the likely costs of abatement, based on data

prepared by the Intergovernmental Panel on Climate Change (IPCC). Case studies have been undertaken in the United Kingdom and Bangladesh to elucidate the particular methodological and data collection problems associated with such analyses.

Biodiversity researchers at CSERGE are analysing the driving forces of natural habitat destruction and the role that economic valuation may play in encouraging biodiversity conservation and/or more sustainable forms of use. CSERGE is currently in the process of developing methodologies to value some of the ecological, genetic, social, economic, and scientific benefits that flow from the preservation of global biodiversity. CSERGE's work on biodiversity is underpinned by field-based research underway in Africa, Central America, the Baltic, and the United Kingdom.

Under the theme of institutional adaptation, CSERGE researchers have been conducting political, administrative and legal studies to appreciate better how governmental, business, and other agencies perceive the uncertain threat of global environmental change and how they are adapting and responding to it. One of the major elements of work has centred on the precautionary principle and its steady incorporation into both national and international law and policy. Other important topics have included coastal zone management in the United Kingdom, the structure and operational record of the World Bank's Global Environment Facility and the response of several European governments to the uncertain threat of climate change.

## OPERATING PRINCIPLES

All research at CSERGE is guided by three principles. First, is the importance of developing collaborative research programmes which benefit from a multi-disciplinary perspective. Interaction is encouraged through links between CSERGE and researchers in

other academic and non-academic institutions. These links strengthen the depth and breath of the overall research effort facilitating interaction within and between groups of epidemiologists, environmental economists, international lawyers, ecologists, political scientists, geographers and experts in development studies and international relations.

The second principle is that wherever possible, CSERGE's research should have a direct policy relevance, although this does not obviate the need for original work of a more theoretical nature. To date, CSERGE researchers have provided evidence to British Parliamentary select committees on coastal zone management and carbon taxation, to the UK government on developing a national sustainability plan, and to the World Conservation Union on the economic value of biological and cultural diversity.

Finally, CSERGE's overall aim is to make recommendations on the design and implementation of appropriate policy responses, including administrative restructuring, the redesign of regulations, and changes in markets and resources pricing. Where possible, advice is analytical rather than prescriptive.

CSERGE has a policy of disseminating its research findings as widely as possible. As well as producing a large number of articles for inclusion in mainstream academic journals, there is growing number of in-house working papers (c 60), books, articles in the popular press and chapters in edited volumes.

#### FURTHER INFORMATION

For a list of CSERGE publications, reprints of journal articles for information on projects and other activities of CSERGE, please contact:

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# Conservation of Forest Resources and the Greater Biodiversity of Vietnam

*Vo Quy and Le Thac Can*

## INTRODUCTION

Perhaps there is nothing particularly new about man's misuse and mismanagement of natural resources and the environment. This misuse has long caused serious problems resulting in the destruction and degradation of vegetation, soil, water, wildlife. However, concern over such losses has increased, particularly over the past half century. Some of the main problems in developing countries are rapid population growth, limited conservation awareness and lack of funding for environmental and socio-economic development projects.

Like many other developing countries, Vietnam is presently facing a great challenge in the area of resource use and environmental protection. In order to meet the rising life demands of the nation's 70 million people, soil, forest, ocean, water, animal and plant resources are being exploited in an unplanned fashion, causing the natural resource base to shrink quickly. Yet, biological production has its limits and cannot be forced to meet ever increasing human demand. If we do not want to damage the fundamental resource production potential and decrease future biological production we cannot over exploit it. What we can do is to learn how to control, and wisely use resources while trying to stabilize social needs by population control.

Moreover, as a result of nearly 100 years of exploitation by the colonial regime, and 30 years of war for independence and for reunification of the whole country, the population and natural environment of Vietnam suffered terribly. The heavy

aftermath of war has rendered the existing problems in Vietnam more acute and difficult to solve.

## BIODIVERSITY IN VIETNAM

Vietnam is located along the south-east margin of the Indo-Chinese peninsula, stretching from latitude 6.5–23.22'N with a total land area of over 33 million hectares and a coast line of about 3200 km. Three quarters of the country consists of mountains and hills. The wide range of latitude and variety of landform — from swampy deltas to limestone karst and high mountains, and a special monsoon climate — has given the country a great diversity of natural environment and a consequent high biodiversity, and an enormous potential of supplies of aquaculture, timber, rice and other food and industrial crops and livestock. But on the other hand, Vietnam's fragile tropical environment is not easy to develop on a sustainable basis.

Vietnam used to be a country rich in forest resources with many different types of forests (but mainly tropical evergreen formations). Abundant precipitation and abundant solar radiation, year-round high temperature and lengthy growing seasons result in a large net productivity of plant biomass. The luxuriant vegetation and diverse floristic composition of these forests conveys the impression of high productivity with great potential for raw material production, which can ensure the existence of agriculture and other resources necessary to man over time. However, the ecosystem of the tropical ever-

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green forest is complex and extremely fragile under man's interference. The destruction of forest vegetation for agricultural lands leads to a rapid impoverishment of the soil, a loss of stored nutrients, leading to drastic changes in the physical and biological characteristic of the ecosystem.

The natural environment of Vietnam contains a great wealth of plant and animal species. It is estimated that there are about 12 000 species of higher vascular plants, of which more than 7000 species have been identified. Additionally, there are 800 species of mosses and 600 species of mushrooms. Many are valuable and useful species, including some 2300 species that are known to be used by humans for food, medicines, animal fodder, wood and other purposes. The use of many species is unknown, though certainly many more will be found to be beneficial when their properties are fully explored.

Vietnam has also a wealth of faunal varieties. Some 276 species of mammals, 820 species of birds, 180 species of reptiles, 80 species of amphibians, 472 species of freshwater fish, and about 2038 species of ocean fish and many thousands of invertebrate species. These groups show a high degree of local distinctiveness, with many endemic species of great scientific and economic interest. Some of the most spectacular species include the elephant, Javan rhinoceros, banteng ox, kouprey, tiger, gibbons, douc langur, sarus crane, giant ibis, white shouldered ibis, white-winged wood duck, pheasants, crested argus pheasants, crocodile, python and sea turtles.

Vietnam is one of the parts of the world which has not yet been studied systematically. In 1992 scientists identified an entirely new species of large mammal, a cow-like creature with the glossy coat of a horse, the agility of a goat and the long horns of an antelope. DNA tests on 11 specimens performed by Peter Arktander, a Danish scientist, confirmed that the animal was unlike any in the bovid family, which includes cattle, sheep, goats and antelopes. This was the first new large mammal to be discovered since a species of wild cattle — the kouprey — from northern Cambodia, southern Laos and south-western Vietnam was described in 1937.

Scientists gave this animal the name *Pseudoryx ngh etinhensis*. It was found in the Vu Quang area of Ha Tinh province in central Vietnam, a dense area of high quality forest, along Vietnam's mountainous border with Laos, a remnant of forest which has remained relatively undamaged.

In Ha Tinh province some years ago, we de-

scribed a new pheasant of the world, the Vietnamese pheasant *Lophurahatinhensis*.

It is more surprising that, less than two years after discovering the Vu Quang ox, Vietnamese scientists and those with the World Wide Fund for Nature (WWF) in February 1994 found yet another new large mammal in the Vu Quang reserve — a new species of deer. More recently in May 1994 one of the author's (Vo Quy) found this new animal in the Ho Ke Go reserve. Such finds are extremely rare. The scientists are calling this latest find, 'the giant muntjac', because of its size — estimated to be at least one and a half times larger than the largest known muntjac (*Muntiacus muntjak*). No live specimen was taken but we found two trophies of the new deer in hunters' homes in Kim Quang, the village where trophies of the Vu Quang ox were discovered in May 1992, and two other trophies of the same new deer in the village Ky Thuong of Ho Ke Go. Villagers hunt the giant muntjac, which they called *mang* (meaning muntjac) for its meat. In that area it is one of the most commonly caught wild species, after the wild pig. Between 15 and 20 animals were trapped in the villages from July 1993 to January 1994, suggesting that the newly discovered species is relatively common.

## AN ERODING BIOLOGICAL HERITAGE

Vietnam's biodiversity and its biological resources have provided a firm basis for the survival of the Vietnamese people during past generations and hopefully for their future development. Yet, during the last few decades, the forests of Vietnam and their natural resources have been seriously damaged. In 1943, forest areas covered about 46% of the total area of the country. The period from 1945 to 1975 was one of almost continuous war and the environment of Vietnam still bears severe scars as a result. As described in somewhat greater detail in the accompanying article in this issue of *AJEM* by Can and Quy, herbicides and other military action turned millions of hectares of tropical forest into denuded lands.

Forest cover has declined even more rapidly since hostilities ceased, principally owing to agricultural clearing, forest fires, extraction of timber and firewood and urban expansion. Today forests cover only 20 to 28% of the national territory. Forest lost is estimated to be about 150 000–200 000 ha

per year. About 50 000 ha of this total is caused by unplanned agriculture clearance. Another 50 000 ha is lost each year to forest fires while the destruction of the remainder is the result of the relentless collection of fuel wood and timber. The result is vast areas with rich ecosystem turned into wasteland unable to regenerate naturally.

The on-going loss of biological resources in Vietnam, as in many other countries in the world, is due to the conflict between demand and supply: natural resources are limited, but people's demands are increasing daily. On the other hand, biological products from developing countries, especially poor countries with high biological diversity, attract much attention from developed countries. Trade of biological products is extending to the detriment of biodiversity. Moreover, any area of high biodiversity with a large number of species, often means that there is a small number of individuals for each species. Therefore, whenever a highly valued species is discovered, it will quickly become a commodity, and if it is of exportable value, it will be overexploited in a short time and probably become exhausted or even extinct. This may happen even to the most common species which possess large numbers of individuals.

In Vietnam, in recent years, the trade in many species of plants and animals, including protected ones and products thereof, has increased dramatically. This has led to the destruction of tropical forests and to the danger of extinction of many species, such as rhinoceros, elephant, tiger, douc langur, gibbon, pheasants, *Fokienia hodginsi*, eaglewood and *Azelia xylocarpa*.

The active export of many common species, such as pangolins, monitor lizards, frogs, turtles, and snakes to Hong Kong, Thailand, and especially to China, in recent years is encouraging the Vietnamese people to trap them throughout the country. Their population numbers in rice fields have declined rapidly as a consequence, which in turn, has resulted in a number of environmental problems. These include, a high incidence of insect related diseases, and rats, both causing serious losses in agricultural production. Properly utilized and managed, the wild fauna and flora of Vietnam could be a very valuable renewable resource, but the decline of the country's wildlife is occurring very rapidly.

In Vietnam the consequences of the forest loss are particularly evident since the country is mountainous. The resultant changes in water flow, erosion,

floods and drought are far more severe than in other countries. Most of the deforested areas have become barren. Almost 40% of the country is now classified as unproductive wasteland.

Recognizing that forest loss is the single most serious factor threatening the long-term productivity of the country's renewable natural resources, we are carrying out a great planting programme in order to re-green our war-scarred land and correct the mistakes of rapid development. The aim is to reforest 40 to 50% of the countryside by the twenty-first century. In this way we hope to re-establish the ecological balance in Vietnam, to preserve biodiversity, and to do our part in delaying global warming. To grow one or two trees is very easy, but to plant hundreds or thousands of hectares of forest is not simple, especially under the conditions of compacted, leached earth and dry, blazing climate now found in areas that were once cool, moist and fertile.

An intensive programme of reforestation and afforestation should include the establishment of forest buffer zones and economic forest plantations to provide both fuelwood and timber. Planting efforts should aim to develop mixed forests of indigenous species most suitable to local conditions and climate, rather than monoculture and the use of exotic species.

We hope to bring this about in many ways. First of all, we know that in order for our efforts to succeed we must have the support of the local people, so we have to arouse public awareness and begin agroforestry training in local villages and schools. Throughout Vietnam, the villagers are setting up tree nurseries. Every winter, during our New Year Festival, we celebrate the New Year with a tree planting. All school students in Vietnam must also plant trees every year. Primary school students plant one tree, secondary students plant two trees and high school students must plant and care for three trees.

Before 1985, when we first launched our National Conservation Strategy, we were planting only 60 000 ha of forest annually — and losing 200 000 ha. In recent years, we have planted 100 000 to 160 000 ha of forest annually. Our goal is to plant 300 000 ha per year as soon as possible, though even this is not enough to compensate for ongoing forest destruction.

Many years ago, reforestation in Vietnam was based on the monocultural production of timber, but there are few convincing examples of successful large scale and long-term trees monoculture in this country.

After the war, Vietnamese scientists attempted to replant several species of indigenous trees destroyed during the massive defoliation raids. These initial trials failed, largely because young saplings were consumed in grass fires during the dry season. We now have a new programme. To protect the seedlings from the hot tropical sun, scientists first established a forest cover of fast-growing trees. When these trees gained sufficient height, they planted several species of indigenous trees. Several thousand hectares of exotic acacia, indigofera and eucalyptus give shelter to up three different species of indigenous dipterocarps, *Dipterocarpus alatus*, *D. dyeri* and *Hopea odorata*.

Today we are developing a village-level process for local people to produce large numbers of seedlings of indigenous tree species for planting around villages, in adjacent areas or for reforestation projects, without the need for setting up and maintaining orthodox tree nurseries.

This experiment offers great promise for our country in replanting tropical forests with indigenous species, but it also demonstrates how time- and labour-intensive the process of rehabilitating tropical woodland is. Millions and millions of hectares of barren land are awaiting our replanting efforts.

It is clear from the above that in order to improve this situation, a variety of measures are required. Among them, population control is a critical requirement to release pressure on the forest resources. But in terms of forestry measures, the following objectives are critical and thus in need of attention:

1. Accord full protection to existing forests and forest lands and improve their productivity.
2. Withhold permission to exploit a forest until a scientifically sound management plan is prepared, and rigorously monitor implementation of the plan. Concentrate commercial logging in plantation forests established for such use.
3. Make restoration of degraded land areas a high national priority. Large areas must be reforested. The hill-dwelling people must be helped to adopt more resource-efficient, environment-friendly technologies, so that they can use natural resources rationally and sustainably.
4. Promote tree planting on communal lands, such as roadsides, canal sides, village wastelands.
5. Encourage individual farmers to grow trees on private land, on farm boundaries and in home gardens.

6. Promote environmental education through the mass media, youth movement societies, women's unions and primary schools.
7. Promote agroforestry as part of a joint programme with agricultural staff.

Vietnam has made only limited progress so far in saving wildlife and the natural environment. Nonetheless, the government started to establish nature reserves as early as 1962, when it opened the first national park at Cuc Phuong. Further extension of the reserve system was held up by the war, but has proceeded very quickly since 1980. A system of national parks and protected areas was proposed and 87 of them have been approved by the government in 1986, accounting for 3.3% of the total land area of the country. Vietnam has recently established a number of special protected areas. These include Tram Chim Reserve in the Mekong Delta for the endangered eastern sarus crane and Xuan Thuy Reserve in the Red River Estuary, the first Ramsar protected area in Vietnam or elsewhere in Southeast Asia, for migratory birds.

However, in re-examining the listed protected areas, we have found that many necessary ecosystems and endangered species are not as yet included. Small, well-located protected areas may serve a critical need for some species but are not favourable for the conservation of large animals, especially those that require large foraging areas. We have made a proposal for the extension of the protected area system. Some new areas should be selected to fill the gaps in the present coverage and some existing reserves should be enlarged. It is planned to reach a target of 2 million hectares of such forests, representing 6% of the entire country.

Vietnam has 25 important wetland sites. Hence, it is necessary to establish wetland reserves to effectively conserve the wetland ecosystem and its plentiful fauna and flora. Vietnam also has the East Sea with a bounty of sea animals and coral reefs to conserve.

For the extension of protected areas, all political jurisdictions, from provincial to village level, should be encouraged to select and set up protected areas, which would enable them to conserve their local habitats and their valuable plant and animal species. Protected bird colonies, bat colonies and protected *Erythrophloeum fordii* forest already exist in several villages. These should serve as good models to be more widely adopted.

Vietnam is making great efforts to establish a wide range of reserves and protected areas. The most difficult tasks for the protection of Vietnam's nature reserves and national parks result from the presence of settlements of local people inside these areas. The populations of these settlements have to shift between agriculture, hunting, and forest-product exploitation for their survival and hence present obstacles to protection activities. The government has carried out a resettlement programme for moving the people of the forest since 1972. This programme was initially undertaken in Cuc Phuong National Park and has already had some success. But experience has shown that co-operation with local residents and recognition of their needs is a more effective means of protection than relocation alone. Buffer zones must be set up to provide employment for local people so that they do not continue to put pressure on the protected areas. This requires legal authority, money, education and enforcement powers.

In order to reduce the pressure of the local people on the Cuc Phuong National Park we started to intensify public relation activities, education and integration of the people who live in the park and a positive buffer zone into the park protection, helping them to adopt resource-efficient, environment-friendly technologies so that they can use natural resources rationally and sustainably.

With the support of Oro Verde and Dr Manfred Niekisch, we are establishing a new protected area in Ky Anh district for the four most endangered species of pheasant in Vietnam and many other threatened species including the new species of giant muntjac just discovered, and at the same time protecting the watershed and the rich fauna and flora of this area. For this purpose we have co-operated with the local people by encouraging their responsibility to the forest and enhancing their quality of life by helping them to implement the agro-forestry system, to plant fruit trees, to keep bees, etc.

These first experiments offer great promise for our country in conserving and saving our protected areas, our diversity, but also demonstrates how difficult and costly the process of organizing and managing the protected areas in a poor and overpopulated country is. About one hundred protected sites are awaiting our management efforts. We have to help the local tribal people develop alternative

and stable agricultural methods that enable them to maintain their traditions, customs and culture, while at the same time, conserving the ecosystems on which their lives depend.

## CONCLUSION

How to meet the basic needs and aspirations of the people of our country without destroying natural resources? How to restore and develop the deteriorated areas and preserve the country's resources in order to build a strong economy from one which is still poor? This is a great and difficult task. The fulfillment of this task calls for a large-scale plan based on the principles of ecology (conservation) and economics (development).

We are concerned with the fact that the Vietnamese people's future and welfare depend on the integrity and productivity of the environment and resources.

The question is how to rely on the people to restore and maintain their own environment for their benefit with a deep knowledge of the paramount importance of the task. To this effect, we must deepen the people's knowledge of the environment, which we are trying to do.

As noted earlier, Vietnam is facing an upset in its already unstable environment, largely because of the ecological catastrophes caused by population pressure, poor planning and management and residual effects of war. By learning from other countries's experiences, and analyzing its own development models, Vietnam is now choosing a new form of development, concentrating on family planning and on a wiser and more rational use of natural resources, thinking out development targets in which environmental problems play a central role.

It is a great and difficult task, but we are optimistic about future prospects, for we firmly believe that these catastrophes are not inevitable, that our country's basic resources can still be renewed, and that the Vietnamese nation has in it enough strength, sense of discipline and talent to cope with those dangers which are now threatening it.

We think big, we think on a grand scale, but we begin small, and we work step-by-step, and we believe that we can achieve our conservation aim.



# The Political Process and Environmental Management: The Political Changes Needed for Environmental Improvement in Hong Kong

*Christine Kung-wai Loh*

## ABSTRACT

The territory of Hong Kong has achieved very impressive economic growth but has done so at a high cost to its environment and the quality of life of its people. A crucial feature of the development-environment nexus in Hong Kong is the lack of public participation in 'public' (i.e. governmental) decision-making. Massive infrastructure projects, such as the port and airport development, channel vast resources into specific directions which irreversibly impact the environment. These developments are evaluated, designed, and launched with virtually no public consultation. Such an approach to government means that decisions are made according to the priorities and values of a few individuals. These decisions pay little attention to environmental sustainability or the long-term liveability of Hong Kong. A sustainable model of development for Hong Kong and its people can only be realized with greater involvement of the public in the decision-making process.

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## THE POLITICAL CONTEXT

Within only a few decades, Hong Kong has been transformed from a modest city to an international trading capital of 6 million people. The pace of change accelerated in the 1950s with the start of industrialization. Hong Kong was one of Asia's early 'sweatshops'. From the 1970s to the 1990s, Hong Kong's economy shifted from that of a low cost, labour-intensive manufacturing centre to a sophisticated service economy. By 1993 wealth as measured by per capita Gross Domestic Product was over US\$16 000 and well ahead of that of Britain — its colonial master until 1997.

The political structure in which this transformation took place was, and remains, autocratic and

paternalistic. Until 1991, when the first direct elections were held for a minority of the seats on the Legislative Council, the constitutional structure remained much as it had been in the nineteenth century. The colonial governor still appoints the Executive Council, his top policy advisory body, and makes appointments to other bodies including the legislature. Appointees largely represent business and professional viewpoints. Hence, Hong Kong can be said to be ruled by an oligarchy. This oligarchy is not prescribed by formal constitutional rules, but the appointment system co-opts the rich and influential and was created to give the colonial structure a semblance of local involvement. Civil servants like to describe the Hong Kong system as an '*executive-led government*' where officials set policies, with the

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Legislative Council merely approving expenditure and passing laws. With no real representative government, the civil servants are, in effect, the *government party*. The Legislative Council sometimes functions more like an opposition party.

For many years, public policy favoured private wealth creation, with low taxation and low public spending. Despite the vast social disparities which this approach allowed, Hong Kong as a whole grew richer. Yet the economic and political conditions of today have outgrown the existing public policy decision-making process because better education has created higher expectations and a desire to be better informed on the part of the people of Hong Kong. The rise in political consciousness in Hong Kong is also making people more interested in public affairs. Paternalism, exemplified by the notion of an 'executive-led government', however well-intentioned, will no longer satisfy the growing popular desire for direct participation in the political process.

### Environmental Politics

There is also a slow rise in environmental awareness in Hong Kong, which is gradually making its citizens more thoughtful about what they value as a society. People are beginning to question their government about the kinds of impacts public policies create. And, the concept of *sustainable development* has at last arrived in the political parlance of Hong Kong, albeit only uttered softly at this time.

For the environment to be higher on the government's policy agenda, the government itself has to be convinced that its way of measuring social progress needs adjustment. For the public to participate meaningfully in policy decision-making on the environment (or indeed, in any other area of policy), there are two pre-conditions. Firstly, the public needs to be provided with access to information in order to assess policy in an informed way. Secondly, policymakers ought to be held accountable to the public about decisions they make in the name of the public. As elaborated below, at present there remains a basic deficiency with respect to both of these matters in Hong Kong.

### A DAMAGED ENVIRONMENT

As the government itself notes, 'pressure on Hong Kong's environment is intense' (EPD 1994). Hong Kong is small (under 1100 km<sup>2</sup>), but it has some of

the highest residential population densities in the world of nearly 1000 people per hectare. Each day Hong Kong produces on average nearly 20 000 tonnes of solid wastes. The quantity of solid wastes is expected to increase to 24 000 tonnes per day by the year 2006 (EPD 1994). There is an urgent need to identify means to facilitate waste prevention, minimization, reuse, recovery and recycling. The government has so far only commissioned a consultancy on waste management, the final results of which are expected in April 1995.

Hong Kong has become one of the noisiest cities in the world. According to the government, an estimated 350 000 people are exposed to severe aircraft noise and close to 1 million out of a population of six million people are exposed to unacceptable levels of road traffic noise (EPD 1994). Various other activities, such as the extensive and prolonged construction, and 24-hours cargo-handling expose many residents to constantly high noise.

The daily traffic jams, particularly near the container terminals, and on roads leading to the Chinese border, are unlikely to ease until far more freight is moved by rail between Hong Kong and the fast developing Pearl River Delta region in south China. Every day, more than 20 000 goods vehicles pass through the border and the figure is growing by about 15% per year. The Financial Secretary acknowledged, when he delivered the 1994-95 budget, that 'much of the cross-border freight is far more suited to be moved by rail than by road. But existing rail capacity simply cannot cope with the demand' (Financial Secretary 1994).

Southbound cargo from China alone is estimated to double by the year 2001 to 55 million tonnes per year. The government's own Railway Development Study accepts that it would be more cost-effective to move 2 million containers by rail every year than by other means, such as by road or barge (Transport Branch 1993). That means that the most cost-effective way for Hong Kong to handle cross-border freight would be to move 5000 containers per day by rail by the end of the decade. In 1993, Hong Kong moved only 16 containers per day by rail, but the government has yet to decide whether or not to build a new rail-link to handle this volume of freight to China. In 1994, the government allotted HK\$104 million (US\$13.3 million) for this purpose, but in the meantime, it has to spend HK\$8 billion (about US\$1 billion) to build more roads to ease traffic congestion (Finance Branch 1994).



One of Hong Kong's most obvious and serious pollution problems is caused by vehicle emissions. The density of vehicles on Hong Kong's road system — already among the highest in the world — is estimated to increase by 60% before the end of the decade, and correspondingly, air quality is estimated to worsen by 50% (EPD 1993). The inability to control the rapid growth of the number of vehicles has offset any reduction in pollution brought about by more stringent laws for emission controls. In 1992, 9 out of 10 air-quality monitoring stations (measuring air pollution levels at tens of metres above the road surface) showed levels to have been above the statutory limits (EPD 1993). In 1993, there were slight improvements at some stations, because the government mandated a lower diesel sulphur content, but the improvements may be short-lived as the overall number of vehicles continues to increase. Survey research showed that high incidence of asthma and bronchitis in parts of Hong Kong can be linked to air pollution (Hedley *et al.* 1993). Follow-up research showed that improvements in air quality due to relatively inexpensive controls lead to improvements in respiratory health among school children (Barron *et al.* 1994).

The magnificent Victoria Harbour and surrounding marine areas have been seriously damaged by toxic industrial pollution, the dumping of agricultural waste and sewage, and constant dredging and reclamation. Local fish show increasing levels of heavy metals and *E. coli*. The levels of paralytic shellfish poisoning rose 1300% in the first quarter of 1994 (EPD 1994). In July 1994, cases of cholera were linked to the eating of seafoods kept in polluted water from Hong Kong's typhoon shelters.

Hypodermic needles, medical wastes and other unsavoury items have been washed-up on Hong Kong's once pristine beaches. While Hong Kong is belatedly putting in a sewage system, water quality will continue to deteriorate until the entire system is in place, which is still some years away. The cost of the system is estimated to be about HK\$17 billion (approximately US\$2.2 billion) to be spent over the next 10 years (EPD 1994). The government is looking to recover recurrent expenditure to the sewage services from the public.

### REDEFINING 'DEVELOPMENT'

The government's priority to build infrastructure was

undoubtedly right in the days when Hong Kong was relatively undeveloped. Now, however, Hong Kong must be careful to consider how it should continue to develop without destroying what is left of its land, sea and air. Unfortunately, the government still continues to invest in vast infrastructural programmes (and indeed is embarking on ones of unprecedented scale) without clearly asking those outside the small circle of government decision makers whether this is the best use of Hong Kong's limited physical and financial resources.

For example, although studies had been underway since about 1985 on Hong Kong's replacement airport and port expansion, there was no substantial public consultation and no indication from the government of what it planned to do. Then in late 1989, again without public consultation, a commitment was made to the development of an airport at Chek Lap Kok and to enormous port expansion as a confidence-boosting measure after the Tiananmen Square Incident in Beijing. This Port and Airport Development Strategy (PADS) project had an estimated cost of HK\$106.2 billion (US\$13.6 billion) in 1988 prices. (And this for a territory of only 6 million people!)

The Provisional Airport Authority was eventually set-up to distribute the funds for the first batch of airport core projects. No comprehensive environmental impact assessment (EIA) study was carried out for the entire project although all of the component projects occur within a relatively small geographic area and hence cumulative effects are potentially of major importance. Instead, EIAs were carried out on individual component projects. Furthermore, the environmental monitoring reports for these projects are only provided to the government and not regularly released to the public. There is alarmingly little public accountability on not only the environmental impact of PADS, but also on the details of its budget. The Director of Audit does not have any power to inspect the Authority's efficiency and spending!

The port development part of PADS consists of building another seven container terminals, one on Tsing Yi Island and six on Lantau Island at an estimated cost of HK\$72.8 billion (US\$9.3 billion) (Parry 1994). The objective in building these terminals is to maintain Hong Kong as a premier container port until the year 2011. This will enable Hong Kong to tranship another 150 million tonnes of freight each year, on top of the 100 million tonnes a year it already handles (Transport Branch 1993). The con-

tainer terminals will be expensive because the land on which they will be built must first be 'reclaimed' by filling in the seabed in areas near the shore.

There are two factors which argue against the perceived necessity on the part of the government to undertake massive port expansion concurrent with the airport expansion. Firstly, it is possible that over the next 10 years, Hong Kong will no longer be the dominant container port for south China. On each side of the territory, in the Chinese areas of Yantian, Shekou and Gaolan, ports are being planned and built, sometimes with private Hong Kong investment capital. This should not be seen as a threat to Hong Kong. It would be desirable for the transshipment pressure to be eased, and instead, for Hong Kong to provide the capital and expertise for port development elsewhere in China. Secondly, there are opportunity costs to factor into the equation. The vast sums of public and private money which must be invested in Hong Kong's own infrastructure developments reduce the availability of capital for other investments including those for greater environmental protection (i.e. a more advanced and thorough sewage treatment system, less polluting and more efficient transport and electric power systems).

The present policy is strongly tilted towards land-intensive, rather than people-intensive development. Such investments add to Gross Domestic Product (GDP) but it is uncertain how much they add to the quality of life. The government's goal seems to be to maximize land values which result in filling-up the public purse when government-owned land is sold to the private sector for development or redevelopment. Yet, a policy which favours maximizing land value for the government may result in economic incentives which are socially destructive. For example, when the Environmental Protection Department (EPD) insisted that land be set aside to relocate the bleaching and dyeing industry for purpose-built pollution treatment areas, this was rejected by the Lands Department which insisted on putting the land out to auction for the highest return, since industrial usage fetch lower prices than either commercial or residential usages (Industry Department 1993).

If Hong Kong should choose to limit its land and infrastructure-based development, Hong Kong will not stop growing. There were many people who could not envision Hong Kong being a thriving economy without low-cost labour back in the 1970s. Yet, Hong Kong has moved away from that and has

tripled its GDP over the last 15 years (Census and Statistics Department 1994). Hong Kong was able to grow because worker productivity increased, value-added increased and the service sector greatly expanded. In other words, Hong Kong invested also in developing its human resources which enabled a higher production rate than before.

Hong Kong is now at a cross-road. Its greatest asset to China's modernization is not its land and natural resources, both of which are severely limited in supply, but its people. It seems futile to compete with China where they have substantial advantage. It is going to be the expertise, creativity, international connections, ability to access information and raise capital which will continue to make Hong Kong valuable to China. As Hong Kong's economy is rapidly shifting to meet the demands of economic reform in China, Hong Kong must ask itself what investments does it want to make in order to yield the highest return in the long run. It must also ask whether the types of development it wants to make are sustainable. If Hong Kong does not redefine 'development', it will soon have nothing left to develop.

Yet, there seems to be little inclination on the part of the government to look more toward investing in Hong Kong's human resources. Tellingly, the government is planning to spend 25% of its total public expenditure over the next five years on infrastructural development (Leung 1994). The extent of infrastructure building has now reached a point where it can be clearly seen that more will lead to a further deterioration in Hong Kong's quality of life. This concern was raised not only by the traditional environmental lobbying groups in Hong Kong, but also by such organizations as the Hong Kong General Chamber of Commerce which represents the broad spectrum of the business community.

An alternative economic vision is for Hong Kong to invest more heavily in human infrastructure, in developing services, such as in health and education and in developing new technologies. Investing in people will require substantial and continuous funding for the entire education system, including pre-schooling and on improving teaching skills. Hong Kong should also identify research and development investment areas which are likely to exploit further its comparative advantages, especially in terms of human resources and services. The government should identify key non-land intensive industries in which Hong Kong can excel. This is essential because the work force has to be channeled

into employment which will continue to absorb local talent and put it to good use.

### INTEGRATING THE ENVIRONMENT INTO ECONOMIC DECISION-MAKING

To achieve sustainable development, the environment must be integrated into economic decision-making. Economic decisions reflect the incentives people face everyday. This process includes not only price incentives, revenues, profits, and incomes. It also includes policies and procedures of government, public agencies and private enterprises as well as informal incentives, such as social praise and censure, and shared community values. If the decisions people make in their day-to-day lives are destructive (e.g. to the environment), then the incentives which they are presented with are somehow inappropriate. To improve the basis for decision-making, the incentives need to be adjusted. Often, Hong Kong public policies end up actively encouraging unsustainable development. For example, Hong Kong policy still fails to distinguish between the environmental and health effects of petrol versus diesel motor vehicles. When the government's own professed goal is to encourage the use of unleaded petrol and discourage the use of diesel, it is perverse that the price for diesel remains far lower than that for petrol. Electric power provides another example of setting the wrong economic incentives. Hong Kong spends enormous amounts of money building power plants but very little on energy efficient technologies and on promoting efficiency services. Hong Kong's schemes of control for regulating the electric utilities are designed in such a way that the utilities can only profit from investment in building power plants. There is no incentive for them to promote efficiency.

A key first step is to ensure that the government itself is aware of the environmental impacts of development projects. At present there is no law requiring EIAs to be carried out. The government is expected to propose legislation in 1995 to require EIAs to be carried out for public and private development projects (PELB 1994). It has also been promised that the findings of these EIAs will be made available to the public. This will certainly help the community to understand the nature of the development projects better. But the government should go further, and also enshrine in legislation that any subsequent environmental monitoring reports dur-

ing the lifetime of such projects will also be available to the public.

A second step is for the government to inform itself about the environmental impact of its policies. EIAs on government projects seem to be used solely to help identify relatively low-cost measures which somewhat lessen the most visible environmental impacts. EIAs rarely seem to play a part in deciding whether to proceed with a particular project or not.

There is an opportunity this year to change the way Hong Kong assesses social progress. The government is considering switching from the use of GDP to Gross National Product (GNP) forecasting. Both of these methods — while useful in certain respects — are deficient as overall indicators of material progress since they do not account for such important considerations as depletion of resources, the pollution of the environment, and the state of public health (Census and Statistics Department 1994). Indeed, the increasing resources which Hong Kong has to spend on cleaning-up the environment adds to GDP and GNP.

The government should develop a parallel index alongside the GDP and GNP forecasts to chart overall progress. The new index should include such factors as distribution of income, the quality of services such as transport, the cost of commuting, spending on public health, education, the arts and recreation, estimates of damages caused by pollution and a measure of government accountability. Such indices are being developed in other parts of the world (Lutz 1993). When the new index is set along side those showing GDP and GNP forecasts, then it can be clearer whether the quality of life is really improving. If not, then the government itself should be convinced that changes in its approach to development are needed. Perhaps this is the only way to convince the government to take on environmental concerns comprehensively and to divorce itself from the conventional logic of more and more of growth.

Perhaps most basic of all is the very limited 'right to know' in Hong Kong. In the absence of freedom of information legislation, government officers may simply withhold at will any information they choose no matter how specific or how basic (e.g. the amount and type of chemicals it puts into watersheds for pest control, or the results of studies of alternative fuel systems such as liquified natural gas which could greatly affect pollutant emissions from the power, industry, residential/commercial and transport sectors).

Hong Kong is unfortunate to be caught between two governments, those of Britain and China, which have two of the strongest traditions of official secrecy in the modern world. The British tradition is magnified in colonial Hong Kong where civil servants seem to believe they should be the only people setting policy priorities. They appear to find it difficult to consider how valuable an access to information law might be to the people of Hong Kong, and worry about what an inconvenience it would be to their administration.

There is no reason why much of the data, research and analyses gathered or commissioned by government with taxpayers' money, should not be made available to the public as a right. The government has resisted continuous public pressure for an access to information law, and has so far only indicated that it will provide an administrative code of practice in early 1995 (Chief Secretary 1994). A code is a step in the right direction, but to provide a right to official information (such as that proposed by the author in January 1994) would be more effective.

### THE ROLE OF GREEN GROUPS

In the last decade, environmental pressure groups have become well-established in the community. These groups actively challenge public expenditure priorities and the government's deep-seated reluctance to provide information on its decisions. Like environmental movements elsewhere, environmentalism in Hong Kong has provided a venue for a traditionally apolitical public to protest against official policy. Green groups have, for instance, forced the government to accept their representatives on the Advisory Council on the Environment, which reviews public projects where the environment is affected.

These groups provide high-profile challenges to the government's claim that it alone is the best judge and guardian of the public interest. For example, in March 1993, Friends of the Earth Hong Kong won a ruling of maladministration against the government for wrongfully approving the development of a private golf course on country park land (Commissioner for Administrative Complaints 1993). By questioning policies, the green groups have forced the government to justify and explain decisions that used to be accepted without question. The message that

these and other community groups are putting forth is that the government is to serve the public, and that the public interest should be decided together with the public.

### PARTICIPATORY DECISION-MAKING

The town planning process provides a good example of what is lacking in the current public decision-making process, and how the system can be improved. The civil service's definition of the 'executive-led' style of government can be seen from the government's own review of the Town Planning Ordinance. In justifying the lack of public accountability in the town planning process, the review states that planning is:

currently an entirely administrative process, guided by the land development policy committee, chaired by the Chief Secretary. Territorial and sub-regional plans ... may raise issues of widespread public interest, but they do not confer or restrict development rights. Thus, there is no need to bring them within a statutory framework.

In other words, government can decide what is the public interest without involving the public. In the planning process, the location and design of development areas do not include any public hearings or consultation. Indeed, it can even be difficult for interested parties to obtain access to planning information.

All district planning decisions are made by the Town Planning Board (TPB) whose members are appointed by the governor. The TPB meets behind closed doors and no agenda or minutes are released of their meetings. Planning applications submitted to it by private developers are likewise unavailable for public inspection, and the TPB does not consult residents on their views. Thus, tenants and owners of properties which are affected will not know about a developer's proposal until the TPB has already given its approval to the project. By the time the plans are released, all fundamental decisions have been taken with very little room for changes.

The current process involves very few people, and typically does not include those whose lives will be directly affected. Planning should deal with a wide range of social interests and it is the job of government to ensure that all the interests receive a fair hearing. The government must ensure that it

does not confuse its own narrow goals for redevelopment (which seems to be to increase public revenue) with the interests of the community for an improved overall living environment. It is for this reason that other governments, such as those of the United Kingdom and the United States of America, require open hearings to gather public views on redevelopment throughout the process. Those meetings are presided over by an independent commissioner whose job is to ensure that local residents' objections receive a fair representation and that the public has access to all relevant information. That sort of public forum provides an opportunity for professional planners to hear firsthand the residents' concerns. Welfare, green and heritage groups can also relate their experience in the community to offer ideas and solutions.

Community ideas can be useful. For example, since 1967, the American Institute of Architects has held urban design programmes involving 21 million people in 40 American states (Wates 1994). Over a structured weekend of site visits, workshops, group design sessions and public meetings, the public was able to involve itself in formulating redevelopment plans of their cities. This effort is itself the cumulative result of years of frustrating delays caused by conflicts between government planners, private developers and the public interest.

More resources will have to be allocated to the planning process if Hong Kong is to involve the public. The advantage of public involvement is that it enables more efficient use of resource allocation for development. That these changes are necessary to respond to the changing political environment for not only greater participation, but also greater accountability.

The system as it stands has virtually no public accountability. Instituting a system of public participation in the government's decision-making process will empower citizens and give them a real sense of involvement in the society in which they live.

## CONCLUSION

Redefining 'growth' is essential if Hong Kong is to truly prosper in the future. Environmental problems demand that we change our thinking and priorities fundamentally.

The people and government of Hong Kong must recognize that economic activity results in some degree of trade-off in terms of environmental

degradation. The extent and nature of that tradeoff can be greatly influenced by the political process. In Hong Kong the extent of environmental degradation associated with economic expansion has been unnecessarily — and unwisely — high. Setting the direction of economic activity is a political process. Decisions on how to allocate resources and establish the necessary incentives for private capital are shaped by the interests of those who hold political power.

The political changes in Hong Kong that are necessary to improve the environment are those that will bring decision-making into wider public debate. The enormous PADS project which will forever change the Hong Kong landscape was carried out by a government that shuns public consultation and accountability. The Hong Kong public was never allowed to participate in a debate over the long-term social and ecological costs or the alternative possibilities to such massive infrastructure development.

The needed debate, at the very least, requires public access to information and a directly accountable government. Public participation will not, of course, necessarily always lead to 'correct' choices when it comes to balancing development and environmental goals. Yet, without such participation, decisions on the level of environmental quality to be enjoyed (or suffered) by the people of Hong Kong will continue to be made by the few. At best, these few within the government will continue to promulgate their own opinion of what is good for the rest of the people and, at worst, might conceivably neglect such interests to serve the desires of influential groups within the larger society.

In the view of the author, Hong Kong can no longer afford continual massive infrastructure and material expansion, creating ever increasing mountains of pollution and other forms of environmental degradation and leading to severe negative side-effects (externalities) imposed on the very people such development is meant to serve. Instead Hong Kong must now — particularly as a society already among the wealthiest in the world — seek to move in the direction of much greater sustainability, public participation and a recognition that the quality of the air we breath, the level of noise, the safety of our food and water and protection of natural environments, are as much a part of our quality of life as the factors used to calculate GDP or GNP.

A more sustainable model of development in Hong Kong, therefore, is intractably linked to the creation of a more democratic and open

decision-making process. Indeed, fundamentally changing our economic priorities is only possible if the interests of those who shape economic policy can be openly checked against the public interest.

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# Vietnam: Environmental Issues and Possible Solutions

*Le Thac Can and Vo Quy*

## ABSTRACT

Like many other low-income, developing countries, Vietnam is now facing the critical issues of the degradation of its natural resources and a decrease in environmental quality. Since 1975, after 30 years of devastating war, the Vietnamese people and government have undertaken efforts to conserve resources and protect the environment. A National Conservation Strategy was prepared in 1985 and since then a National Action Plan for the Environment and Sustainable Development has been developed and partly implemented. On the basis of this national plan, various activities related to environmental legislation, management, education, research and experimentation are being carried out in the country. The ongoing transition from a centrally planned economy to a market economy, the acceleration of economic growth, and greater investment and participation in regional and international trade are all providing important benefits to the people of Vietnam. However, these changes are also posing new problems for the task of environmental protection and sustainable development. International co-operation with both developed and other developing countries is important in helping provide valuable support to Vietnam in meeting the challenge of environmental protection in the face of rapid economic change.

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## INTRODUCTION AND GEOGRAPHICAL BACKGROUND

As noted in the Invited Commentary article in this issue of *AJEM*, Vietnam is essentially a tropical country with a humid monsoon climate. The mean annual temperature is 23°C in Hanoi; 25°C in Hue City, and 27°C in Ho Chi Minh City. The average annual rainfall is 1678 mm in the north; 2890 mm in central region; and 1979 mm in the south. About 80% of the annual precipitation falls in the rainy season, the time and duration of which vary according to the specific geographical conditions of the different regions in the country. This large quantity of rain water is drained to the seas by a myriad of

rivers and streams, among these the most important are the Red River in the north, and the Mekong River in the south.

In Vietnam there are about 11 million ha of arable land, including 8 million ha suitable for annual crop plants, and 3 million ha for perennial crop trees. The largest expanses are in the Red River Delta, the Mekong River Delta and the western plateaux in the central region. There are also 16 million ha of forest land: among these 8 million are still covered with forest vegetation. Vietnam's subsoil contains important mineral resources such as coal, iron, bauxite, copper, tin, gold, silver, precious stones, oil and gas. The potential total hydropower of Vietnam is estimated to be about 28 000 MW. Coastal

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fisheries produce annually around 1 million tonnes of fish and 50 000 tonnes of shrimp (State Committee for Sciences 1991).

The population of Vietnam is now about 70 million, ranking twelfth in the world and seventh in Asia. Eighty-one percent of Vietnamese live in rural areas, employed in agriculture, forestry, fisheries and handicrafts. The most important urban centres are: Hanoi, with a population of 3 million; Ho Chi Minh City (4 million), and Haiphong (1.5 million, including the suburban areas). The population distribution is uneven. The population density is 1000 people/km<sup>2</sup> in some districts of the Red River Delta; 300 to 500, in the Mekong River Delta; and only 50 in remote mountainous areas. About 40% of the population is of working age. This large population and abundant manpower constitute the most important resource for the country's development. On the other hand, rapid population growth is creating heavy pressure on living conditions, employment, natural resources, and the environment.

## ENVIRONMENTAL ISSUES

With the above-mentioned geographical characteristics Vietnam could be considered as a country endowed with abundant natural resources and favourable environmental conditions. Yet, as everywhere, the environment of Vietnam, along with the positive aspects, also has its negative side. The distribution of the natural resources does not always coincide with human needs. Floods, droughts, typhoons and other natural calamities are frequent in Vietnam. The profusion of heat and humidity creates conditions for the propagation of diseases and epidemics, contamination of food products, corrosion of metallic materials and technical equipment. Vietnam lacks many natural resources necessary for the development of agriculture and industry. The disparity of mineral ores makes investigation and exploitation difficult and costly. These features along with rapid demographic growth, the backwardness in economic development during the last few decades, and the impact of more than 30 years of devastating war has created serious environmental issues. The most important among these are:

- deforestation;
- degradation of land resources;
- inefficient conservation of fresh water;
- irrational use of mineral resources;

- over-exploitation of biological resources and serious loss of biodiversity;
- environmental pollution; and
- the long term environmental effects of war.

## Deforestation

It is estimated that in the nineteenth century Vietnam had 19 million ha of natural forest. The ratio of forest area to the total land area was about 58%. With the rapid population growth and consequent needs for agriculture land, these forests have been heavily exploited and then denuded, firstly in the low lying delta and coastal plains, and then progressively higher into the hills and mountains. According to an inventory made by French foresters in 1943, the forest area of Vietnam was then 14.1 million ha, nearly 44% of the total land area. This ratio decreased to 40% in the beginning of the 1960s, and then to less than 24% by 1983. Monitoring data in 1989 show an increased percentage of forest cover due to the inclusion of industrial tree plantations and some low-productivity secondary vegetation cover to the category of forest (RERP 1985; GSO 1991).

The situation is especially serious in some regions, such as the northwest corner of Vietnam, the central plateaux, the broadleaf forests of southeastern Vietnam and also in some newly rehabilitated mangrove forests. Current reforestation efforts, estimated at about 100 000 to 150 000 ha per year, are not keeping pace with the rate of deforestation. Deforestation has led to serious impacts on water resources, soil erosion, loss of wildlife, and deterioration of landscape and climatic factors.

## Degradation of Land Resources

In 1945 when the population of Vietnam was 25 million, the total land resource per capita was about 1.3 ha, with 0.2 ha used for agricultural exploitation. With the rapid demographic growth the land resource per capita is now 0.47 ha, where only 0.11 ha is under agricultural exploitation. In the Red River Delta, 93% of the potential arable land has been intensively used. In the Mekong River Delta this ratio is 82%. Some extension of agricultural land is still possible in certain areas such as the hilly land in the northern Vietnam, in southeastern Vietnam and the plateaux of central Vietnam. Such an extension would require high financial, manpower,



and advanced technology investments and appropriate approaches to the solution of complex economic, ecological and environmental problems (SCS 1991).

Along with the decrease of area per capita, land resources are subjected to a number of serious problems including soil erosion, degradation of soil fertility by inappropriate cultivation practices, laterization in hilly areas, salinization and acidification in coastal areas. The annual rate of soil erosion from rainfall is estimated to be about 10 to 20 tonnes/ha from watersheds, and 100 tonnes/ha from plantations.

A complex geological formation history has endowed Vietnam with an unusually wide range of minerals, including those basic for the development of agriculture and industry, and also many rare and valuable deposits. The north is the richest in mineral resources, with coal in Quang Ninh and Bac Thai provinces; apatite and rare earth in Hoang Lien Son; lead, zinc, silver, gold in Cao Bang; antimony in Ha Tuyen and precious stones in many places. Central Vietnam has important iron deposits in Ha Tinh; bauxite in Nghe An; chromite in Thanh Hoa, gold, copper and zinc in Quang Ngai. There are large reserves of oil and gas in the continental shelf of southern Vietnam, important deposits of bauxite in Lam Dong province, peat in the Mekong River Delta, and brown coal in the Red River Delta. Mining in Vietnam is being carried out in hundreds of sites of various sizes. Because of technological limitations and mismanagement, serious loss and wastage of minerals has occurred during the investigation, design, planning, extraction and utilization of extracted materials. It is estimated that loss in coal extraction is about 12 to 15% in open mining and 40 to 50% in underground mining. In addition to the direct economic losses, inefficient and inappropriate practices for mineral extraction activities are creating serious air, water pollution and landscape deterioration (SCS 1991).

### **Inefficiency in Conservation and Use of Water Resources**

The potential water resources in Vietnam are estimated to be about 6.4 m<sup>3</sup> per capita, which is relatively high. Because of financial and technical constraints, however, these resources are not well conserved or rationally used. Current use of water resources is often inefficient because of the inad-

equate design and building of water supply and irrigation systems. High levels of sedimentation resulting from soil erosion reduce the efficiency of canals and shorten the life span of reservoirs. In 1991 important hydropower plants in Da Nhim, Tri An in the southern part of the country could not operate normally in the dry season because the adjacent reservoirs were seriously lacking in water. Smaller reservoirs such as Cam Son, Song Hieu, Boc Nguyen in the northern and central parts of the country were seriously affected by sedimentation within ten years after completion of construction. Water pollution from industrial and domestic sewage became a serious issue in many areas in Ho Chi Minh City, Haiphong, Hanoi and other cities. Contamination of underground water sources occurred in some delta and coastal areas, by intrusion of saline or acidic water during exploration or exploitation. Mineral and thermal water including carbonic, sulphuric, silica, ferrous and fluoride groups are found in more than 350 sources but remain underexploited (SCS 1992).

### **Degradation of Biological Resources**

As more fully described in the Invited Commentary on Vietnam's biodiversity, Vietnam contains a great wealth of flora, though some of this is under severe threat. The country also has a rich variety of wild fauna spanning a wide range of habitats from the equatorial lowlands to the high temperate plateaux and alpine peaks. It is estimated that there are 273 species of mammals, 773 species of birds, 180 species of reptiles, 80 species of amphibians, hundreds of fish and many thousands of species of invertebrates. These groups of animals show a high degree of distinctiveness with many endemic forms. Following deforestation and deterioration of wildlife habitats, many valuable animal species are becoming scarce or are in danger of extinction. The list of these species includes the kouprey, wild buffalo, rhinoceros, elephant, and tiger. The decline of Vietnam's wildlife is taking place very rapidly. The protection of these precious genetic resources is one of the most urgent conservation needs. Recent studies have shown that about 500 species of plants and 354 species of animal must be urgently protected (RERP 1986; SCS 1992).

Coastal and estuarine areas play a very important role in the exploitation of biological resources in Vietnam. The mixing of sea water with fresh wa-

ter, rich in nutrients discharged from the Red River, the Mekong River and other smaller rivers of central Vietnam makes the estuarine and coastal regions of Vietnam ideal spawning and breeding grounds for many species of fish, shrimp, crabs, oysters and other marine organisms of high productivity and commercial importance. Some marine 2000 fish species have been identified, including about 100 species of high economic value. There are also large mangrove forests and rich coral reefs with a wide range of fauna and flora of important economic and scientific value. These areas are now suffering from over-exploitation. Due to the lack of investment and technology for deep sea fishing, fishing is highly concentrated in estuaries and shallow coastal water, which are the spawning and breeding ground of many species and home for young fish and larva. The fishing tools used are in many cases overly destructive. Examples include fine-meshed nets, and use of explosives. Fishing intensity is rapidly increasing, but the total catch is only slightly improving. Due to overfishing in the past decades many economic species have decreased or are threatened. Some species abundant 30 years ago are now absent, such as *Clupanodon thrissa*, *Dorosoma nasus* and *Megalops cyprinoides*. Mangrove forests, including those newly restored after the war, are subjected to clearing for brackish fish and shrimp breeding ponds, exploitation of fuel wood and building materials. In some places in the central coastal part of the country, coral reefs are exploited for making quicklime (RERP 1986).

### Pollution

As noted above, inappropriate use of chemical fertilizers and other chemical products in agriculture has already caused pollution in some rural and agricultural areas. Although Vietnam has little developed industry, and only a few very large cities, environmental pollution is becoming a serious issue in some urban and industrial areas. The total daily solid waste of Hanoi is estimated to be about 360 tonnes. The daily sewage effluent from Ho Chi Minh City is 500 000 m<sup>3</sup>. The emission of more than 50 toxic and hazardous gases has been recorded in Hanoi, Ho Chi Minh City, Vietri, Lam Thao and other industrial areas. Dust pollution is reaching alarming levels in various urban centres, particularly around construction sites and around roads with intense traffic. Water pollution is especially serious in urban cen-

tres and also in villages in the Mekong River Delta where during the dry season there is limited or no flow of surface water. In many factories and construction sites serious noise, heat, humidity, light, radiation pollution are creating harmful impacts to the working and health conditions of workers.

### Environmental Impacts of War

The three decades of war from 1945 to 1975 caused serious environmental damage in Vietnam. From 1965 to 1975, 72 million litres of herbicide were sprayed on the forest and agricultural land, affecting millions of hectares. Large tracts of forests, agricultural land and villages were cleared by giant bulldozers. Some 13 million tonnes of bombs and shells were dropped, creating more than 25 million craters and displacing 3 million m<sup>3</sup> of earth. The impact of this devastation on the environment continues to this day. Since 1975, in the post-war reconstruction, the Vietnamese people have rehabilitated an important part of devastated towns, villages, agricultural and forest land. Some areas, however, were so severely contaminated from chemical warfare and devastated by explosives that they have not recovered.

### SOLUTIONS TO ENVIRONMENTAL PROBLEMS AND PROMOTION OF SUSTAINABLE DEVELOPMENT

Since 1975, after thirty years of hard struggle for national independence, the Vietnamese people have faced new challenges. The restoration of the country's damaged and degraded environment and the provision of the basic living conditions for a population of 55 million people impoverished by many decades of war moved to the forefront. Thus far, the task of addressing environmental issues has been carried out in three phases. From 1975 to 1980, rehabilitation of environmental damage caused by war was paramount. From 1981 to 1990, the focus was on resource identification and use and environmental issues linked with socio-economic development and population growth. Since 1991, the emphasis has been on promotion of appropriate strategies for resource development and environmental management aimed at sustainable development.

### Restoration of the Environment Damaged by War

Restoration work was mainly carried out in the late 1970s. First priority was given to the restoration of settlement and agricultural areas. Restoration activities consisted of: the identification of the location and destruction of unexploded bombs and the filling in of bomb craters; reconstruction of damaged houses, schools, hospitals, roads, bridges, irrigation, water supply, drainage and other types of infrastructure, amelioration of land management and land use, plantation of trees. In the areas contaminated by chemical agents, special disinfection of houses, of farm lands, and of water supply systems were completed before resettlement. Later came the restoration of the forests, including artificial reforestation, the conservation and creation of favourable conditions for natural regeneration, the reintroduction of wildlife and the transformation of some forest lands into agricultural ones. Immeasurable efforts have been deployed in the provision and amelioration of living conditions for millions of war invalids, orphans, diseased, homeless, landless and other types of war victims aimed at creating an acceptable material and moral living environment.

### Solution of Environmental Issues in Postwar Development

After 1980, Vietnam entered a new period of economic growth with more intensive development of agriculture, forestry, fishery, handicrafts, the promotion of exports and the starting of industrialization. Among these activities were:

- the intensification of agricultural production in the delta and coastal plains in northern and central Vietnam;
- the extension of rice farming areas in the Mekong River Delta;
- the development of rubber, coffee, tea, pepper plantations in the central plateaux and the midlands of southern Vietnam;
- the building of large water reservoirs and hydropower plants in the Red River and Dong Nai River, thermo-power plants in Pha Lai, the construction of important cement factories at Hoang Thach and Bim Son; and
- the development of roads and railways.

While these activities had some benefits and some

negative effects on the environment, they also took place within a context of rapid population growth. This created pressure on the national economy and other aspects of society which in turn have raised new environmental issues.

In 1981, aware of the urgency of these environmental problems, scientists from the universities and research institutes in Vietnam proposed the establishment of an interdisciplinary research programme for the rational use of natural resources and environmental protection. The proposal was accepted by the Ministry for Higher Education and the State Committee for Sciences and Technology. The National Resources and Environment Research Program (RERP) started its activities in mid 1981. About 200 researchers from the leading higher education and research institutions in the country participated in the implementation of 18 research projects of the programme.

The research projects were oriented to the following subject areas:

- ecosystems management;
- biodiversity conservation and establishment of protected areas;
- pollution control and abatement;
- environmental education and awareness;
- environmental impact assessment (EIA); and
- human ecology problems and development.

Research activities carried out from 1981 to 1990 have had good results. Among these are: (1) identification of the major environmental issues in Vietnam; (2) identification of the solution of these issues, especially the promotion of the more rational use of natural resources; (3) the establishment of a nature conservation network; (4) the proposal to higher decision-making bodies of specific policy and legislation for environmental protection.

Based on a proposal made by the State Committee for Sciences on 20 September 1985, the Council of Ministers of the Socialist Republic of Vietnam issued the decision concerning 'the intensification of basic investigation of natural resources, their rational use and the protection of the environment.' To implement this decision, the ministries of agriculture, forestry, fisheries, mineral resources, water resources and other sector ministries carried out studies on natural resources and environmental conditions in the country. Provincial administrations also made inventories and evaluations of their local resources. Research institutions began study and ex-

perimentation projects aimed at rationalizing the use of resources, limitation of resources wastage and reduction of pollution sources.

From 1988, the General Assembly, the State Council and the Council of Ministers of Vietnam have passed a number of important laws, orders and regulations related to natural resources use and environmental protection. These include the Land Law (1988), People Health Care Law (1989), Order on Mineral Resources Use (1989), Order on Aquatic Resources (1990), and Forest Law (1991).

In 1985, the Resources and Environment Research Programme, with technical assistance from the International Union for The Conservation of Nature (IUCN), prepared a National Conservation Strategy (NCS) for Vietnam (NRERF 1986). The Vietnam NCS proposed:

1. The maintenance of ecological processes and life-support systems in Vietnam, namely the maintenance of forest, midlands, croplands, freshwater, estuarine and coastal, deep sea ecosystems;
2. the preservation of genetic diversity by development of protected areas, identification of protected species, establishment of hunting regulations, control of the wildlife trade, and *ex situ* conservation;
3. the sustained utilization of renewable resources, the maintenance of environmental quality for human life; and
4. the international implementation of conservation in Vietnam.

### **Environmental Protection and Sustainable Development**

In the late 1980s, concerned about the future demands which economic development would place upon resources and environment, the Vietnamese government requested Vietnamese scientists to prepare, with the assistance of international experts, a National Environment Action Plan. The State Committee for Sciences, in co-operation with UNDP, SIDA, and IUCN, organized an International Conference on Environment and Sustainable Development in Vietnam held in Hanoi in December 1990. Participants in the Conference approved the submission to the Council of Ministers of Vietnam a document entitled, 'National Plan for Environment and Sustainable Development: A Framework for Action'. On 12 June 1992, the Na-

tional Plan was officially approved by the Chairman of the Council of Ministers (SCS 1991).

The objective of the National Plan, which has taken the issues raised in the National Conservation Strategy as its point of departure, is to provide for the gradual development of a comprehensive framework for national and sub-national environmental planning and management leading to specific actions that are required in the short term to address priority problems at their roots.

The framework includes a wide variety of components, including: the institutional, legislative and policy framework, giving orientations for the establishment of environment authorities, development of environment policy and law, environmental monitoring, information management, integrated and sectoral strategies for sustainable development, EIA, and environmental disaster management.

The framework identified seven action programmes, namely: (1) urban development and population control; (2) integrated watershed management; (3) integrated coastal and estuarine zones management; (4) protection of wetlands; (5) maintenance of genetic diversity; (6) national parks, protected areas and wildlife reserves; and (7) pollution control and waste management.

The framework also determined two support programmes: education, training and awareness promotion, and international and regional co-operation. A list of research, baseline data collection priorities and also areas for testing the feasibility of the action plan have been also determined.

In implementing the action plan, the government prepared a draft of the Environmental Protection Law, which was then passed by the National Assembly in December 1993. An Environmental Impact Assessment Provisional Regulation has been also issued by the Ministry of Science, Technology and Environment. The government has taken the decision concerning the amelioration of problems in the existing Cuc Phuong and Cat Ba National Parks, and the establishment of 87 nature and cultural, historic and scenic reserves. Activities related to the reforestation programme and the promotion of agro-forestry projects rapidly expanded, especially in the midlands of the northern and central part of Vietnam and in the coastal zones of the southern part. Some pollution control and abatement activities have been carried out in Hanoi, Ho Chi Minh City and other urban centres. In 1991, Vietnam officially joined the Ramsar Convention.

The 12 000 ha Con Lu Reserve (located in the Red River Estuary) participates in the global network of wetland conservation.

Concerning environmental research, the Resources and Environment Research Program entered a new phase of its development in 1991. The programme was given a new name: National Research Program for Environmental Protection. It is one of the 14 major national research programs of the country in the 1991–95 period and consists of 17 research projects grouped into four sections:

- *Environmental monitoring*, includes two projects carrying out comparative studies and research aimed at determining environmental quality criteria and standards, and the design of an environmental monitoring network appropriate with the conditions in Vietnam.
- *Environmental engineering* includes five projects on pollution control and abatement, waste management, promotion of cleaner technologies in urban, industrial and also in rural, and agricultural areas.
- *Ecosystem management* includes six projects on biodiversity conservation, sustainable use of natural resources, and integrated resources use for rural development in typical ecological areas of the country. This section also includes research concerning the possible impacts of climate changes on Vietnam.
- *Socio-economic problems of environmental protection* includes three projects on EIA and one project in environmental education, training and promotion of environmental awareness (Can 1993).

#### **NEW TRENDS FOR ENVIRONMENTAL CHANGES IN THE PERIOD OF RAPID SOCIO-ECONOMIC DEVELOPMENT**

In 1986, Vietnam entered a new period of socio-economic development characterized by the shift from a centralized, planned economy into a market oriented one. The liberalization of agricultural and industrial production, as well as the development of services and the opening of the country to foreign investment, the effort to industrialize, and the promotion of exports are bringing to Vietnam relatively rapid economic growth, but at the same time are creating resource and environmental problems.

#### **Increase of Environmental Pollution**

With the rapid economic growth and the acceleration of industrialization in the past several years, environmental pollution in Vietnam is becoming more serious. Urban and industrial areas are being polluted by the increasing number of motor vehicles; the expansion of existing industrial areas; creation of new factories and industrial parks; and the continued use of aging machinery in old factories. A number of important questions concerning pollution control in large urban and industrial areas exist, such as: the centralized treatment of sewage, dumping and burning of solid waste, and toxic waste treatment. The urbanization programme, aimed at the establishment of three big urban-industrial poles in Hanoi, Haiphong, and Quang Ninh in the north, Quang Nam and Danang in central Vietnam, and Ho Chi Minh City, Bienhoa and Vung Tau in the south, will have a severe impact on environmental conditions.

The intensification of agricultural production for both the internal market and for export is increasing the need for chemical fertilizers and pesticides, creating the risk of soil and water contamination in rural areas. The development of oil and gas exploration and exploitation, along with its transportation and processing, will create a risk of marine pollution.

#### **Increasing Pressure on Land, Water and Mineral Resources**

Demographic growth, intensification of industrialization, expansion of urbanization, infrastructure construction for the development of roads, railways, waterways, airports, irrigation systems, electricity transmission lines are contributing to increasing pressure on land resources. It is estimated that the agricultural land per capita in the Red River Delta, which is now about 0.11 ha will decrease to 0.06 ha in the year 2000, to 0.05 ha in 2005, and to 0.034 ha in 2025.

The lack of safe drinking water for the population, as well as adequate quality water for industry and for irrigation will be an important issue in many areas of the country, especially in the dry season in the denuded hilly midlands, the coastal and estuarine regions with intrusions of saline sea water, and also in some urban centres. The overexploitation of underground water to meet domestic and industrial needs in cities located in the delta areas could lead to subsidence and damage to buildings.

Serious losses and wastage of mineral resources in large state-owned mines continues. Losses during mineral extraction at small and medium-sized private mines are important because of the large number of these enterprises.

### **Urbanization and Disorganized Population Migration**

Before the socio-economic renovation the percentage of the urban population in Vietnam was relatively stable: 19.1% in 1980, and 19.3% in 1985. The situation rapidly changed after 1986. The urban population percentage share grew to 20.3% in 1990, 22.7% in 1991, 24% in 1992, and it is estimated to reach 26% by the year 2000 and probably 36% by 2005 (Le Hong Ke 1993). With the projected rapid urbanization, the shortage in infrastructure and technological conditions for housing, water, energy supply, public service, health care, educational and cultural activities could become acute. The environmental quality in large cities such as Hanoi, Ho Chi Minh City, Vietri, Haiphong and Bienhoa, and Dongnai will be degraded rapidly unless preventative and remedial measures are taken in time.

The disparity in income levels, especially the gap between worker salaries in cities and villages, is leading to disorganized rural-urban population migration, which will make the environmental issues more complex. The migration of large groups of people from the northern provinces with scarce land resources to the central and southern provinces could cause deforestation and unplanned use of scarce land and forestry resources.

### **Lack of Environmental Management Instruments**

In the new period of development, the task of environmental protection and sustainable development in Vietnam becomes more complex and requires more efficient use of resources and environmental management. This in turn requires clear policies, strategies, legislation, regulations, education, training, awareness promotion, and research and experimentation; it also requires better technical tools for monitoring, control and information — all of which are seriously lacking in Vietnam. This situation could result in many difficulties for environmental management at the national as well as at the local levels.

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## **DEVELOPMENT OF ENVIRONMENTAL MANAGEMENT**

As noted above, in December 1993 the National Assembly of Socialist Republic of Vietnam passed the Environmental Protection Law. This is the basic environmental law of the country, which includes an introduction and five chapters on: (1) general provisions, with nine articles; (2) protection and abatement of pollution and environmental quality degradation, with 20 articles; (3) solution to environmental pollution and environmental risks, with nine articles; (4) environmental management, with three articles; (5) international co-operation in environmental protection, with four articles; (6) environmental inspection and solution to violations of law, with eight articles; and (7) laws on implementation, with two articles.

The central government and the local People's Committee, from provincial, municipal, district and village levels, which are the executive bodies, will be responsible for enforcement. The Ministry of Science, Technology and Environment (MOSTE) and its affiliated offices at the corresponding levels are the agencies responsible for the technical aspects of the law enforcement. Following the promulgation of the law regulations concerning environmental-quality standards, environmental-quality control and inspection, and environmental-impact assessment will be issued.

In 1992 and 1993, with the assistance of UNEP 3 EIA Technical Training courses were organized in Hanoi and Ho Chi Minh City. Of these, two EIA Training Courses were organized with Asian Development Bank (ADB) assistance by the Ministry of Science, Technology and Environment. EIA is also taught as a compulsory subject in the regular post-graduate course on environmental management at Hanoi University. Through these training activities, there are now about 200 people in Vietnam with basic knowledge of EIA, among these 50 have been involved in some EIA practical activities. An EIA Methodologies Manual was edited during the National Research Programme on Environment in December 1993.

A number of EIAs have been carried out in the past few years including the Hoabinh Water Reservoir post-construction EIA case study, the Bai Bang Pulp and Paper Plant, the Thach Nham Irrigation System and the south Uong Bi Reclamation Project. In 1991, the EIA of Quan Lo-Phung Hiep Project

was completed by the Canadian firm ESSA. In 1992, an EIA of Yali Hydropower Plant Project, was completed by the Swiss company Electrowatt. From 1990 to 1993, more than ten EIAs of industrial development projects in Ho Chi Minh City and the southern provinces have been completed by the Ho Chi Minh City Environmental Protection Center. In northern and central Vietnam, the EIAs of Thac Mo, Song Chinh, Son La hydropower plants were carried out in 1992 and 1993. A preliminary EIA of oil and gas exploration drilling in five blocks were done by BP-Vietnam, Shell-Vietnam, and AEDC-Vietnam companies in 1992 and 1993.

The Ministry of Science, Technology and Environment has established Offices for Sciences, Technologies and Environment in all provinces and major cities of the country, creating a network of governmental authorities responsible for environmental management.

Universities and colleges are developing new training courses in environmental engineering, environmental economics and EIA. Various activities for promotion of environmental awareness are carried out by the Youth Union, the Women's Union, central and local television, and by radio and newspapers.

The Vietnamese people and government are receiving support of various kinds for resource conservation and environmental protection from developed countries including Sweden, Canada, Australia, France, and Germany. It is also co-operating with and receiving technical aid from developing countries in the region, as well as financial and technical aid from many international organizations and funding agencies. Internal efforts combined with this external assistance are creating favourable conditions for the implementation of sustainable development in Vietnam.

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# Mineral Development in Thailand: The Need for Land-Use Planning for a Better Balance of Environmental and Economic Goals

*Duangjai Intarapavich and Allen L. Clark*

## ABSTRACT

The inability to resolve conflicts between land use for mineral resource development and land use for other activities is a prime factor obstructing the growth of the Thai mineral industry. The government's current 'green policy' is to increase forest land from 26% to 40%. Much of the required additional forest area will likely cover the 15% of Thailand considered favourable for mineral exploration. In these areas permission to use forest land for mining will be increasingly difficult to obtain, and land-use conflict can be expected to intensify. The mineral industry must effectively address the issues of forest protection, mining pollution, and land reclamation in order to conduct mining in an environmentally sound manner. Meanwhile, if the government implements rational land-use planning to identify land suitable for mining, the mineral industry will be encouraged to avoid conflict concerning the use of limited resources. If these steps are not taken, the Thai mineral industry is in danger of never recovering.

*Keywords:* Thailand, mining, forestry, environment, sustainable development

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## INTRODUCTION

The mineral industry has contributed much to the success of the Thai economy. In addition to rice, timber, cassava and rubber, tin was one of the major exports in the early periods of economic development, bringing a large amount of foreign exchange which stimulated the growth of the economy.

During the periods of mineral price booms, the government promoted the mineral industry. As a result, large numbers of miners were licensed regardless of qualifications and often without minimum investment guarantees to ensure efficient mining and environmental protection. The problem

is magnified because most mines in Thailand are small to medium-scale and miners are generally poorly educated, have no formal technical training, and tend to lack long-term perspective on mining operations or environmental protection. While Thailand has enacted laws and regulations to control mining operations and their environmental impacts, these are not effectively enforced. Post-mining land reclamation and reforestation projects in Thailand are not commonly conducted and those that have been undertaken are mostly conducted by the government and are projects to reclaim previously abandoned tin mines.

These past abuses by the mining industry have

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resulted in present conflicts over land usage, a problem which exists in almost every country. In Thailand, as in many countries, the use of land for mining activities is no longer considered a priority and the emerging trend is to preclude mining activities from certain lands. These exclusions represent a major impediment to the development of the Thai mineral industry and such conflicts have become more serious as the public becomes increasingly aware of the magnitude of deforestation in the country.

In the future when the domestic mineral industry becomes less important to the economy and Thai society becomes more aware and concerned with environmental quality, present environmental practices of miners will likely become even less acceptable. In particular, unless the issues of land restoration, forest protection, mining pollution, social impacts and compensation for loss of aesthetic value are addressed in a mining project, permission to use the land for mining will be difficult to obtain. To obtain the goal of sustainable development, the government needs to implement policy measures and actions which mitigate adverse environmental impacts from the mineral industry and the miners will need to respond and adapt to these changes and stringent environmental regulations.

#### THE THAI MINERAL INDUSTRY: PAST, PRESENT AND FUTURE

The Thai mineral industry, established decades ago, was based primarily on tin mining with Thailand among the world's major tin producers and exporters. Tin was a major source of foreign exchange contributing greatly to the early growth of the Thai economy. During periods of soaring tin prices, export revenues generated from the mineral industry were substantial — accounting for about 10% of total export revenues.

Since the early 1960s, the government has formulated policy guidelines, as part of the National Economic and Social Development Plans, designed to facilitate development of mineral resources. For mineral development, the aims of each plan changed, reflecting the prevailing government's attitude toward resource exploitation. For example, during the First Plan (1962–66) when world mineral prices were high, export was a primary goal. In later plans when prices were lower, domestic consumption was encouraged. As tin prices have continued to decline,

Thailand has diversified mineral production into other commodities. The number of tin mines has decreased from 71% of all mines in 1980 to 16% in 1993, while more mines for industrial minerals have been developed (Table 1).

Table 1  
Number of Active Mines by Kind of Minerals

Mineral	1980	1985	1986	1990	1993
Antimony	36	46	48	22	13
Ball clay	1	6	7	18	20
Barite	38	51	44	12	8
Chromite	1	2	2	2	0
Diatomite	3	1	2	3	6
Dolomite	3	6	7	9	17
Feldspar	15	28	29	43	43
Fluorite	58	64	61	38	29
Gemstone	2	26	32	34	15
Glass sand	11	18	18	19	15
Gold	0	0	0	1	1
Granite	0	0	4	32	50
Gypsum	9	21	19	26	28
Iron	6	7	8	7	10
Kaolin	18	42	44	55	71
Lead	7	13	14	10	5
Lignite	9	17	20	18	25
Limestone	8	25	26	30	41
Manganese	14	18	15	8	6
Marble	4	43	44	61	88
Marl	8	0	0	7	6
Phosphate	8	16	16	11	10
Quartz	4	4	7	8	7
Scheelite	5	4	6	3	2
Shale	5	5	5	5	9
Talc	5	8	6	4	5
Tin	737	696	623	226	102
Travertine	0	0	0	4	4
Wolfram	22	10	7	5	4
Zinc	0	1	1	1	7
Zircon	0	1	3	2	0
<i>Total Active Mines</i>	1034	1179	1118	724	647

Source: Permpon et al. 1992, and Mineral Statistics, Department of Mineral Resources.

Overall, the role of the mining industry has declined as Thailand has become more industrialized. During the last decade, only 2–3% of Thai Gross Domestic Product (GDP) originated directly from the mining sector with an additional 5–8% of GDP derived from the mineral-based manufacturing sector. Mining as a percent of GDP, however, does not accurately reflect the overall role of minerals in the

**Table 2**  
**Mineral Production of Thailand**

Mineral	1980		1993	
	Quantity (Ton)	Value* (Million Baht)	Quantity (Ton)	Value* (Million Baht)
Ball clay	1 557	0.30	345 846	121.10
Barite	305 057	208.10	42 385	67.80
Dolomite	8 130	0.90	537 119	188.00
Feldspar	24 158	12.10	600 835	453.00
Fluorite	232 892	305.40	48 387	84.30
Glass sand	171 000	20.50	459 062	160.70
Granite	0	0.00	109 267	298.00
Gypsum	411 977	113.50	7 454 806	2 010.50
Kaolin	24 954	16.30	614 023	338.60
Lead	24 847	228.60	14 233	44.00
Lignite	1 426 566	171.30	15 592 759	7 796.40
Limestone	3 957 929	98.94	33 039 751	2 808.90
Marble	5 649	2.50	88 389	225.00
Shale	800 682	16.00	3 596 952	323.70
Tin concentrate	45 986	11 545.60	6 363	614.20
Zinc	10	0.00	445 761	2 186.00

\* The exchange rates in 1980 and 1993 are US\$1 00 = 20.48 Baht and 25.32 Baht, respectively.  
Source: Mineral Statistics, Department of Mineral Resources

Thai economy. With a shift away from tin mining, Thailand has emerged as one of the largest gypsum producers in the world with approximately 7 million metric tons of gypsum produced locally each year, of which 80% is exported. Other minerals produced extensively in Thailand are limestone, shale, dolomite, feldspar, glass sand, kaolin, zinc, and lignite (see Table 2).

While areas available for mining decline, an upsurge in domestic demand for minerals, and especially industrial minerals, has occurred and is expected to increase. As shown in Table 3 during the Seventh National Economic and Social Development Plan (1992-96) annual consumption of industrial minerals is projected to increase from between 8.9% for granite to about 20% for kaolin and feldspar (Intarapavich *et al.* 1992). Projected growth in ferrous and non-ferrous mineral consumption range from 4.8% for nickel to over 6% for aluminium, copper, iron and steel, and zinc (Chutinara and Hanjavanich 1992). Such growth in consumption, among the highest in the world, indicates that without substantial development of domestic resources Thailand will become even more import dependent. In 1991 imports of steel products was about US\$3 billion, while lead was about US\$1 billion, and copper US\$300 million (Chutinara and

Hanjavanich 1992). To a large extent the development potential for domestic minerals hinges on resolving land use conflicts, particularly for forest lands.

**Table 3**  
**Projected Average Growth Rate of Mineral Consumption (1992-96)**

Cement Manufacturing Raw Materials (%)	
Gypsum (for domestic consumption)	11.7
Limestone (for cement)	13.3
Construction and Decoration Materials	
Marble	11.7
Granite	8.9
Glass and Ceramic Raw Materials	
Feldspar	19.4
Glass sand	12.6
Kaolin	21.1
Metallic Minerals	
Zinc	8.7
Tin	10.6
Aluminium	6.3
Copper	7.1
Nickel	4.8
Iron and steel	6.3

Sources: Intarapavich *et al.* (1992), and Chutinara and Hanjavanich (1992).

**Table 4**  
**Summary of Mineral Potential Areas Interpreted from Airborne Geophysical Data**

<i>Mineral Commodities</i>	<i>Number of areas (km<sup>2</sup>)</i>	<i>Type of Mineral Potential</i>
1. Tin and tungsten	88 (18 854)	Tin, tungsten, some heavy minerals, e.g. ilmenite, rutile, monazite
2. Base metal	132 (31 206)	Copper, lead and zinc with some tin, tungsten and silver
3. Industrial	66 (9 549)	Fluorite, barite and antimony
4. Gold	2 (7 549)	Gold
5. Gemstone	28 (6 273)	Ruby, sapphire
6. Chromium and nickel	4 (1 503)	Chromite, nickel

Source: Japakaset and Jarnyaharn (1992).

The potential for Thailand to secure significant supplies from domestic sources, particularly of ferrous and non-ferrous minerals, can be seen in Table 4 which summarizes areas of high mineral potential. The evaluation and development of this potential, however, depends on resolution of environmental, land classification and mineral policy issues. The issue of the land classification in future development can be seen from Figure 1 and Table 4 which show that approximately 75 000 km<sup>2</sup> of land are geologically favourable for mineral development, an area equal to that proposed by the government for addition to existing forest lands. The size of these areas, when compared to existing mining areas and Thailand's overall long-term development plan for forest lands, will require major policy decisions regarding land use for the sustainable development of the Thai economy.

## MINING, FORESTS AND ENVIRONMENT

Besides external factors such as declining world mineral prices, the development of the Thai mineral industry has been beleaguered with domestic problems, especially conflict over land use between mineral resource development and forestry.

### Mining Area

Thailand's total land area is around 513 120 km<sup>2</sup> and although approximately 15% is considered geologically favourable for the occurrence of mineral deposits, less than 1% has been allotted for mining activities, and this proportion has been declining (see Table 5). In 1978 the areas allocated for mining

activities reached 629 km<sup>2</sup> or approximately 0.12% of total land area. As a comparison, the granted areas for mining activities in 1990 was 478 km<sup>2</sup> or approximately 0.09% of total land area, of which actual operating areas are much less than the granted areas.

**Table 5**  
**Onshore Mining Concession Area in Thailand**

<i>Year</i>	<i>Concession Area (km<sup>2</sup>)</i>	<i>% of Total</i>
1978	629.09	0.123
1982	695.28	0.136
1986	647.04	0.126
1987	575.20	0.112
1988	557.25	0.109
1989	513.41	0.100
1990	478.18	0.093

Source: Division of Survey and Division of Planning, Department of Mineral Resources, Thailand.

The present area for mineral resource development is minimal relative to the country's total area or even compared to land area encroached upon by squatters. Even if the 75 000 km<sup>2</sup> (15%) of geologically favourable land is considered, it is doubtful, based on international norms, that more than 3 000-4000 km<sup>2</sup> would actually be designated for mining concessions. Indeed the number would undoubtedly be considerably smaller. It should be emphasized that problems arise from the location of mines and their environmental impacts, not the amount of land required.

Mineral Potential Areas  
of  
**THAILAND**

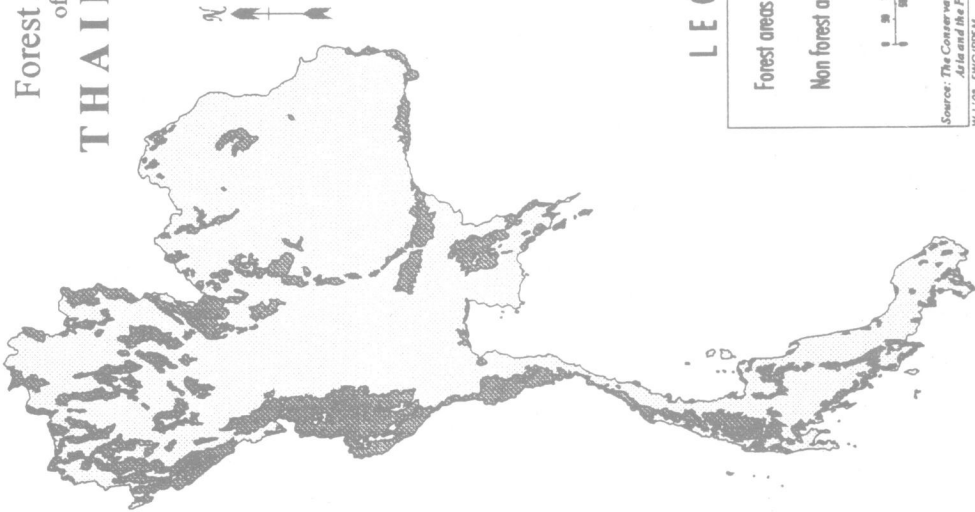


**LEGEND**

Base Metals	
Tin, tungsten	
Precious metals	
Barite, fluorite	
Chromite, nickel	

Source: After MRDP, 1992 and OMR, 1992  
W.I.'93 - EWC/PREM

Forest Areas  
of  
**THAILAND**



**LEGEND**

Forest areas	
Non forest areas	

Source: The Conservation Atlas of Tropical Forests  
Asia and the Pacific  
W.I.'93 - EWC/PREM

Fig. 1 Forest and mineral resource areas of Thailand.

## Forest Area

The forest areas in Thailand are broadly classified into two types: conservation forests and commercial forests. *Conservation forest* refers to those protected to preserve the country's biological resources and rare species of flora and fauna. Additional purposes are education, research, amenity, and national security. They also act as buffer zones for the mitigation of some natural disasters such as flooding and landslides.

Conservation forests may be divided into two categories:

- i. Conservation forests which have been declared by a royal decree or cabinet resolution and comprise (a) national parks, (b) wildlife sanctuaries, (c) class-1A watershed areas and (d) protected mangrove forest, and
- ii. additional conservation forests consists of areas which remain under permanent forest cover and are appropriate for nature conservation, and areas considered as local or national heritage sites.

Commercial activities are strictly prohibited in conservation forests.

The term 'commercial forest' refers to forest areas designated for commercial purposes, either as an economic forest or an agricultural forest. The remaining forest areas are classified as farm holdings, swamp, urban areas, highways, and railroad lands. Therefore, only relatively small, specific areas are available for mining, and overall this area is likely to decrease further through time (Intarapravich 1992).

In an effort to increase the country's forest land, the government has declared any area having an average slope of 35% and more to be a forest area and has prohibited its use for any activity. This has an extensive impact on mining since many, if not most, of Thailand's mineral deposits are found in areas of high relief and consequently steep slopes. Even in areas designated as commercial forest, where economic activities are allowed, mining permits are often turned down. This policy evolved as a result of both government inaction and abuses by the mining industry. In the case of government, there is both a lack of adequate policy and enforcement of what policy does exist. In the case of the miners, they have failed to honor their legal obligation for environmental protection and land reclamation.

## Environmental Laws and Regulations

The argument over environmental degradation related to mining is a key issue leading to usage conflicts, with users of resources other than minerals claiming the moral high ground. The development of mineral resources unavoidably results in a loss of aesthetic value and changes in topography. It may also entail varying degrees of environmental damage, e.g. soil erosion, landslides, waste water discharge, and dust pollution. These environmental impacts, can be mitigated or prevented with proper planning and management. However, in practice, miners usually pay little attention to environmental problems and throughout Thailand have ignored post-mining environmental rehabilitation and reforestation.

Within Thailand specific laws and regulations have been enacted with respect to mining and environmental protection. To get a mining license for any area, a miner is now required to submit an Environmental Impact Assessment (EIA) to the Office of Environmental Policy and Planning of the Ministry of Science, Technology and Environment for approval before commencement of activities. The EIA must fully address aspects relevant to the surrounding environment as well as possible future implications. The applicant must also state clearly the follow-up activities he plans to implement to protect and rehabilitate the environment of the mining area. This applies to all mining operations regardless of size. In addition, mining activities must comply with the National Environmental Quality Act B.E. 2518 (1975) (later replaced by the Improvement and Conservation of National Environmental Quality Act B.E. 2535 (1992)) concerning water at discharge, quality of ambient air, and noise levels. The Mineral Act B.E 2510 (1967) (amended in 1973, 1979, 1983 and 1985) also establishes regulations and standards to protect the environment.

Although these environmental laws and regulations exist, they have not proved effective because they are not enforced. There is insufficient monitoring of and compliance with laws and required follow-up activities have been inadequate. In other words, environmental regulation and rehabilitation requirements look good on paper, but are usually not executed in the field.

The non-compliance of miners and the weak enforcement capability of concerned government agencies have resulted in accumulated environmen-

tal impacts. The highly visible and extensive damage to land, resulting from reckless mining operations and inadequate reclamation of mined-out areas in the past, has provided a strong focal point for criticism from environmental advocates and the general public. The resulting poor image of the mineral industry is causing operators increasing difficulties in obtaining mining permits in the economic forests and even unclassified forest reserves. Consequently, the industry is struggling with problems such as an inability to expand into new areas as well as an inability to operate in current areas (with valid mining licenses) as licenses to use forest land expire and renewals are refused.

### CRISIS IN THE MINERAL INDUSTRY

Prior to 1960, forests covered more than half of Thailand's land area. However, they declined from 273 648 km<sup>2</sup> in 1961 to only 149 056 km<sup>2</sup> (or about 29% of total land area) by 1985, and are now about 133 411 km<sup>2</sup> representing roughly 26% of total land area (see Fig. 1 and Table 6). This major reduction of forested area is due to many factors including urbanization, expansion of cultivated land and illegal timber harvesting.

**Table 6**  
**Status of Forest Lands in Thailand**

	Area (km <sup>2</sup> )	
Current Forest Area	133 411	(26%)
Target Forest Area	205 248	(40%)
Conservation Forest	128 280	(25%)
Commercial Forest	76 968	(15%)
Total Country Area	513 120	(100%)

Source: Royal Forestry Department, Thailand.

The sharp decrease in forest land has prompted the government to implement policies to increase forested areas in the country. In May 1985, the Thai government attempted to preserve the country's diminishing forests by enacting a watershed classification as a basis for defining appropriate land use. Watershed areas are divided into five classes based on the characteristics of the area's ecosystem. Watershed Class 1 refers to conservation forest and headwater source areas, and is divided into Classes

1A and 1B. Both 1A and 1B are areas of conservation forest, but the areas in Class 1A remain under permanent forest cover, while in Class 1B, portions of the area have already been cleared for agricultural use or are occupied by villages. Watershed Class 2 refers to commercial forest, Class 3 to fruit tree plantations, Class 4 is upland farming, and Class 5 is those in lowland farming.

In January 1989, the government revoked forest concessions countrywide and closed forest reserves for land reclassification. Under the current Seventh National Economic and Social Development Plan (1992-96), 40% of the country's total area is earmarked for forest reserves, of which 25% will be set aside as conservation forest in which all activities are prohibited, and 15% will be designated as commercial forest in which permission for mining activities will be considered on a case by case basis. Overall, less land will be available for mining and permission to use land for mineral resource development will become even more difficult to obtain.

To open a new mine in an area which is not privately owned, a miner must obtain a permit from the Department of Mineral Resources (DMR) and also get permission from the Royal Forestry Department (RFD), two organizations with incompatible objectives and policies. The DMR attempts to promote exploration for and assessment of new mineral reserves which means opening up new areas for mineral resource development. The RFD is enforcing its policy to increase forest reserves which means more areas must be set aside for forestry. This basic conflict of interest is naturally leading to severe conflicts over land management.

In addition to conflicting policies, several other obstacles arise from the mix of existing regulations. For example, the permission to use forest land, issued by the RFD, is granted for a 10-year period, while mining licenses issued by the DMR can be granted for periods of up to 25 years. Problems occur when permission to use forest land has expired and the RFD refuses to renew it on environmental grounds. In this case the miner cannot use the land for mining even though his mining license is still valid.

As noted above, all economic activities are strictly prohibited in the land proclaimed as conservation forest by royal decree or cabinet resolution and can be made available for economic activities only after they are declared 'open'. For conservation forests created by royal decree — such as national parks and wildlife sanctuaries — an 'open'

status can be obtained only by changing the decree, which is extremely difficult and time consuming. For conservation forests created by cabinet resolution (e.g. Class-1A watershed areas and protected mangrove forest) conservation forest status can be revoked only by replacing the previous resolution with a new one. Although difficult, this can be more easily managed and takes less time than changing a royal decree. However, with the current government policy to increase forest land, it seems unlikely that the government would even consider such actions.

Attempting to use the prohibited land for mining thus means an increase in land-use conflicts among concerned bodies. That means that not only will the country fail to gain maximum benefits from utilizing its domestic resources, but also that the mineral industry will have a poor prospect for survival. Investment in the industry will tend to decrease because of a lack of assurance that the operators will be granted permission to use the land for mining, after spending large amounts of money for mineral exploration. In some instances high-grade, profitable deposits will remain unexploited if the deposit is within or adjacent to conservation forest lands. Overall, forest activity is more likely to be allowed than a commercial activity of equal value. For example, a large eucalyptus plantation probably would be preferred over a small mine. The entire process tends to lack transparency as long as no precise guidelines for land use permission exist, and this has already led to uncertainty among investors interested in the Thai mineral industry.

Unless the Thai government takes action to resolve the conflict, it can be expected to become more serious during the nation's Seventh Plan as the policy to promote mineral resource exploration and assessment attempts to coexist with the policy to increase forest reserve areas. In all likelihood, mineral resource development will continue to have less priority for land use than forestry.

### LAND-USE PLANNING CONFLICTS

The need for comprehensive land-use planning has been recognized since the First National Economic and Social Development Plan (1962-66) which initiated soil surveying and mapping, land capability classification, the collection of data on economic, social, and environmental analyses as a basis for future land-use planning. Land evaluation, the most

important part of the land-use planning process, began in 1983 in the North and Northeast of Thailand and now has been completed for the entire country (Onchan 1990). The Land Development Department (LDD) is the government agency responsible for land-use planning in Thailand.

The land-use planning process in Thailand involves three major steps:

- i. *Land-use survey.* The study performs a detailed survey on the physical characteristics of the land, including topography, landform (i.e. flat area, mountain or plateau), climatic conditions, precipitation, temperature, natural water bodies, forest conditions). The survey also includes economic and social conditions of local people and the present land uses.
- ii. *Land evaluation.* The land evaluation is composed of (a) an evaluation based on physical characteristics of the land in order to divide it into smaller units according to potential alternative uses; and (b) an evaluation of the economic values possibly obtained from each alternative use of each land unit. Each unit of land will be designated for the uses providing the highest economic values.
- iii. *Land classification.* Based on the results of Step ii, land classification for various activities is determined. Typically, the classification is made on the basis of five major economic activities: agriculture, pasture, forestry, fishery and water bodies, and others (see Table 7).

It can be seen that the primary cause of conflict over land-use in Thailand is due to the failure of the land-use planning process itself which was originally designed to determine the total area suitable for agriculture, with soil surveys and land-use surveys being conducted as a basis for agricultural development planning. In addition, it has emphasized a single, exclusive use, rather than multiple, or mixed uses of land. Critical to the mineral industry is the fact that mining is not recognized as an alternative use of land although in some cases it may offer greater benefits than other activities.

No comprehensive field surveys have been made to identify the mineral resource potential of Thailand and no mineral zones are designated within the land-use classifications. In practice, mining activities normally receive lower priority than forestry and a lack of clearly defined authority over land use between forestry and mining has worsened conflicts.



**Table 7**  
**Classification of the Areas into Different**  
**Economic Zones**

I. Agricultural Zone
– irrigated agricultural areas
– agricultural areas with development potential for irrigation projects
– rain-fed agricultural areas
– farming
– field crops
– field crops or fruit trees
– rubber trees or fruit trees
II. Pasture Zone
III. Forestry Zone
– good-condition forest area
– within national forest reserves
– outside national forest reserves
– reforestation area
– within national forest reserves
– outside national forest reserves
– damaged forest to be redesignated for agricultural areas
– farming
– farm crops
– farm crops or fruit trees
– rubber trees or fruit trees
IV. Fisheries and Water Bodies
V. Others
– industrial
– urban
– tourism
– military

Source: Land Development Department, Thailand.

Though plans for land use exist, they have not yet been put into practice since the LDD which is responsible for preparing the plan does not have the power to implement it. In actuality, any land-use plan is simply a guideline or recommendation, from the government, for the use of the land and with the exception of some prohibited areas, people can propose any category of land use in the plan and then subsequently engage in another activity. At present, there is no mechanism to force people to follow the plan or any penalty for not doing so.

### **MINERALS AND FORESTS: A DELICATE COMPROMISE**

Clearly, massive deforestation is a critical problem in Thailand necessitating a reforestation policy to increase forest land. However, it is also true that

mineral resource development is beneficial as a base for domestic downstream industries. Resolution of conflicts over land use does need not be at either extreme. A balanced and diversified use of forest land is likely to provide higher net yields.

A study by Intarapavich *et al.* (1992) shows that only some minerals are likely to present land-use problems. These include glass sand, where several deposits are located in the areas considered to be local identity and national heritage sites, and lignite, where most deposits are located in areas designated as national parks and wildlife sanctuaries. Claims that some mineral reserves exist in conservation areas are not always accurate. In some cases, reserves only partially overlap conservation forests, meaning portions could be developed. Therefore, land-use conflicts could be deferred by first identifying and developing the reserves outside conservation lands.

The sequential development of mines, prioritized by their location in non-forest, commercial forest, or conservation forest lands, would be the most practical way to mitigate land-use conflict. Mineral deposits outside forests where no restrictions are set, should be given priority with respect to permission for new mining licenses. Mineral deposits in commercial forests, where the land should be put to its best possible use, should be a close but second choice. Conservation forests should be opened only as a final option if it will provide the country with greater economic and social value than the loss of forest that is incurred. However, this practical solution is not possible without the involvement of the government in multiple rather than single land-use planning.

### **THE NEED FOR BETTER LAND-USE PLANNING**

Overall land use planning should be viewed as the best method for optimizing land utilization in Thailand, an imperative for the successful development of both the mineral industry and the Thai economy as a whole. Without rational land-use planning designed to consider all uses and strongly enforced, mining activities will continue to have lower priority than forestry and agriculture as a desired land use.

We propose a series of specific activities, (i.e. a mineral resource assessment, benefit-cost analysis,

designation of economic mining zones and model mining/environment programmes) to effectively develop and implement a rational land use planning procedure in Thailand that includes the mining industry as a priority land use equal with forestry and agriculture.

### Mineral Resource Assessment

Acquiring a rational land classification that takes into account mineral potential and thereby promotes the mining industry requires that (a) responsible mineral development will not be impeded, (b) appropriate land use decisions be based on adequate data, and (c) land use for mining today will be followed-up by activities ensuring that alternative land use for the same area is possible in the future. The development of such a land classification and use system is based on the premise that high mineral potential areas can be (and have been) defined. Internationally (within the United States, Canada, Costa Rica, Bolivia, Brazil), such classifications have been made based on mineral resource assessments specifically designed to identify and quantify the occurrence of economic mineral deposits on land, prior to classification.

When viewed in the context of the present land-use classification problem in Thailand with regard to minerals, the DMR should be empowered to undertake a prioritized resource assessment of Thailand. Based on this initial survey and the definition of the mineral favourable areas, future analyses would focus first on evaluating high priority areas within proposed commercial forests, second on areas adjacent to existing conservation and commercial forests, third on areas of known high mineral potential outside the above two areas and finally on all other areas.

The most environmentally sensitive areas, the conservation forests, are not evaluated in the above programme for two basic reasons:

- i. such areas are already designated to a specific land classification which proscribes use, and
- ii. the importance and need for resources from these areas can only be evaluated once the other areas have been identified and quantified.

### Benefit-Cost Analysis

The economic costs of mineral development, besides those of actual production costs, should be the

focus of considerable analysis before land classification is made. Such an assessment should consist of defining (i) the opportunity costs for the land use, (ii) environmental costs, and (iii) resource user costs.

i. *Opportunity costs.* These arise as a result of the comparison of land for multiple use. Using land for mining activities will preclude the use of that land for other economic activities. For example, a mining operation may disrupt a traditional agricultural activity. The benefits that can be collected from alternative uses will be foregone when this land is utilized for mining. Such foregone benefits, called 'opportunity costs,' are the costs of mining. When a mine is operated in forest areas, the opportunity cost is the loss of forest and biological diversity. The real benefits (social benefits) of mining cannot be evaluated if the opportunity costs are ignored.

ii. *Environmental costs.* These are costs required for protection from and mitigation of all environmental damage resulting from mining activities, including costs for land reclamation for other uses after mining. It must be accepted that environmental costs are real and need to be counted as an integral part of operating costs — the same as production costs — and the miner who damages the forest must be responsible for paying for that damage. Failure to take into account environmental costs tends to result in an economically (as distinct from financially) over production level for minerals. It is the government's duty to implement proper enforcement mechanisms to ensure that environmental costs will not be left as external costs to society, but be internalized into the production costs of miners.

iii. *Resource user costs* must be factored into the assessment process. Mineral resources are non-renewable and their consumption at one time comes at the expense of consumption foregone in later periods. Although user costs are less tangible and more difficult to estimate than opportunity or environmental costs and involve the forecast of future events to determine future price and scarcity, it should not be ignored.

These three types of costs should be fully assessed and compared with the resource's overall benefits and the net benefits among all competing resource uses should then be compared. Where the usage of land for mineral resource development of-

fers the greatest benefit, the land should be allocated for mining. It is therefore imperative that the additional 14% of the natural forests, targeted to become forest reserves during the Seventh Plan, undergo such a benefit and cost evaluation before being finally designated. As stated previously, a prerequisite of such planning for mineral resource development is that extensive mineral resource surveys be conducted to obtain adequate data on the geological structure and possible reserves of mineral-bearing lands in Thailand.

### Designation of Economic Mining Zones

Within Thailand there is still the need to address the problem of multiple authorizations, from multiple agencies, required prior to the initiative of a mining venture. It is imperative that this process be centralized and streamlined to (a) promote development, (b) provide an accountable oversight agency, and (c) to preclude the inclusion of multiple conflicting agendas of individual agencies.

Therefore, after land-use values have been estimated and the extraction of a mineral resource is finally determined by the appropriate government agencies to be the best possible use of the land, it is important that the government set aside the area as a declared economic mining zone. In these zones, mining activities should be given priority. It is proposed that applications for mining activities should be assessed and approved promptly and exclusively by the DMR according to its rules and regulations, instead of having to go through various government agencies for final approval. Designation of an economic mining zone is especially significant for the forest areas and other areas prone to land-use conflict.

Two areas currently holding economic mining zone status in Thailand include the area of 10 km<sup>2</sup> around Had Sompan district in Ranong province, and the area of 6870 km<sup>2</sup> in Loei province and vicinity. Additional areas are in the process of approval as new economic mineral zones, including gemstone reserves in Chantaburi and Trad, limestone reserves for the cement industry in Saraburi and Lopburi, and some reserves in Kanchanaburi and Rajchaburi provinces.

### Model Mining/Environment Programmes

Elements of land-use planning must provide for managing, monitoring, and enforcing an appropriate

land-use plan. To a greater or lesser extent, these activities worldwide are more often and more readily applied to uses other than mining (e.g. forestry, agriculture, industry). This may result from the perception, and unfortunately often the reality, of mining as a primary pollution problem which translates to a highly negative view of mining and ultimately to the low ranking of mining among land-use priorities. Therefore, major progress in resolving the conflict of mining with other land uses (on an environmental basis) would be possible if the Thai government developed and enforced a programme of mineral development with a high level of environmental quality, a 'Pilot Mining and Environment' programme.

In such a programme, industry, in return for a preferred position with respect to land use, would agree to develop the mining venture as a 'model' of the ability of mining to co-exist with responsible development and environmental quality. Key elements of such a programme would be:

- i. adoption of the most efficient technologies in mining and processing activities,
- ii. adoption of the best environmental technologies for implementation throughout mine/project life,
- iii. constant monitoring of air, water and environmental quality,
- iv. ongoing reclamation programs to maintain the lowest environmental impact,
- v. reduction of impact via limiting infrastructure and undertaking many activities in other less environmentally sensitive areas (transport ore for crushing and grinding, concentrating, smelting and refining in other areas), and
- vi. broad-based environmental audits

Central to any such programme is the development of a cooperative relationship which must develop between the industry and the responsible government agencies who will monitor and expedite the environmental aspects of the project.

In proposing such model 'Mining/Environment' programmes, it is assumed that emphasis will be on medium to large-scale projects rather than on small mining operations, which by and large are not suitable for such a programme. An exception to this general rule would be in areas where there is a high concentration of small mining activities which may be amenable to a larger scale of integrated activity.

Overall, the model 'Mining and Environment'

programme would be designed to insure both successful land-use management, a more positive image for industry and, more importantly, to insure that in the future land will be available for additional usage and result in a truly multiple-use land classification and usage system.

## CONCLUSION

Conflict over land use is a major constraint hampering the development of the Thai mineral industry. Regarding the current national situation, it is accepted that the goal of the government during the current Seventh Plan is to increase the country's forest land. For the mineral industry to survive, however, it is necessary that the issues of forest protection and mining pollution be squarely addressed. The Thai government is in the process of establishing a policy to collect a bond from miners as a measure to guarantee environmental protection and land reclamation. In addition to this bond, it is imperative that a na-

tional land-use plan for mineral resources be developed and implemented.

Effective multiple land-use planning will provide several advantages for the Thai economy in general, and for the mineral industry in particular. It will mitigate conflict over land use and prevent unnecessary disruption of mining activities. It will reassure operators with regard to their tenure and use of land and overall encourage investment in the mineral industry thereby allowing for healthy growth. In return, this growth would support the expansion of domestic downstream industries, and ensure maximum benefits for Thailand in the utilization of its own natural resources. Such planning requires the integration of a wide array of factors and organization to fully assess and compare the resource's contributing benefits and incurred costs among competing resource uses. To this end, where mineral resource development is considered to be the best possible use of the land, the designation of economic mining zones is a possible way to settle land-use conflicts.

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# Flood-Hazard Problems and Programmes in Asia's Large River Basins

Jeffrey W. Jacobs and James L. Wescoat, Jr.

## ABSTRACT

This paper compares issues and accomplishments with respect to international flood hazard reduction programmes in five of Asia's major river basins: the Changjiang and Huang Ho of China, the Ganges-Brahmaputra, the Indus, and the Mekong. It describes the current situation for flood problems and the programmes and organizations to address these problems. Despite significant efforts at flood control, floods continue to rank among the more serious environmental management problems in Asia. Asian flood-hazard programmes could be enhanced by information exchanges across these five basins, as well as more thorough examination of the historical record of adjustments to floods. Several international organizations in Asia are well-positioned to co-ordinate such research efforts and distribute results through the region.

**Keywords:** *Asia, comparative analysis, floods, hazards, organizations, river basins, water resources*

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## INTRODUCTION

Floods give rise to some of the more devastating hazards in mainland Asia. The average annual cost of property damage in Asia due to floods has been estimated at more than US\$3 billion (ESCAP 1989). A significant proportion of the estimated 2.5 billion people living in mainland Asia face a variety of flood hazards. They occupy flood-prone lands along rivers and coastal areas in some of the world's more densely concentrated agricultural and urban settlements. In these flood-prone regions, population growth rates tend to be relatively high and standards of living low. At the same time, there have been many creative experiments to reduce flood damages in Asia. From the ancient river control works of China to the massive Flood Action Plan in Bangla-

desh, Asia has been a region of focused concern in flood hazard research and damage reduction.

In addition to surveying current problems and programmes, this report identifies two major inadequacies. First, flood-hazard experiences in one area are not widely disseminated to, or sought out by, flood specialists in other areas. If this lack of use of the experience gained in other river basins within the region is as widespread as it appears, this may indicate the difficulty of making practical comparisons and use of information from other areas, as well as obstacles to information dissemination.

Second, the professional water resources literature on Asia gives relatively little attention to flood hazards compared with other water issues. For example, a bibliography of *Water Resources Management in Asia* published by the East-West

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Center in Hawaii includes only some 20 references to floods out of a total of 456 (Cruz *et al.* 1984; and supplement 1986). This neglect may indicate that flood hazards have not received the same level of attention from research scientists as they have from governmental and nongovernmental organizations. Alternatively, it may be symptomatic of a broader failure to examine the importance of flood hazards assessment in water sector planning in Asia.

This paper surveys the current situation of flood-hazard problems and programmes in Asia with the aim of sharing experience among the areas. A longer term aim is to develop a more rigorous basis for making long-term international comparisons of flood problems, programmes, and successes in the region.

Five basins are studied: (1) the Ganges-Brahmaputra; (2) the Indus; (3) the Mekong; (4) the Changjiang (Yangtze River) of China; and (5) the Huang Ho (Yellow River) of China. Each basin offers experience and approaches that are potentially relevant in the other basins. Several types of comparison were sought. Principally, we wanted to know if there were similarities among flood problems and approaches in Asia's large or highly regulated river systems. In addressing these issues, we compared social and economic data which affect the ability of people and institutions to address flood hazard problems. We also examined trends in flood damage, to help determine whether the regions were becoming more or less vulnerable to flood hazards. A key goal of future research is to identify general principles which can be drawn from Asian flood problems and programmes, as well as how differences among the basins and flood management efforts lead to differences in vulnerability and protection.

## AIMS

This report surveys the current situation with respect to Asian flood issues including recent experience with major flood events in the five basins and international programmes developed to deal with those events. This study only examines the ESCAP countries of mainland Asia. Flood hazard problems of Asia's island countries and its industrialised and newly-industrialized economies are substantially different from those of mainland Asia and are not included here. However, some bilateral programmes involving ESCAP and industrialized countries and lending organizations (e.g. the Asian

Development Bank) are included. For the purposes of this paper the 'current situation' is defined as the period from 1980 to 1994.

There is a staggering range of different physical causes, processes, impacts, and adjustments to floods in mainland Asia. The principal focus of this study is upon the administration of flood hazard programmes. We designed a typology of Asian floods, emphasizing river basin problems and programmes, followed by international programmes. This typology is as follows:

- A. River Basin Problems and Programmes
  1. The Ganges-Brahmaputra River Basin
  2. The Indus River Basin
  3. The Lower Mekong River Basin
  4. The Changjiang Basin
  5. The Huang Ho Basin
- B. International Flood Programmes
  1. United Nations
  2. International Lending Organizations
  3. Regional Intergovernmental Organizations
  4. International Non-Governmental Organizations

## ASIA'S PRINCIPAL FLOOD HAZARD PROBLEMS AND PROGRAMMES

### A Regional Overview

It is useful to begin this survey with comparative information about Asian rivers, including area, population and growth rates, riparian countries, and income levels. Table 1 indicates the riparian countries for the five major basins considered here. The number of countries and historical relations among them has influenced the types of international programmes that have developed in the basins, as well as the types of co-operation that presently exist.

Whereas the Mekong has six riparian states, the Changjiang and Huang Ho lie entirely within China. Some boundaries and territories are disputed, as in Kashmir and Tibet, which affects the efficacy of flood hazard warning and mitigation programmes.

Table 1 also provides basic information about the sizes of the rivers, including their ranks among Asian and world rivers. The Changjiang and Huang Ho are the longest rivers listed here, both over 5400 km in length. However, the Huang Ho has the smallest drainage area, while the Changjiang is three times as large. An even greater disparity exists between the

**Table 1**  
**Major Asian Rivers: Riparian Countries and Hydrologic Characteristics**

RIVER BASIN	RIPARIAN COUNTRIES	LENGTH (miles) (world ranking, Asian ranking)	DRAINAGE AREA (sq. mi.)	DISCHARGE (1000 x cfs) (world, Asian)
Changjiang	China	3716 (4) (1)	750 000	770 (3) (1)
Ganges-Brahmaputra	Bangladesh, Bhutan, China, India, Nepal	Ganges: 1557 (48) (21) Brahmaputra: 1800 (31) (14)	Ganges: 409 000 Brahmaputra: 361 000	Ganges: 660 (5) (3) Brahmaputra 700 (4) (2)
Huang Ho	China	3011 (7) (4)	260 000	116 (31) (14)
Indus	Afghanistan, China, India, Pakistan	1800 (31) (14)	358 000	196 (23) (10)
Mekong	Burma, Cambodia, China, Laos, Thailand, Vietnam	2500 (16) (10)	310 000	390 (14) (8)

Source: van der Leeden (1975).

*Water Resources of the World: Selected Statistics*. Port Washington, NY: Information Center, Inc.

**Table 2**  
**Major Asian Rivers: Social and Demographic Characteristics**

River Basin Country	Population (x 1000)	Population Growth Rate (1985-90)	Per Capita Income (1994 US\$)	ODA as % of GDP
Changjiang China	1135	1.4%	\$294	1%
Ganges-Brahmaputra				
Bangladesh	115.6	2.7%	\$220	15%
Bhutan	1.5	2.2%	\$180	31%
China	1135	1.4%	\$380	1%
India	853.4	2.1%	\$310	2%
Nepal	19.1	2.5%	\$170	20%
Huang Ho China	1135	1.4%	\$380	1%
Indus				
Afghanistan	16.6	2.6%	\$220	2%
China	1135	1.4%	\$380	1%
India	853.4	2.1%	\$310	2%
Pakistan	122.7	3.5%	\$410	8%
Mekong				
Burma	41.7	2.1%	\$210	9%
Cambodia	8.2	2.5%	\$200	2%
China	1135	1.4%	\$380	1%
Laos	4.4	2.5%	\$250	16%
Thailand	55.7	1.5%	\$1840	9%
Vietnam	67.2	2.2%	\$200	2%

Source: van der Leeden (1975).

average annual discharges of these rivers — differences which translate into different types of flow, floodplain morphology, and flood hazards.

Table 2 provides social and demographic information about countries which lie within the river basins. These data are unfortunately at the aggregate country level and not for the basins alone. They are thus more indicative of country situations which affect national policies toward river development and flood hazards, and not the social situation in the basins themselves. China has the largest population but the lowest population growth rate. All countries except Thailand have a low gross domestic product (GDP). These figures do not reflect the actual population at risk, but may be taken as a surrogate for social pressure on flood-prone lands. The percent of GDP which is overseas development assistance indicates dependence upon other countries, which ranges from 1% to 31%. Reliance on aid may be a source of vulnerability or buffering, depending upon how outside countries respond after disaster. Thus, these economic indicators can be taken as a rough

indicator of both the pressure to intensify floodplain use, and the resources available for adjustment to flooding.

Table 3 lists major flood events and associated damages in five countries. In light of the inexactness of damage estimates these estimates do not involve a quantitative analysis of factors affecting flood damages. However, they do involve qualitative comparisons which consider both social and physical factors.

In recent decades, the greatest and most frequent losses of life have occurred in the Bengal delta. A half century ago, comparable losses of life occurred in the Changjiang and Huang Ho valleys. It is important to account for both the increased deaths in Bangladesh and the decreases in China. At the same time, as much as 10% of the Chinese population is affected by catastrophic flooding. Economic losses associated with flooding are substantial, raising questions about continued economic investment in the floodplain. The low number of deaths in the Mekong also deserves close attention. Aside from

**Table 3**  
**Major Asian Flood Events**

<i>Country</i>	<i>Year</i>	<i>Deaths</i>	<i>Damage (K\$)</i>	<i>People Affected</i>	<i>Comments</i>
Bangladesh	1970	300 000	86 400	3 648 000	Tropical cyclone. One of history's larger natural disasters
Bangladesh	1987	2055	330 000	29 700 000	Flooding in most rivers of the country
Bangladesh	1988	2379	2 137 000	45 000 000	Worst flood in a century
China	1931	3 700 000	n.a.	1 400 000	Changjiang
China	1939	500 000	n.a.	n.a.	Dam failure on Huang Ho
China	1989	2000	2 789 000	100 000 000	Rains and typhoons in eastern China
China	1991	1040	5 800 000	134 000 000	Worst flooding in a century
Laos	1966	300	15 300	70 000	Mekong floods
Pakistan	1977	848	n.a.	777 000	Monsoon floods
Pakistan	1978	393	n.a.	2 236 000	Monsoon floods
Vietnam	1978	0	n.a.	4 000 000	Mekong Delta

Source: OFDA, 1991.



the delta, Vientiane, and the Cambodian lakes, the Mekong floodplain has low population densities relative to the rest of Asia. In addition it has a sophisticated flood forecasting and warning system.

### Flood Damages and Mitigation Programmes

This section describes the variety of flood problems in the different river basins, highlighting recent flood losses and mitigation programs. It also illuminates the marked differences between these areas which complicate comparative analysis.

#### *The Ganges-Brahmaputra Basin*

This basin covers parts of five countries within and to the south of the Himalayan mountain complex: Bangladesh, Bhutan, China, India, and Nepal. For international water management purposes, the principal 'basin countries' are Bangladesh, India, and Nepal.

The focus of the basin's flood problems are in the Bengal Plain of Bangladesh and India. There the Ganges, Brahmaputra, and Meghna Rivers meet to form a river two and one-half times the size of the Mississippi River in North America. Though the total area of the Ganges-Brahmaputra watershed is slightly less than one-half the area of the Mississippi Basin, it receives four times the Mississippi's annual rainfall. Approximately 85% of that rainfall falls during the monsoon season (Rogers *et al.* 1989). A feeling for the immensity and power of this river system can be gained by description of its dynamics.

In a recent 'normal' small shift of a lower section of the Ganges-Brahmaputra, the river moved its course east in a matter of days by about one kilometre in front of the port city of Chandpur in Bangladesh. It cut a new east bank channel about 45 meters deep, adding that land to its sediment load and carrying it out to the sea. No embankments or river-training works in the world can control these forces if they are taken head on (Rogers *et al.* 1989).

The Bengal Delta, with its high population density, low-lying position, intense rainfall, coastal storm surges, and huge river discharges, may be the most flood-prone and flood-vulnerable region in the world. One of the more severe natural disasters in recorded history occurred in 1970 when a combination of coastal storm surge and river flooding claimed an estimated 300 000 lives (OFDA 1991). In September 1987, some 25 million people in Bangladesh

were affected by a catastrophic cyclone and rainfall event. Thousands lost their lives in that disaster, in addition to the inundation of 46 620 km<sup>2</sup> of land, 2 million ha of damaged crops, and damage to some 5 million homes (OFDA 1991). The next year, 1988, a comparably destructive cyclone hit the Bengal delta. In April 1991, yet another cyclone struck coastal Bangladesh, tragically reconfirming its vulnerability to an array of water related disasters.

The successive floods of 1987–88 sparked a major set of studies and investment programmes. The 1987–88 floods in Bangladesh led to several major international investigations, and to more flood hazard reduction programmes than the catastrophic floods of 1970. Reports on Bangladesh's flood problems and policy options were separately conducted by UNDP (1989), the US Agency for International Development (Rogers *et al.* 1989), the French government (Michael *et al.* 1991), and the Japanese government. These studies led to a massive international water development and flood hazard reduction programme known as the Bangladesh Flood Action Plan (FAP). The FAP was organised by the World Bank, UNDP, and a consortium of donors for the period 1990–95 (Nicholas 1990).

As of 1992, the FAP had 26 parts including 11 'components' and 15 'supporting activities.' As might be expected, this scope of work, along with the scope of all previous reports, includes a broad range of flood preparedness and response alternatives. On paper, the range of choice is unprecedented in international flood planning programmes. However, full implementation will require several decades. As both a planning and investment programme FAP represents the world's most ambitious flood hazard programme to date. Further upstream in the Ganges-Brahmaputra basin there are perennial flash-flood problems in mountain catchments of Nepal and the Himalayan foothills of India. At one point, it was presumed that upstream deforestation in Nepal and the terai region of India aggravated flood hazards in the Bengal delta. There is little question that deforestation worsens local flooding, erosion, sedimentation, and land degradation problems in the lower portions, mountain catchments and their foothills. However, Ives (1991) and others (e.g. Kattelmann 1990) have argued that mountain-originating flood impacts attenuate rapidly downstream and do *not* constitute the major coastal flood hazards in Bangladesh.

To summarize, recent catastrophic flooding in the Ganges-Brahmaputra basin in the late 1980s led

to international flood investigation and hazard mitigation programmes of an unprecedented scale. The potential lessons for regions other than Bangladesh — in terms of the types of materials available, the process of investigation and debate, and the problems of access to information and participation — deserve close consideration.

### *The Indus River Basin*

The Indus Basin is one of the world's most highly developed and regulated river system, with a history of massive inundation canals dating back four millennia. The present system of perennial canal irrigation was initiated in the fourteenth century and greatly extended during British colonization of the region in the late nineteenth and early twentieth century. Expansion of irrigated area continues, offset however by salinity, waterlogging, and flood losses.

Flood hazards in the Indus Basin differ in many ways from those in the Ganges-Brahmaputra, though they have a common upstream riparian (India). Damaging floods occur less frequently and with fewer deaths on the Indus, but the losses can nevertheless be substantial (Bhalme and Mooley 1980). The most recent floods of September 1992, for example, were the worst floods in living memory in Pakistan. Flood flows resulted from torrential rains in the upper reaches of the Jhelum River in Kashmir, Azad Kashmir, and Punjab; discharging into the Indus main stem and threatening the major earthen barrages on that river. Although Mangla Dam is the second largest dam in the Indus system, with a storage capacity of 4.5 million acre feet (MAF), it was little match, volumetrically or operationally, for the monsoon runoff. Reservoir operations and operating policy became the subject of several inquiries in the wake of the following events:

On 8 September the water flow into the Mangla reservoir exceeded by a third what the dam could cope with. Its managers released a blast of water from the reservoir. A second wave hit Mangla the next day, forcing engineers to release three times as much as they had the previous day. Within hours, the river surged over its banks and engulfed the city of Jhelum, which lies at the foot of the dam. (The Economist 1992).

Total damages were estimated at US\$1 billion, including US\$513 million in public infrastructure damages (UNDRO 1992a). This tragic event portrays the vulnerability of people in the Indus basin to flood hazards. Dissemination of flood warnings

in Pakistan has historically been a weak link in the response system. Improving the warning system is a high priority, and is the focus of a study underway by the Delft Hydraulics Institute. But it is also a relatively small component of a more comprehensive and expensive scheme to build structural flood protection levees throughout the Indus main system (Chaudhri 1981).

The upper Indus Basin, like the upper Ganges, has flood hazards distinct from those on the plains. Ice dam outburst flooding and landslides are relatively frequent on the Indus main stem and its upper tributaries. Hewitt (1982, 1985, 1989) has identified 29 major outburst floods that have occurred over the past 200 years, the most damaging of which was in 1929. A five-year study completed in 1989 on snow and ice hydrology in the Upper Indus Basin began to assess these hazards in five glaciated sub-basins, and a follow-up study is underway. Constraints on adjustment to upper basin flooding include: a weak foundation of basic glaciological research in the Upper Basin, limited topographic maps, inaccessibility (both physical and political), large uncertainties in predicting glacial flood releases, and limited glacial data monitoring and forecasting.

The alternatives for flood damage reduction change as one proceeds downstream. As river velocity decreases, so do slope and drainage. Current government flood management policies concentrate on levee protection schemes.

### *The Lower Mekong River Basin*

The Lower Mekong River basin represents the most comprehensive effort to-date in international integrated river basin planning. Responsibility for planning and development of water resources in the Lower Basin is vested in the Mekong Committee. Formed in 1957, the Mekong Committee has made several important contributions in addressing the region's flood problems. The Committee consists of the four lower riparian states: Cambodia, Laos, Thailand, and Vietnam. The upper basin riparians — Burma and China — are not involved in the international planning effort.

The Mekong has its own distinctive set of flood problems on the river's mainstream, ranging from occasional urban flood damages in the Laotian capital of Vientiane, to severe erosion and channel changes, to crop damage further downstream in the lower reaches of Cambodia and the delta in Viet-

nam. Though Mekong floods are of lower magnitude than those in the other case study areas, flood damage mitigation is a vital component of the Mekong Committee's integrated water resource use and management programme. In addition, some areas of the basin suffer from such extreme poverty that any losses may be catastrophic compared with the resources available to address them.

The low level of water development is another outstanding feature in the Lower Mekong. No dams yet cross the Lower Mekong (though one has been constructed on the Upper Mekong in Yunnan Province, China, with several more proposed for the Upper Mekong) and only 1% of the hydropower potential of the Lower Mekong and its tributaries has been tapped (Mekong Secretariat 1992).

The primary flood problems of the Lower Mekong occur in three areas: (1) the Vientiane-Nong Khai flood plain, (2) the area surrounding Cambodia's Great Lake, and (3) the Mekong Delta of Vietnam. The 1966 flood, still the largest recorded Mekong flood in Laos, killed 300 people in Vientiane and affected 70 000 others (OFDA 1991). In 1991 Laos again suffered flooding which affected some 332 000 people and caused extensive agricultural damage.

Floods in the Lower Mekong Basin would result in more deaths and damages if not for the efforts of the Mekong Committee. The Committee has not been able to build large mainstream flood control structures which might encourage floodplain settlement, but it has operated a flood forecasting and warning system since 1970. That system is credited with saving lives and warning farmers of impending flood hazards (Thammongkol 1986). Sharing of hydrologic and meteorologic data is important in this flood-prone international river, and has been much more successful in the Mekong than in other parts of Asia. Thus, lessons gained from the Mekong experience may be valuable for promoting similar programmes in other international basins, such as the Indus and Ganges.

The Committee's flood damage mitigation programmes have concentrated on smaller-scale projects and operational hydrology which do not require large structures or capital investment. This has by no means been detrimental to flood hazard mitigation; on the contrary, certain types of flood hazards require a small-scale approach, and all flood hazards programmes benefit from advanced operational hydrologic and meteorological capability (Jacobs 1992).

## The Changjiang and Huang Ho Rivers of China

China, with its rich history of riverine civilization, has the region's longest record of flood problems and programmes. The magnitude of flood damages in China's past rivals contemporary problems in Bangladesh. As recently as 1931, some 3 700 000 people were killed as a result of Changjiang flooding (OFDA 1991). Many of these deaths have been attributed to famine and water-borne disease following the floods. In addition, more than 8.5 million acres were inundated. In 1939, an estimated 500 000 people were killed in a dam failure disaster on the Huang Ho (OFDA 1991). It is a source of pride that China has not suffered flood damages of that magnitude since the revolution. However, China has a long history of combined structural and non-structural flood abatement approaches which predates the revolution and which deserves close attention from other countries.

The Changjiang and Huang Ho are notable for their size, their centralised control by governments for centuries, and their distinctive flood regimes. Construction of flood control dikes on the Huang Ho dates back to the third millennium BC (Zhang 1983). The combination of large discharge, gentle slopes, heavy sediment loads, high population densities in the floodplains, and strong economic dependence upon these rivers has resulted in some of the larger flood disasters — and flood disaster reduction programmes — in the world (ESCAP 1991b and OFDA 1991).

### *Changjiang River*

The Changjiang experienced its most recent flood damages in 1991. Heavy rainfall in eastern China caused extensive flooding in the agricultural provinces of Anhui, Jiangsu, and Henan (as well as neighboring provinces). An estimated 2470 people died and 18.4 million were seriously affected. The total population of the affected area is 320 million persons. The Chinese government mobilized a massive response:

The Chinese army, the Chinese Red Cross, and other local relief organizations were mobilised to combat floods, build dikes, drain flood waters, and deliver relief assistance. The People's Liberation Army and the China Armed Police deployed 360 000 troops, who worked with local citizens to provide relief. An additional 58 medical teams were dispatched to

Anhui for relief and disease control, and over 80 000 medical workers were sent to fight the spread of water-borne diseases in the most affected areas (OFDA 1991).

Eighteen governments and seven intergovernmental organizations provided relief. Red Cross societies in China and 11 other countries were particularly active in responding to this disaster, though it is noteworthy that, in contrast with the role of international NGOs in Bangladesh, most international NGO assistance was turned over for distribution and management to Chinese organizations.

The controversial Three Gorges Project has drawn renewed international attention with reports that project will be implemented after decades of controversy, though it is not clear whether the project will receive international financial assistance (LaBounty 1984; Boxer 1988). Planned for construction in central China on the Changjiang, Three Gorges would be the world's largest dam if it is built. The dam would create a 500-km long reservoir, and have 13 000 to 20 000 MW of installed electrical generation capacity, depending on the dam's eventual height. The dam's other primary purpose would be flood control. In addition to the Three Gorges dam, a downstream structure, the Gezhouba project, has already been constructed. It was the first dam built on the mainstream of the Changjiang (LaBounty 1984). Gezhouba will be used to create an after-bay below Three Gorges, to improve navigation conditions as well as to generate additional hydropower.

Several negative impacts would accompany Three Gorges. Probably the most significant of these would be the resettlement of more than 1.5 million people (Dixon *et al.* 1989). Other possible negative impacts would be: high costs (some estimates suggest the total would exceed US\$20 billion); sedimentation of the reservoir; aesthetic concerns (Three Gorges would flood an area of great scenic beauty); negative health effects (malaria is the most significant endemic disease in the Three Gorges area; schistosomiasis is not a problem in the area); and a threat to several endangered aquatic animals (including endemic dolphins and alligators) in the Changjiang.

Three Gorges Project has been planned for construction for over seven decades; it was first proposed by Dr Sun Yat-Sen in the 1920s (Barber and Ryder 1993). This proposal represented a departure from traditional methods of water control in

China, to one involving greater reliance on modern engineering structures. Construction of the mammoth project has been postponed for several reasons, including war, ideological struggles, and economic problems. The project has gained additional currency with the economic liberalization of China under Deng Xiaoping, in spite of increasing environmental problems in the country, and has been approved by the Chinese government. However, Three Gorges is not yet a *fait accompli*, and is certain to generate additional controversy, whether constructed or not.

### Huang Ho

Dikes constructed along the middle and lower Huang Ho have raised the riverbed elevation and lessened its slope (Yellow River Conservancy Commission, n.d.). In addition, the sediment content of the Yellow River is greater than that in all other major rivers of the world (Xie 1989). During the past 137 years (since the last major shift of the river) the river's bed has been aggrading rapidly because of silt deposition. These factors greatly increase the risk of catastrophic flooding in alluvial rivers.

However, there have not been catastrophic floods on the Huang Ho in the past half century. According to the Yellow River Conservancy Commission, levees were deteriorating in the early twentieth century (they were also purposefully breached during the struggles for power in the 1930s).

In a period of 2540 years from 602 B.C. to 1938, there were 543 floods recorded and 26 river course changes with the major five changes occurring in years of 602 B.C., 11, 1048, 1128, and 1855, causing great disasters. (YRCC 1991)

Snow and ice melt coupled with extreme rainfall events tend to trigger flooding on the Yellow River, but vulnerability has also been a function of the maintenance of the levee system, government capacity, and population growth in the north China plain.

Following the stabilization of power under the People's Republic of China, sustained flood control works have been undertaken and the massive levee system greatly improved. However, as the dikes along on the riverbanks were raised, the riverbed in the lower reaches is some 3–5 metres higher than adjacent land behind the dikes (Zhang and Xie 1989). Large numbers of people are dependent on the river for irrigation, and many bridges, railways and other river crossing works continue to be constructed. Though Zhang and Xie (1989) conclude that 'the

present channel can be safely maintained for another 100 years', addressing this precarious situation will be a huge challenge.

Greer (1979) describes in some detail the reliance upon traditional contracting and construction techniques for bank strengthening and enlargement — techniques which require enormous amounts of labour and governmental co-ordination. Naturally, modern earth moving and engineering methods have also been integrated with these traditional labour practices in recent decades. According to Greer (1979) flood control has been the most successful component of the Yellow River water management programme. It should therefore be examined closely for aspects which might work in other regions of Asia.

### **INTERNATIONAL FLOOD PROGRAMMES IN ASIA**

International programmes include those within the agencies of the United Nations and those of financial banks, intergovernmental, non-governmental, and private voluntary organizations. They involve both bilateral assistance programmes, and a limited amount of involvement from international military organizations.

#### **United Nations**

The United Nations has numerous programmes which bear directly or indirectly upon flood hazard reduction in Asia. At the most general level, the UN Department of Economic and Social Affairs (UNESCO) and the UN Department for Technical Cooperation and Development (UNDTCD) have published international reports and proceedings on flood loss prevention and management (e.g. UNESCO 1976).

The key UN organizations and initiatives in Asian flood problems include UN sponsored meetings, UN regional commissions (e.g. ESCAP), World Meteorological Organization (WMO), International Hydrological Programme (IHP), The UN Disaster Relief Organization (UNDRO) and the UN Children's Emergency Fund (UNICEF).

#### ***Recent UN-Sponsored Meetings***

In 1992 an International Conference on Water and Environment was held in Dublin in preparation for

the UN Conference on Environment and Development (UNCED) at Rio. Aside from China, surprisingly little emphasis was placed on flood hazards in national water resources position papers. This neglect should raise concern, because the environmental value and damages associated with floods are major factors in ecological and social well-being.

The UNCED conference dealt with a broad range of issues, including biodiversity, climate change, and forest protection. The principal document from UNCED, known as AGENDA 21, only briefly referred to floods.

The most important UN initiative is the International Decade for Natural Disaster Reduction (IDNDR). It is unfortunate that a stronger association was not made between the IDNDR and UNCED. Nevertheless, the IDNDR has organized regional symposia and programmes related to meteorological and hydrologic hazards in Asia.

#### ***UN Regional Commissions — ESCAP***

More substantial flood control efforts have been underway in the regional commissions of the UN, especially the ESCAP. In fact, international scientific flood hazard assessments began on a sustained basis in Asia under the auspices of ESCAP and its predecessor agency ECAFE (Economic Commission for Asia and the Far East). Beginning in 1951, ECAFE published a Flood Control series, which continued up to 1963, when it was renamed the Water Resources series, reflecting its joint concern for water resource development and flood mitigation. As early as 1955, the Flood Control series was broadening its scope to encompass wider aspects of water resource planning.

Perhaps ESCAP's most important regional programme is the Typhoon Committee, organized in 1965. The Typhoon Committee (1984) has published systematic guidelines for the collection of damage information, as well as a regular forum and resources for forecasting and research. In 1991, ESCAP and the Typhoon Committee published a volume focussed on *Urban Flood Loss Prevention and Mitigation*, funded by the Government of Japan. Mainland Asian case studies included the cities of Kuala Lumpur, Bangkok, Hong Kong, Vientiane, Hanoi and Benxi. More recently, ESCAP (1991c) has issued a *Manual and Guidelines for Comprehensive Floodloss Prevention and Management* based on expert group

meetings from 1987 to 1990. In neither of these reports is much attention given to differences in approach followed in different regions.

#### ***World Meteorological Organization — WMO***

The most sustained flood-related programme is the Tropical Cyclone Programme (TOP) run by WHO's World Weather Watch (WOW) and ESCAP (WMO 1988). The TCP includes a technology transfer component and a regional component to develop forecasting and operational centres and to promote regional co-operation.

#### ***International Hydrological Programme — IHP***

The International Hydrological Programme has a regional office for South and Central Asia in New Delhi and for Southeast Asia in Jakarta (IHP 1992). The IHP launched a Humid Tropics Programme in 1992 with regional administrative centres. Its regional programmes for South and Central Asia will include a workshop on coastal zone management with special emphasis on the Bangladesh experience.

#### ***The UN Disaster Relief Organization — UNDR0***

The UNDR0 was created in December 1971. Over the past 20 years, UNDR0 has assisted flood-afflicted regions by sending relief assessment teams, co-ordinating international response, preparing 'situation reports' on a regular basis, and tallying country contributions for relief. The organization publishes *UNDR0 News* on a bimonthly basis which sometimes includes reports of regional flood and typhoon cyclone conferences in Asia.

UNDR0 also operates electronic information systems through the United Nations International Emergency Network (ANOINT), which include news services titled APPEALS, DMTP, and ICDO.

#### ***UN Children's Emergency Fund — UNICEF***

UNICEF has the largest public health programme related to disaster mitigation, but it has with a few important exceptions focussed on preventative medicine and human disasters (e.g. civil strife, war refugee populations). One of the most important exceptions, however, is the provision of medicines, vaccines, and diarrheal control programmes in Bangladesh, where flooding has generated outbreaks of water-borne disease.

## **International Lending Organizations**

### ***The World Bank***

The World Bank Environment Department has a natural hazards co-ordinator. Regional, sectoral, and mission offices of the Bank also address natural hazards problems on an *ad hoc* basis, but effectively, there is only one Bank officer for all hazards in all member countries. According to that person, response to flood disasters does not follow a set procedure or method, but is instead contingent upon country requests. The Bank, for example, loaned some US\$40 million to the Government of Pakistan for infrastructure repairs in Punjab after the 1988 floods (World Bank 1989). Flood loan data were not readily available, however, from the World Bank.

### ***The Asian Development Bank (ADB)***

The ADB provides a larger number of loans and grants to flood-affected countries. The grant amounts have not been large. They total US\$5.5 million (< 2% of loans), two thirds of which was given to the Philippines in 1988 (ADB 1992). Loans range in size from US\$5–115 million. The largest loans have gone to Pakistan and Bangladesh. It may be noted that ADB loans for reconstruction over the past two decades total US\$291.1 million. Economic damages in the 1992 flood in Pakistan alone were estimated at US\$1 billion.

In 1991 the ADB published a useful volume on *Disaster Mitigation in Asia and the Pacific*. The ADB also published a more general volume titled *Disaster Management: A Disaster Manager's Handbook* indicating its expanding interest in the field (Carter 1991). This represents an important step toward formalizing the role of international lending organizations in disaster mitigation, replacing what had previously been an *ad hoc* approach.

## **Regional Intergovernmental Organizations**

### ***South Asian Association for Regional Cooperation (SAARC)***

SAARC was established in 1983 with members from Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Though aimed at regional co-operation it serves as a forum for regular communication. According to Dasgupta (1992), natural

disaster reduction is an officially recognised field for co-operation among the SAARC countries. More broadly, SAARC is attempting to integrate natural hazards reduction within a broader array of issues including sea level rise, global warming, and environmental protection.

#### *Association of Southeast Asian Nations (ASEAN)*

The principal intergovernmental organization for Southeast Asia, ASEAN, was established in 1967. Its membership includes Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Although its principal functions are political and economic, ASEAN has a longer history and greater stability than SAARC, and it has officially encouraged regional climate and hydrological hazard reduction programmes.

#### **International Non-Governmental Organizations**

##### *International Red Cross/Red Crescent*

Non-governmental organizations have played a variety of important roles in responding to Asian flood damages. Historically, the most active organizations have been the International Red Cross, based in Geneva, and Red Crescent, which has been active in flood relief in Asia for almost a century. Kaur (1992) briefly reviews the activities of the Red Cross in India (Indian Red Cross). The Red Crescent is active in Asian countries with large Muslim populations including Afghanistan, Pakistan, Bangladesh, India, Indonesia, and Malaysia.

##### *Asian Disaster Preparedness Center*

To the knowledge of the authors, there is only one major international research organization focussing on hazards in the Asia region. The Asian Disaster Preparedness Center at the Asian Institute of Technology (AIT), Bangkok, Thailand, serves as a center for information dissemination as well as for research (ADPC 1992).

Scanlon (1990) describes the ADPC as the 'one place with Asia-wide acceptance' and the only regional disaster training center in the world. The ADPC runs advanced training courses for disaster managers. It also maintains a disaster library and an association with academic departments at the AIT.

#### **Other Private Voluntary Organizations**

UNDRO disaster situation reports indicate that many international PVOs are involved in flood relief. Those most often listed include Caritas and Care, which provide both contributions and relief workers. Religious organizations involved in relief include the American Friends Service Committee and Lutheran World Service.

#### **Military Organizations**

Military organizations play an important role in disaster assistance in all of the countries discussed in this report. The US military has in recent years provided transport, relief supplies, and emergency infrastructure for flood mitigation in Asia. In 1991, for example, the US Marine Corps fortuitously became involved in distributing flood relief supplies to coastal Bangladesh when returning from the Persian Gulf war. On a more sustained basis, the US Air Force and US Navy operate a Joint Typhoon Warning Center (JTWC) in Guam to provide typhoon information in the North Pacific (ESCAP 1989). Given the recent expansion of the US military into more humanitarian-type missions, they may eventually play a more prominent role in Asian flood disaster response.

#### **FINDINGS AND RECOMMENDATIONS**

Despite massive efforts to alleviate flood damages in Asia, floods continue to result in a large number of deaths and economic losses in the region. Some countries, such as Bangladesh, have escalating losses, while others, such as China, have had some successes. In light of the populations and risks involved, along with the rich record of experiments in flood damage reduction in Asia, flood problems and trends need to be more closely analysed and compared.

In comparing flood hazards across the countries and basins, consistent 'flood-hazard profiles' are needed. Useful international data sets do exist, though they have problems that have been widely discussed. More detailed databases on both flood hazards and flood-hazard information and expertise might reduce some of those problems. A format for compiling and comparing data on flood hazards, as offered in this report, could be used to structure information about flood events, responses, vulnerability, policy, and priorities.

Although the organizations and scientific literature are substantial, there are reasons to doubt that they are being effectively utilised or that experience is shared among regions and organizations. The Mekong Committee, and more recently the FAP organizations in Bangladesh, appear to have made the most effort to obtain information and expertise from other areas. There is less evidence that such information is sought or sent from the Indus basin or Chinese river basins. Language barriers to research on floods in the Chinese basins are significant. Translation of Chinese publications and research on Chinese flood-hazard programmes should be high priorities. There is almost no explicit evidence about whether and how the information obtained from one region is used in any other.

In light of the heavy involvement of multi-lateral and bilateral organizations, comparative research will also have to emphasize the flow of ideas and information from and through persons and agencies outside Asia. Persons and agencies working on flood hazards in Asia need to become more familiar with the longer record of flood-hazard adjustments in Asia. The historical record of adjustments to flood hazards may contain information on past successful adjustments which have not been incorporated into contemporary planning and policy formulation. Those adjustments, especially as practised by indigenous social groups, have received little attention in the scientific literature and almost no attention in the engineering, planning, and policy literatures.

Research on the cultural and political dimensions of flood hazards and flood-hazard reduction remains a difficult challenge. However, the FAP in Bangladesh will yield an unprecedented record of debate and inquiry which deserves close consideration for the broader insights that might be drawn.

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Among the many reasons that the FAP has generated this record of debate is the fact that numerous scientific and public organizations are involved, or demanding to be involved. Their arguments and perspectives are being recorded and internationally disseminated to influence decisions, but the record of their efforts will have longer-term value for flood hazards research internationally. The FAP also provides an outstanding example of where an Asian flood-hazard mitigation programme could greatly benefit from the types of cross-basin analyses and perspectives offered in this report.

The institutional and research framework through which Asian flood management could be enhanced currently exists. Regional organizations such as the ADPC, the ADB, and ESCAP, as well as international organizations such as the WMO and the IHP, stand well-prepared to co-ordinate studies and disseminate the results to the Asian and international communities. We believe that Asian flood management efforts, as well as the entire flood-hazard research community, would greatly benefit from the cross-basin analyses and historical assessments recommended here.

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# Sewage Treatment in Metropolitan Melbourne: Conservation and Waste Management Lessons for Urban Areas in the Asia-Pacific Region

Patrick C.C. Lai and Paul K.S. Lam

## ABSTRACT

This paper examines a specific wastewater treatment facility in Melbourne, Australia and explores the applicability of these techniques to other places in the Asia-Pacific Region. Three treatment methods, namely lagoon treatment, land filtration, and grass filtration are described. The extensive wetland systems created as a result of the treatment processes provide important habitats for wildlife, resulting in the declaration of the area as a 'Wetland of International Importance'. Economic benefits derived from livestock grazing, crop cultivation and methane production are also important components of this sustainable development. This paper hopes to demonstrate how waste management may be combined with environmental conservation, and explores the possibility of applying these techniques in Asian countries with similar space and climatic conditions.

**Keywords:** *Werribee, lagoon treatment, land filtration, grass filtration, sustainable development, wildlife conservation*

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## INTRODUCTION

Proper disposal of domestic sewage is one of the major challenges facing environmental managers in large urban centres. The discharge of untreated or inadequately treated sewage into inland waterways and coastal waters is an important cause of environmental pollution in the receiving systems. This problem is particularly acute in cities in developing countries, including those in Southeast Asia, which are experiencing rapid population growth as a result of natural increases in population and internal migration of people from rural to urban areas.

In these countries, wastewater is often 'managed' on an *ad hoc* basis, lacking long-term strategies

and having little regard for national and international standards. The absence of large scale wastewater treatment plants in these areas is often attributed to a lack of resources in the construction, maintenance and running of these facilities. Interestingly, however, it has been estimated that the cost of wastewater treatment per person using conventional purification works can be as high as 10–20 times that of certain technologically simple waste treatment facilities such as waste stabilization ponds, although the difference in costs tends to decrease as populations become larger (Gloyna 1971). It is conceivable that technologically simple methods of wastewater treatment such as land filtration and waste stabilization ponds may be appropriate in these countries, particularly if

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the capital costs involved can be kept to a minimum.

In this paper, we use a specific treatment facility in Melbourne, Australia, to illustrate how sewage treatment, livestock grazing, and wildlife conservation can be combined in an ecologically sustainable way and at a relatively low cost. This alleviates the seemingly unavoidable conflict between environmental conservation and waste management. Despite its enormous potential, we are not aware of the existence of such systems in Asia, although waste stabilization ponds are in use in countries such as India, Japan, Pakistan and Thailand (Gloyne 1971). There is some anecdotal evidence that small wetland systems have also been employed to treat domestic wastes in some Asian countries (e.g. in China).

Here, we propose that the unique system in Melbourne, or at least some significant parts of it, could be adopted in some Southeast Asian countries where land availability is not critical.

Assuming that the higher temperatures in tropical Asia will speed up chemical and biological processes, the efficiency of the system in handling wastewater should be increased. In this paper, we explore the feasibility, desirability and potential

constraints/limitations of applying such a system in an Asian context.

## THE WERRIBEE TREATMENT COMPLEX

The Werribee Treatment Complex (WTC) is located 35 km south-west of Melbourne covering an area of 108.5 km<sup>2</sup> (Fig. 1). The local climate type is marine with mild winters and warm summers, all seasons are moist. The mean maximum and minimum January temperatures are 26 and 13°C respectively, while those recorded in July are 14 and 6°C. Two or three times each summer there are hot and dry spells when temperatures reach over 35°C for successive days. Annual rainfall totals are approximately 660 mm and usually evenly distributed throughout the year (Linacre and Hobbs 1977).

The sewerage system in Melbourne is currently divided into two parts: an eastern system and a western system (Fig. 1). The western sewerage system covers an area of about 860 km<sup>2</sup> and delivers approximately 50% of Melbourne's wastewater to the Werribee Treatment Complex for purification (Bissett and Pace 1993). The Complex treats the domestic

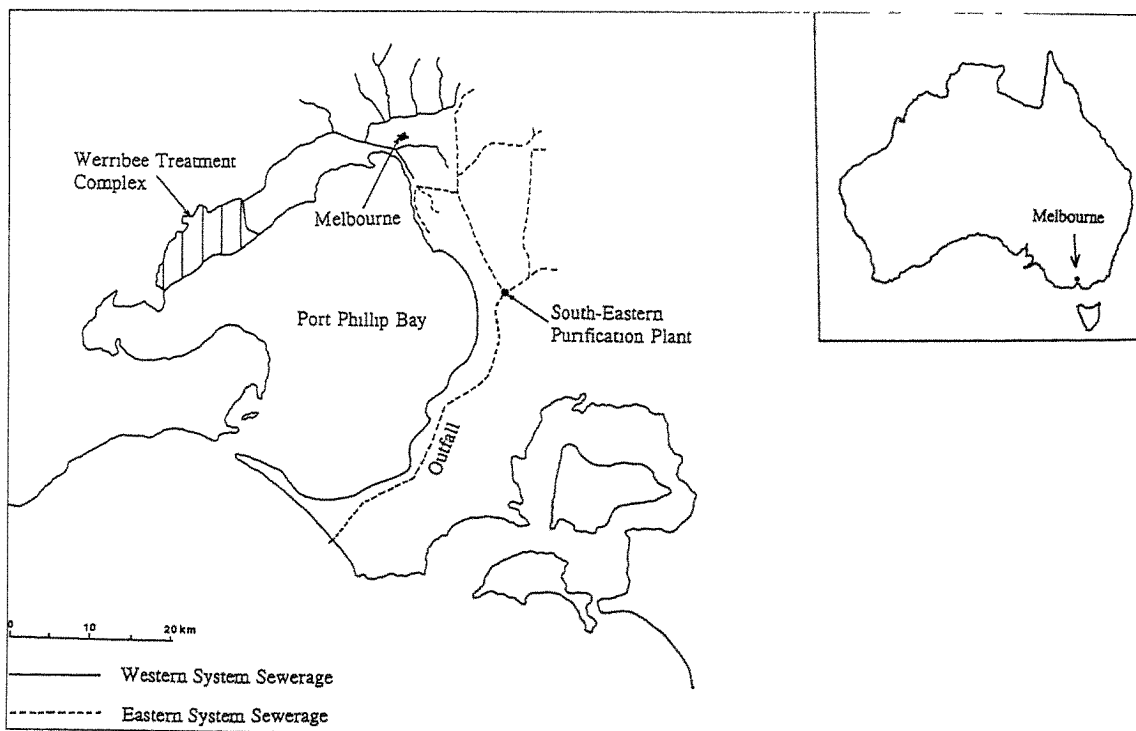


Fig. 1 Location of the Werribee Treatment Complex and the sewerage systems in Melbourne.

sewage of 1.5 million people and 80% of the industrial wastewater in Melbourne. Of the 520 million litres of wastewater it handles daily, 80% comes from domestic sources and 20% from industry. Treated wastewater is carried by drains and discharged via four outlets (plus one additional outlet during winter) to Port Phillip Bay under licence of the Environmental Protection Agency of Victoria.

The WTC uses three treatment systems: land filtration, grass filtration and lagoons (Fig. 2). The use of land treatment systems in Werribee was first proposed in 1890. The first site (35.8 km<sup>2</sup>) was chosen for its low rainfall, high evaporation rate as well as moderate permeable soil type (fine sandy loams), which are all essential factors for the successful operation of the land-filtration treatment process. Subsequent development of the Complex has been achieved through successive acquisition of land and application of new treatment processes to cope with the increasing wastewater loading. In 1930, grass filtration commenced on the western side of the complex with heavier clays and loams as a permanent winter treatment facility. Seven years later, lagoon treatment was introduced at the lower foreshore area of the complex to handle peak daily and wet weather flows which exceeded the capacity of the land and grass filtration systems (Croxford 1978).

It is important to note that, in all of these treatment processes, efforts are made to ensure that energy input and operational costs are minimized, while the recycling of useful resources is maximized. Indeed, the Complex, with the largest scale of slow-rate irrigation system in the world (Seabrook 1975) and lagoon treatment in Australia (AEC 1987) is highly regarded in the development of 'environmentally friendly' land and lagoon treatment technologies. The operational principles of the three treatment processes are described in detail below and summarized in Figure 3.

## PRINCIPLES OF TREATMENT PROCESSES

### Land Filtration

Land treatment of wastewater was first applied in the sixteenth century and became commonly used in Europe in the nineteenth century. Nowadays, its application in Europe is less common because of the large land required. However, it is still widely practised in the United States and Australia (Gray 1992). The important factors in the design of land treatment systems are land availability, permeability, and depth of soil, precipitation level and the evapo-transpiration rate (Johnson 1973).

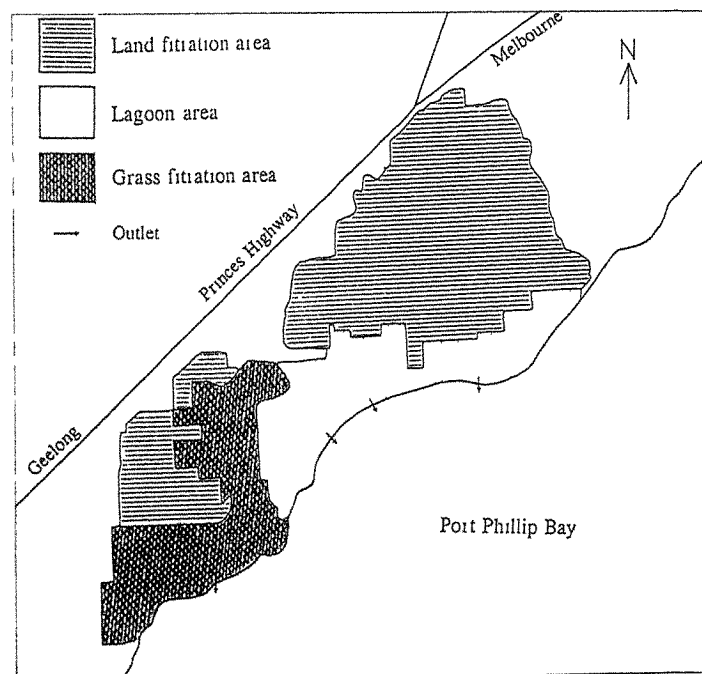


Fig. 2 Physical layout of the three treatment methods in the Werribee Treatment Complex.

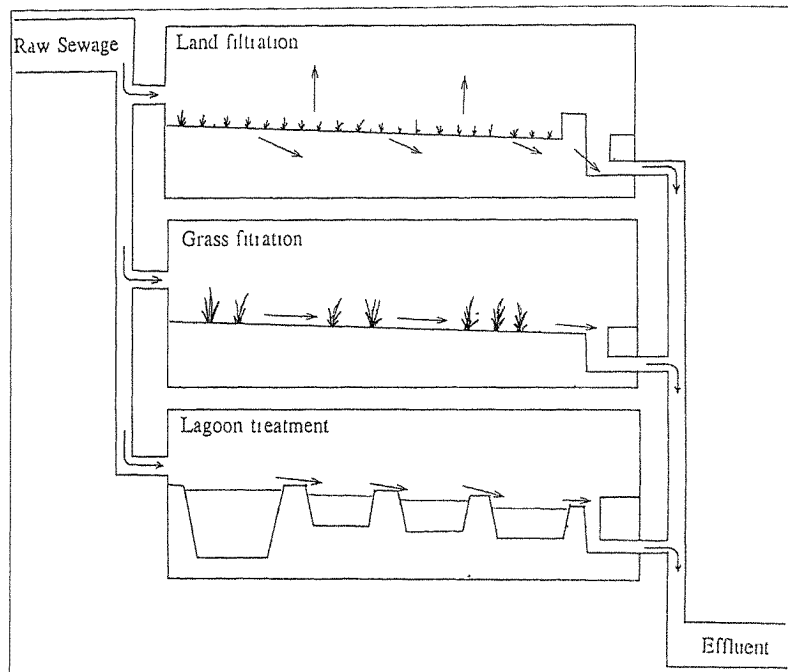


Fig. 3 Diagrammatic representation of the three treatment methods in the Werribee Treatment Complex.

Basically, the wastewater is purified as it passes through soil with moderate permeability. Suspended solids, including micro-organisms are filtered out physically by the top layers of the soil. Organic matter trapped in the soil is then metabolized by a wide range of soil heterotrophs such as fungi, bacteria and actinomycetes. Nutrients released by the decomposition process are subsequently taken up by the plants which have to be harvested regularly to maintain a high nutrient-removal efficiency (Gray 1992). It is also claimed that the humus, silt and clay particles can provide a large adsorption surface for heavy metals and inorganic nutrients, thus removing them from the wastewater (Gray 1992). Significantly, about half of the wastewater is lost to the atmosphere through evapo-transpiration, while the rest is collected by sub-surface drains.

Land filtration in WTC is operated during the summer months (October to April) when the evaporation rate is high (Croxford 1978). The treatment process involves flooding the paddocks with wastewater to a depth of 10 cm for one to two days. The paddocks are surrounded by elevated banks to prevent the overflow of untreated sewage directly into nearby drains. The land is then allowed to dry for five days, followed by a 14-day grazing period by livestock to remove the rapidly growing pasture.

Around 10 to 11 rotations can be achieved each season. Dominant pasture species found in the paddock areas include prairie grass (*Bromus catharticus*) and sea barley-grass (*Hordeum marinum*) on the rides and perennial rye grass (*Lolium perenne*), white clover (*Trifolium repens*) and water couch (*Paspalum distichum*) in the wetter areas. Weed is usually not common in these areas (Cropper and Calder 1987).

Land filtration occupies the largest proportion of land among the three treatment processes but treats only 15% of the total amount of wastewater annually. Although land filtration is considered to be the least efficient treatment method, the quality of the effluent is the best among the treatment processes.

### Grass Filtration

Grass filtration (also known as 'overland flow') refers to the treatment of wastewater as it flows across the land by gravity (Dinges 1982). It is similar to land filtration except that the wastewater flows across the land surface rather than percolates through the soil. Consequently, a specific site with relatively low permeability, such as an area with underlying clay or clay loam soil, has to be chosen (Gray 1992). The land should be prepared to provide a slope between two to six degrees. Suitable grass species should

also be planted as purification is achieved by the filtering and microbial actions as the wastewater flows through the vegetation. During the purification process, suspended solids are settled and retained at the top end of the irrigation bay where anaerobic conditions are created for initial degradation. The organic matter is decomposed biologically by an active film of micro-organisms built up on the stems of the vegetation. Nutrients released and accumulated in the system are taken up by the plants, which have to be removed regularly to maintain optimal operational conditions. Heavy metals are precipitated as sulphides in the anaerobic regions.

Grass filtration in WTC is used from May to September when land filtration is impracticable because of low evaporation rates. Although rye grasses (*Lolium* spp.) are grown in these filtration areas, weed is a serious problem in many paddocks (Cropper and Clader 1987). Rye grasses are chosen because they grow in a slender erect form rather than tufts, and provide better wastewater seeping (Croxford 1978). Furthermore, these grasses can grow under prolonged wet conditions. Prior to passing the wastewater through the grass beds, preliminary sedimentation is carried out to prevent clogging. An average of 36 to 48 hours are required for the wastewater to travel through the filtration area and the effluent is collected in open drains and discharged to Port Philip Bay.

At the end of September, the grass filtration area is let dry and cattle are allowed onto the paddocks to graze on the grasses after they have shed their seeds. Seeds left in the soil are important for the regeneration of the grass beds at the first irrigation in the following season. The establishment of the filtration areas in the next season is carried out in early autumn. Seed germination is first promoted by one or two normal irrigation bouts. Then, a small quantity of sedimented wastewater is allowed to flow through the vegetation to allow the building up of the bacterial film. After two to three weeks, the flow rate can be increased to the maximum and maintained until the end of the season.

### Lagoon Treatment

Porges and Mackenthun (1963) defined a waste stabilization pond (or treatment lagoon) as a basin, natural or artificial, designed or used to treat organic wastes by natural biological, biochemical and physical processes, commonly referred to as self-purification. Pond application as a means of

wastewater treatment was discovered accidentally in ponds formed by the clogging of a prepared gravel seepage in California in 1924 (Pearse *et al.* 1948). Following that, the use of waste stabilization ponds as well as research into the chemical, physical and biological aspects of these systems have been intensely and rapidly developed (Rohlich 1976). Nowadays, they are recognized as a major primary, secondary and tertiary treatment process, and are used throughout the world, serving populations ranging from 1000 to 1 000 000 (Gloyna 1971).

Stabilization ponds can be divided functionally into anaerobic, facultative and aerobic sections with respect to their oxygen content (Tchobanoglous and Burton 1991). It is a common practice to treat wastewater by passing it through a number of lagoons connected in a series (Horan 1990). Due to the high organic loading of untreated sewage, the first few lagoons are always anaerobic throughout the entire water column. The purification mechanisms which occur in these anoxic ponds involve sedimentation and anaerobic bacterial breakdown of organic matter into methane, carbon dioxide and organic acids. The organic loading gradually decreases as the wastewater passes the succeeding lagoons which become facultative and, in the final stages, aerobic.

In the facultative lagoons, the settleable organic matter is degraded anaerobically at the bottom while the soluble fraction is broken down aerobically. Nutrients and carbon dioxide released from the decomposition processes are then consumed by the algae which produce oxygen via photosynthesis. The oxygen is utilized by the aerobic bacteria for further decomposition of the organic matter, thereby completing the 'symbiotic cycle' (Gray 1992). The last section of the series is the aerobic lagoons which mainly function as polishing ponds. At this stage, the algal biomass is often significantly reduced as a result of grazing by zooplankton such as copepods and cladocerans. Nutrients can also be significantly reduced by the lagoon treatment and the removal mechanisms of the key-nutrients in lagoons are summarized in Figure 4. Nitrogenous waste in raw sewage is mainly composed of human excreta and proteins. The organic nitrogen is decomposed by the bacteria into ammonia, which is either lost to the atmosphere as a result of the elevated pH due to increased photosynthetic activities or converted to nitrate through nitrification. Nitrate is then denitrified to nitrogen gas at the sediment-water interface or absorbed into algal cells.

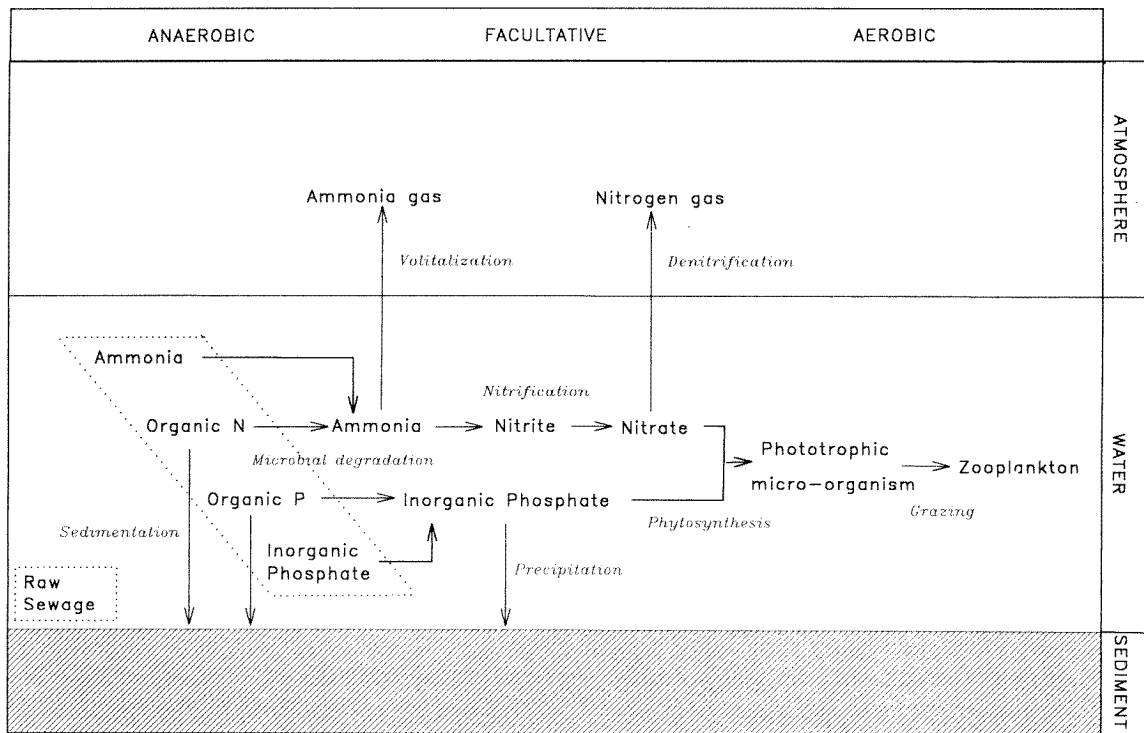


Fig. 4 Environmental fate of the key nutrients in the sewage lagoons.

Phosphorus in raw sewage is present mainly in the form of inorganic phosphate which comes from soaps and detergents. A small amount of phosphorus exists in organic forms. Organic phosphorus is converted to inorganic phosphate which is then precipitated to the sediment in the form of a complex with calcium and hydroxide at high pH. Some phosphate is also lost through cell uptake.

Waste stabilization lagoons are predominantly used to serve small populations in rural areas (Gray 1992). However, in Melbourne, a metropolitan city with a population of over three million, they are used as a major wastewater treatment method. The

lagoon series handle about 60% of the total volume of sewage distributed to WTC annually, and is the major treatment process. The lagoon treatment process in WTC is operated throughout the year. Each lagoon series consists of 8 to 12 ponds, and each pond has an area of between 40 000 to 80 000 m<sup>2</sup>. The depth of the lagoons is approximately 1 m, except for the first pond of each series which is usually 2 m deep to allow for the sedimentation of raw sewage. The detention time for each lagoon series is between 50 to 80 days (Bissett and Pace 1993). The various treatment processes in WTC are summarized in Table 1.

Table 1  
Summary of treatment processes in Werribee (91–92) (Bissett and Pace 1993)

Treatment	Operating season	% of sewage treated	Annual flow (million litre)	Area (km <sup>2</sup> )
Lagoons	all year	60%	109 169	16.54
Grass filtration	winter	25%	46 438	14.43
Land filtration	summer	15%	28 321	32.39



## ECONOMIC BENEFITS FROM THE TREATMENT OPERATIONS

### Livestock Production

Raw sewage contains high amounts of nitrogen and phosphorus which are essential for plant growth. In the WTC, raw sewage has an average of 56 mg/L of total nitrogen and 9 mg/L of total phosphorus (Hussainy 1979). Once the organic sewage is degraded by micro-organisms, the inorganic nutrients are released in forms suitable for uptake by plants. These nutrients are essential in supporting high primary productivity. Fast-growing, high-quality pasture in the land and grass filtration areas provides excellent feed for the livestock which convert primary production into secondary production without significant added energy input.

In 1991–92, there were 13 879 cattle, 14 138 sheep and 873 goats in the Complex (Bissett and Pace 1993). Sheep are purchased in the spring and summer, and are sold in the autumn after being fattened. Cattle are sold and replaced by the new calves that are bred naturally in the Complex. The main cattle herds are Herefords and Aberdeen Angus, while the sheep are composed of Border Leicester Cross, Corriedale, and Corriedale Cross (Croxford 1978). These breeds were chosen because they are hardy and less susceptible to foot rot. Lice control and immunization are also practised. Moreover, livestock are subjected to routine tests for parasites and possible toxic contaminants such as pesticides before being sold at market. Income from the sale of the livestock alone was A\$3.0 million (US\$2.2 million) in 1991–92, which covered 20% of the total operation expenditure at WTC (Bissett and Pace 1993). As the carrying capacity of the Complex in terms of livestock grazing has not been reached, further development is still possible.

### Methane Production

Methane ( $\text{CH}_4$ ) is produced during the process of anaerobic degradation of organic matter at the anaerobic lagoons. By constructing a flexible plastic cover on top of the anaerobic lagoons, methane gas can be collected. The methane can be used to generate electricity to run the aerators at the aerobic sections of the lagoons or to sell to the State Electricity Commission of Victoria. In addition to methane collection, covering the anaerobic pond can

also control the emission of other odorous and greenhouse gases, and retain heat from the degradation processes to increase microbial action. At the moment, methane collection is experimental. It is applied on the newly constructed lagoon systems which have larger surface areas. In 1991–92, 14 000–16 000  $\text{m}^3$  of methane was produced per day (Bissett and Pace 1993).

## CONSERVATIONAL VALUES OF THE COMPLEX — A WETLAND OF INTERNATIONAL IMPORTANCE

The wide range of habitats found in and around the WTC including artificial sewage lagoons, grass and land filtration paddocks as well as natural salt marshes, coastal wetlands, beaches and spits, offer an important sanctuary to a diversity of wildlife. The prohibition on hunting and the constant water supply also render the wetlands a valuable drought and refuge for waterfowl in Victoria. Moreover, the constant input of nutrient and energy sources from the sewage treatment processes also helps to maintain the productivity of the system.

In addition to providing grazing, the grass and land filtration areas also support a wide range of organisms because of the high levels of primary productivity resulting from the nutrient-rich irrigant. In particular, these areas provide an important feeding ground for wildfowl which often forage and rest in nearby lagoon areas. Moreover, the large populations of insects supported by the system in turn attract a great number of insectivorous birds.

As the sewage progresses through the lagoon series, the ammonia content is reduced while the levels of dissolved oxygen and inorganic nutrients are increased. This enables the bacteria to be replaced by the algae, which are then consumed by zooplankton. This section of the lagoon area provides favourable habitats for many waterbirds. Herbivorous birds typically feed on the vegetation and the macrophytic algae along the lagoon banks. Filter-feeding ducks appear in thousands to graze on the zooplankton in the ponds. Diving ducks which feed on the benthic invertebrates such as insect larvae and worms are also common (Lane and Peake 1990). Significantly, fish and other aquatic vertebrates are not present in the lagoons (Lewis 1987).

In 1983, the International Union for the Conservation of Nature (IUCN) designated the Complex

as a 'Wetland of International Importance' under the Ramsar Convention (Lane and Peake 1990). Moreover, due to its significant location for migratory birds in the southern hemisphere, two bilateral treaties, namely Japan-Australia Migratory Bird Agreement and China-Australia Migratory Bird Agreement, were signed in 1975 and 1984 respectively to protect the migratory bird species and their habitats. It became increasingly apparent that the management strategies of the Complex required a comprehensive input of environmental and conservational aims in addition to the wastewater treatment objectives. In 1985, the Melbourne and Metropolitan Werribee Treatment Complex Wildlife Consultative Committee was formed to achieve such goals.

### Avifauna

The Complex is internationally famous for its birdlife of which 252 species have been recorded (Cropper 1987). Permanent water supply, abundant food sources resulting from the sewage treatment processes, roosting and nesting sites provided by the dead trees in the lagoons and reduced human disturbance have attracted numerous bird species to inhabit the Complex. Among these birds, some are of particular importance. For example, the Complex supports up to 50% of the total population of the orange-bellied parrot which is one of the most threatened bird species in Australia (Kennedy 1990). Significant numbers of waders (18 000 to 32 000), of which 75% are migratory, also visit the Complex. They feed on the intertidal mudflats along the foreshore at low tides and roost in the inland areas.

A copious quantity of invertebrates are available in the foreshore area due to the nutrient enrichment from the effluent. Several rare species such as Cox's sandpiper (*Calidris paramelanotus*), Asian dowitcher (*Limnodromus semipalmatus*) and buff-breasted sandpiper (*Tryngites subruficollis*) have been recorded at the Complex, while the most common species is the red-necked stint. Waterfowl such as swans and ducks are common in the lagoon areas. Occasional surveys revealed that the lagoon areas can support up to 65 000 individuals with the most common species being Australian shelduck, grey teal, chestnut teal, pink-eared duck, Australasian shoveler, and black swan. Some rare and vulnerable species — such as fairy tern (*Sterna nereis*) and Lewin's water rail (*Rallus pectoralis*) — are also present. A list of common bird species is given in Appendix 1.

A complete species list can be found in Cropper (1987).

### Mammals

Schulz (1987) identified a total of 24 species of mammals in the Complex, three of which are of state or regional significance. The small mouse-like nocturnal insectivorous marsupial, the fat-tailed dunnart (*Sminthopsis crassicaudata*) is found in the dry grazing paddocks in the Complex. They utilize the surface basalt rocks and cracks in the soil for shelter, nesting and foraging. Along the banks of the drain network that carries purified effluent, water rats (*Hydromys chrydogaster*) nest and feed on aquatic insects and crustaceans. The world famous platypus (*Ornithorhynchus anatinus*) also inhabits the Werribee River at the eastern boundary of the Complex. Unfortunately, introduced species such as feral cats, black rats, rabbits and foxes are also abundant, posing a threat to the survival of many native species.

### Reptiles and Amphibians

At least 17 species of reptiles occur in the Complex, of which 11 are lizards, five snakes, and one tortoise (Lane and Peake 1990). One of Australia's rarest and most vulnerable grassland inhabitants, the striped legless lizard (*Delma impar*) has been recorded in the dry grassland areas. However, the frequent inundation of grasslands during the sewage treatment operations probably renders the paddocks unsuitable for lizards. Seven species of frogs have been recorded in the swampy areas and water courses in the WTC (Schulz 1987). Two of these, the green and golden bell frog (*Litoria rainformis*) and spotted burrowing frog (*Neobatrachus sudelli*), are of regional importance.

### Flora

At present, the most significant conservation value of the diverse plant communities in the Complex is their provision of a wide range of microhabitats for different wildlife (Cropper and Calder 1987). Also, several rare and vulnerable plant species with their own particular importance have been identified. One is a low saltmarsh plant, the grey glasswort (*Halosarcia halocnemoides*), which is the critical food plant for the endangered orange-bellied par-

rots. The endangered little dumpy orchid (*Pterostylis truncata*) occurs exclusively in the dry grazing paddocks. Patches of kangaroo grass (*Themeda triandra*) which remain on the Complex represent one of the few remaining isolated remnants of the native grasslands of Victoria.

## FUTURE PROSPECTS OF THE COMPLEX

### Upgrading Treatment Processes

At present the most pressing task is to upgrade and further develop treatment processes to cope with the increasing sewage loading. Recent development in the land and grass filtration areas involves laser grading to improve the gradient of the bay and the sewage flows (Lane and Peake 1990). Larger and deeper lagoons have been constructed and mechanical aeration devices introduced in the anaerobic ponds to expand the proportion of aerobic sections in the series. Emergent aquatic macrophytes have also been planted along the banks of these new ponds to improve the habitat quality for birds. Significantly, small islands have also been constructed in the middle of these lagoons to provide the birds with a habitat protected from the disturbances of predators such as foxes and feral cats.

Future options for up-grading the system, (e.g. incorporation of activated sludge treatment prior to discharging, conversion of the grass and land filtration areas to treatment lagoons) have also been considered (Lane and Peake 1990). Notwithstanding the importance of improving the wastewater treatment capacities of WTC, the impacts of any augmentation and/or refinement of the systems on local wildlife have to be assessed carefully to ensure that the conservation goals are not undermined.

### Tree Plantation

Four species of eucalypt, she-oak, poplar and pine trees have been selected for planting as a commercial forestry trial using sedimented wastewater as irrigant (Bissett and Pace 1993). It is believed tree plantations will take up much larger amounts of water per unit area compared with the pasture in the land filtration areas. Recent studies show that trees can grow from 10 cm to over 4 m in two years, with the Tasmanian blue gum, mahogany gum and flooded gum showing exceptionally fast growth.

### Harvesting of Zooplankton

A company (Zootech) from Tasmania has been successful in harvesting the zooplankton — mainly rotifers, copepods (e.g. *Mesocyclops leuckartii*) and cladocerans (e.g. *Daphnia carinata*) — from the WTC aerobic lagoons. These are marketed as feed for aquarium fish. Further work is being carried out to investigate the possibility of formulating species-specific feed for native fish (e.g. golden perch, *Macquaria ambigua*, and silver perch, *Bidyanus bidyanus*) by altering the relative proportion of different types of zooplankton in the manufacturing process. This technology is currently being transferred to other countries including Indonesia and Kenya (B. Quin, personal communication). It is worth noting that the removal of zooplankton from sewage lagoons is likely to be beneficial to the system as nutrients and total suspended solids will be removed in the process. However, the long-term impacts of this practice on the treatment processes and the ecological effects on the local biota in the Complex and in Port Philip Bay have to be examined carefully.

### Reuse of Treated Wastewater for Agriculture

Agricultural experiments using treated wastewater from the lagoons have been conducted in WTC. Test results with various species (including a variety of cereal, oilseed, summer grain and forage crops with sunflowers and winter sown barley) show encouraging results. The possibility of using chlorinated secondary treated effluent as an alternative water source for irrigation is currently being explored.

### Gas Collection

Methane gas collection has been carried out in the anaerobic ponds of the new lagoon series. The feasibility and cost justification of this exercise is currently under review. It is clear, however, that the emission of odorous and greenhouse gases can be reduced significantly.

## POSSIBLE APPLICATIONS FOR THE ASIAN SETTING

Many cities in Asia are experiencing rapid popula-

tion growth and industrial expansion. The increasing volume of domestic and industrial sewage causes major pollution problems in these places and poses a serious threat to the health and well-being of their inhabitants (Dudgeon and Lam 1994). In this context, we consider the structural and functional aspects of the unique sewage treatment facility described above as a possible solution to this difficult problem.

We believe that the system in Werribee can be applied in some Asian countries as an alternative to the more conventional treatment works commonly found in modern cities. As noted above, the Melbourne facility uses three treatment systems: land filtration, grass filtration, and waste stabilization lagoons. The successful operation of waste stabilization ponds has been demonstrated in Japan, India, Thailand and Pakistan (Gloyna 1971; Tariq and Ahmad 1985). It is important to note that the costs involved in the construction of these systems are generally low, as no advanced machinery nor complex design is required. Furthermore, since the operational principles involve only natural processes, the need for scientifically trained personnel is relatively low, except in the routine monitoring program to ensure that environmental standards are met. Indeed, one important characteristic feature of the current system is the low energy input and maintenance requirements. As demonstrated in the Melbourne model, a significant part of the running cost can be offset by the economic benefits of cattle ranching, electricity generation, timber production, etc.

Another essential component for the successful operation of the system is a suitable climate. Although Melbourne is situated on 37°S, it lies beside the extensive Port Phillip Bay and only 60 km from the open sea. This prevents it from the harsh conditions that may prevail in many other temperate zone locations. Basically, Melbourne shares similar climatic conditions with those Asian countries having sub-tropical, humid, mild climates (e.g. including parts of China).

In tropical Asian countries (e.g. India, Thailand) there is often a distinct dry season with one or two rainy seasons. In principle, the system in Werribee would be applicable in these areas. Land filtration could be used in warm and dry seasons and grass filtration in cool and wet seasons, whereas lagoon treatment can be operated throughout the year. It is conceivable that in locations closer to the equator, the efficiency of the sewage treatment systems would

be higher than those at higher latitudes as the rate of biological and chemical reactions involved in the breakdown of organic matter should be faster at the higher ambient temperatures. Indeed, Gloyna (1971) has shown that the running cost of waste stabilization ponds in India is lower if the ponds are closer to the equator.

In countries in the equatorial region (e.g. Malaysia and Indonesia) with hot, humid, climates land filtration may be less efficient as high humidity lowers the rate of evapo-transpiration which is a crucial factor in the treatment. Under these circumstances, grass filtration and lagoon treatment should be the dominant treatment processes.

## CONCLUSION

The Werribee Treatment Complex Melbourne, Australia is an example of a sustainable development which is technologically efficient, economically viable, and environmentally acceptable. Such a development could well be a model for some developing and newly industrialized countries in the region with regard to sewage treatment and disposal. The WTC does not require as much in the way of advanced technological facilities, well-trained personnel, and energy inputs as other treatment methods. Significantly, this system should be particularly appropriate for fast growing developing countries where natural habitats have largely been destroyed and hence where there is a great value in artificial wetlands which can provide for the conservation of wildlife.

Clearly, a good understanding of the prevailing physical conditions and cultural characteristics of the local communities is crucial to the success of such undertakings. In particular, a number of key elements are essential:

1. Availability of land with relatively low priority for urban development.
2. The availability of site with an appropriate topography, soil characteristics, and a buffer zone to the urban development.
3. Good urban planning so that sewerage systems can be established and treatment facilities set in place prior to major urban developments.
4. Availability of local biota that are suitable for use in treatment processes (e.g. grass species in the grass and land filtration systems)
5. Good understanding of the characteristics of the

- nature and volume of sewage loading in the area.
6. Regulation of disposal of hazardous materials should be set up and strictly enforced, as illegal discharges of toxicants into the system may render the system inoperable and/or cause contamination of the local biota and livestock.
  7. The acceptability to local people of consuming crops and livestock that have been 'exposed' to sewage need to be assessed beforehand. And
  8. The compatibility of the complex with the envi-

ronmental and conservation aims of local governments must be assured.

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**APPENDIX I: A LIST OF COMMON BIRD SPECIES IN THE WERRIBEE TREATMENT COMPLEX (MODIFIED FROM CROPPER 1987).**

**Seabirds**

Cormorant, great	<i>Phalacrocorax carbo</i>
Cormorant, little black	<i>Phalacrocorax sulcirostris</i>
Cormorant, little pied	<i>Phalacrocorax melanoleucos</i>
Jaeger, Arctic	<i>Stercorarius parasiticus</i>
Pelican, Australian	<i>Pelicanus conspicillatus</i>
Penguin, little	<i>Eudyptula minor</i>

**Hérons, Egrets, Bitterns, Ibis and Spoonbills**

Bittern, Australasian	<i>Botaurus poiciloptilus</i>
Egret, cattle	<i>Ardeola ibis</i>
Egret, great	<i>Egretta alba</i>
Egret, little	<i>Egretta garzetta</i>
Heron, Pacific	<i>Ardea pacifica</i>
Heron, white-faced	<i>Ardea novaehollandiae</i>
Ibis, sacred	<i>Threskiornis aethiopica</i>
Ibis, straw-necked	<i>Threskiornis spinicollis</i>
Spoonbill, royal	<i>Platalea regia</i>
Spoonbill, yellow-billed	<i>Platalea flavipes</i>

**Waterfowl**

Duck, blue-billed	<i>Oxyura australis</i>
Duck, musk	<i>Biziura lobata</i>
Duck, Pacific black	<i>Anas superciliosa</i>
Duck, pink-eared	<i>Malacorhynchus membranaceus</i>
Hardhead	<i>Aythya australis</i>
Shelduck, Australian	<i>Tadorna tadornoides</i>
Shoveler, Australasian	<i>Anas rhynchos</i>
Swan, black	<i>Cygnus atratus</i>
Teal, chestnut	<i>Anas castanea</i>
Teal, grey	<i>Anas gibberifrons</i>

**Raptors**

Falcon, brown	<i>Falco berigora</i>
Goshawk, brown	<i>Accipiter fasciatus</i>
Harrier, marsh	<i>Circus aeruginosus</i>
Kestrel, Australian	<i>Falco cenchroides</i>
Kite, black-shouldered	<i>Elanus notatus</i>
Kite, whistling	<i>Haliastur sphenurus</i>

**Quails**

Quail, brown	<i>Catumix australis</i>
Quail, stubble	<i>Catumix novaezelandiae</i>

**Waders**

Avocet, red-necked  
 Curlew, eastern  
 Dotterel, red-kneed  
 Godwit, bar-tailed  
 Greenshank  
 Knot, red  
 Lapwing, banded  
 Lapwing, masked  
 Oystercatcher, pied  
 Plover, black-fronted  
 Plover, double-banded  
 Plover, lesser Golden  
 Plover, Monogolian  
 Plover, red-capped  
 Sandpiper, curlew  
 Sandpiper, pectoral  
 Sandpiper, sharp-tailed  
 Snipe, Latham's  
 Stint, black-winged  
 Stint, red-necked  
 Tattler, grey-tailed  
 Turnstone, ruddy

*Recurvirostra novaehollandiae*  
*Numenius madagascariensis*  
*Erythronyx cinctus*  
*Limosa lapponica*  
*Tringa nebularia*  
*Calidris canutus*  
*Vanellus tricolor*  
*Vanellus miles*  
*Haematopus longirostris*  
*Charadrius melanops*  
*Charadrius bicinctus*  
*Pluvialis dominica*  
*Charadrius mongolus*  
*Charadrius ruficapillus*  
*Calidris ferruginea*  
*Calidris malanotus*  
*Calidris acuminata*  
*Gallinago hardwickii*  
*Himantopus himantopus*  
*Calidris ruficollis*  
*Tringa brevipes*  
*Arenaria interpres*

**Gulls and Terns**

Gull, Pacific  
 Gull, silver  
 Tern, Caspian  
 Tern, crested  
 Tern, Gairy  
 Tern, little  
 Tern, whiskered  
 Tern, white-winged

*Larus pacificus*  
*Larus novaehollandiae*  
*Hydroprogne caspia*  
*Sterna bergii*  
*Sterna nereis*  
*Sterna albifrons*  
*Chlidonias hydrida*  
*Chlidonias leucoptera*

**Other Waterbirds**

Coot, Eurasian  
 Crane, Australian  
 Crane, spotless  
 Grebe, great crested  
 Grebe, hoary-headed  
 Moorhen, dusky  
 Rail, buff-banded  
 Swamphen, purple

*Fulica atra*  
*Porzana fluminea*  
*Porzana tabuensis*  
*Podiceps cristatus*  
*Poliiocephalus poliocephalus*  
*Gallinula tenebrosa*  
*Rallus philippensis*  
*Porphyrio porphyrio*

**Cockatoos, Lorikeets and Parrots**

Galah  
 Parrot, blue-winged

*Cacutua roseicapilla*  
*Neophema chrysostoma*

Parrot, orange-bellied  
 Parrot, red-rumped  
 Rosella, eastern

*Neophema chrysogaster*  
*Psephodus haematonotus*  
*Platycercus eximius*

### Pigeons and Doves

Pigeon, feral  
 Turtle-dove, spotted

*Columba livia*  
*Streptopelia chinensis*

### Cuckoos, Owls and Frogmouth

Boobook, southern  
 Bronze-cuckoo, Horsefield's  
 Cuckoo, pallid  
 Owl, barn

*Ninox novaeseelandiae*  
*Chrysococcyx basalis*  
*Cuculus pallidus*  
*Tyto alba*

### Kingfishers

Kookabura, laughing

*Dacelo novaeguineae*

### Bush birds

Blackbird  
 Calamanthus  
 Chat, white-fronted  
 Cisticola, golden-headed  
 Cuckoo-shrike, black-faced  
 Fantail, grey  
 Fantail, rufus  
 Fairy-wren, superb  
 Goldfinch, European  
 Grassbird, little  
 Greenfinch, European  
 Honeyeater, white-naped  
 Honeyeater, white-plumed  
 Honeyeater, yellow-faced  
 Magpie, Australian  
 Magpie-lark, Australian  
 Martin, rairy  
 Martin, tree  
 Mynah, common  
 Pipit, Richard's  
 Raven, little  
 Reed-warbler, clamorous  
 Robin, flame  
 Scrubwren, white-browed  
 Shrike-thrush, grey  
 Shrike-tit, crested  
 Silvereye  
 Skylark  
 Songlark, brown

*Turdus merula*  
*Sericornis fuliginosus*  
*Ephthianura albifrons*  
*Cisticola exilis*  
*Coracina novaehollandiae*  
*Rhipidura fuliginosa*  
*Rhipidura rufifrons*  
*Malurus cyaneus*  
*Carduelis carduelis*  
*Megalurus gramineus*  
*Carduelis chloris*  
*Melithreptus lunatus*  
*Lichenostomus penicillatus*  
*Lichenostomus chrysops*  
*Gymnorhina tibicen*  
*Grallina cyanoleuca*  
*Cecropis ariel*  
*Cecropis nigricans*  
*Acridothères tristis*  
*Anthus novaeseelandiae*  
*Corvus mellori*  
*Acrocephalus stentoreus*  
*Petroica phoenicea*  
*Sericornis frontalis*  
*Colluricincla harmonica*  
*Falcunculus frontalis*  
*Zosterops lateralis*  
*Alauda arvensis*  
*Cinclorhamphus cruralis*



Sparrow, house  
Starling, common  
Swallow, welcome  
Thornbill, brown  
Thornbill, yellow-rumped  
Wagtail, willie  
Wattlebird, little  
Wattlebird, red

*Passer domesticus*  
*Sturnus vulgaris*  
*Hirundo neoxena*  
*Acanthiza pusilla*  
*Acanthiza chrysorrhoa*  
*Rhipidura leucophrys*  
*Anthochaera chrysoptera*  
*Anthochaera carunculata*



# An Environmental Charter for Universities: Outcome of a Meeting of the Association of Southeast Asian Institutions of Higher Learning

*G.T. McDonald and R.W. Simpson*

## ABSTRACT

The global need to integrate environmental issues with development generally requires that all sectors of society consider the environmental consequences of their decisions and activities. Universities have a great responsibility in this regard because they play such a vital role in education and training, in research and in technology development. It is therefore logical and desirable that universities would have a charter — a set of principles and a code of practice — to guide their own activities and their relationships with society as a whole.

This paper reports on the creation of such a charter, using previous charters such as the Talloires Declaration and the Halifax Declaration as starting points. This was the outcome of a Conference of The Association of Southeast Asian Institutions of Higher Learning (ASAIHL) Conference 1993: 'Sustainable Development: Challenges for the Asia-Pacific Region in the 21st Century' held at Griffith University in Brisbane, Queensland, Australia on 6–8 July 1993. The conference was attended by 165 teachers and researchers from universities throughout the Southeast Asian region.

*Keywords:* Universities, Environmental Charter, Asia-Pacific Region, ASAIHL, Talloires Declaration, Halifax Declaration

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## INTRODUCTION

The global need to integrate environmental issues with development generally requires that all sectors of society consider the environmental consequences of their decisions and activities. This applies to not just governments when they regulate industries, nor just to manufacturers, miners, and agriculturalists when they carry out their work, but to all sectors of society.

Perhaps universities have a greater responsibility in this regard than most institutions because they

play such a vital role in education and training, in research and in technology development. Universities also carry a social responsibility to show by example ethical practices in their work. It is not good enough for universities just to tell others what must be done. Universities must also practise what they preach.

It would therefore seem logical and desirable that universities have a set of principles and a code of practice to guide their own activities and their relationships with society as a whole. This set of principles could be referred to as a charter.

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This paper reports on the creation of such a charter. This was the outcome of a recent Conference of The Association of Southeast Asian Institutions of Higher Learning (ASAIHL) Conference 1993: *Sustainable Development: Challenges for the Asia-Pacific Region in the 21st Century* held at Griffith University Brisbane, 6–8 July 1993.

ASAIHL is a regional forum for interaction between institutions of higher learning. Its core members are from the countries of Southeast Asia with associate members from around the Pacific basin. ASAIHL is managed by an elected board and by an executive officer (Dr Ninat Olanvaruth) based at Chulalongkorn University in Bangkok. It is appropriate that ASAIHL adopt a leading role in creating and promoting an environmental charter for universities in this region. Certainly the prospects for high economic growth in this region underline the need for such directions both to influence the development of curricula in universities as well as hopefully influencing decision-making in the private sector.

The theme of this ASAIHL conference was the role of universities in developing research and teaching programmes to meet the challenges of sustainable development (McDonald and Simpson 1993). The conference was attended by 165 teachers and researchers from universities throughout Southeast Asia to meet and discuss these critical issues (see Table 1).

The key questions addressed at the conference were:

1. What can and should universities do to develop research and teaching programmes to meet the challenges of sustainable development?
2. What progress has been made? and
3. What strategies should be employed?

**Table 1**  
**Nationality of ASAIHL Conference Delegates**

Australia	64
Brunei	2
Hong Kong	11
Indonesia	22
Malaysia	11
Philippines	5
Thailand	32
Other	18
Total	165

Over 70 papers were presented on these themes. The keynote speakers who played a leading role in the conference were:

Dr Nay Htun, UNEP Regional Director for Asia and the Pacific. Dr Nay Htun was Technical Secretary to the UNCED conference 'Caring for the Earth' in Brazil in 1992.

Professor Mohammad Soerjani Director Pusat Studi Lingkungan of the University of Indonesia, Jakarta. Professor Soerjani is Secretary of the Environmental Studies Centre network in Indonesia and more recently, his centre has been appointed to be the focal point for UNEP tertiary environmental education network in Asia and the Pacific.

Professor Surin Setaminit, Vice President Academic from the Faculty of Engineering Chulalongkorn University Bangkok, and

Associate Professor Mohamad Ismail Bin Yaziz, Head of the Department of Environmental Sciences at University Pertanian Malaysia.

## THE PROCESS OF CREATING A CHARTER

There are at least two existing models of charters of universities that could be considered in creating a new charter for the Asia-Pacific Region in the post-UNCED period: the Talloires and Halifax declarations (see Appendices 1 and 2). The 'Talloires Declaration' was signed by university executive officers from many countries in 1990 and the 'Halifax Declaration' was signed by a large number of universities in 1991. The principles set out in these declarations may, perhaps in modified form, be suitable also for ASAIHL institutions. For a further discussion of the principles of a university environmental charter see the Lester Pearson Institute (1992).

The organizers of the 1993 ASAIHL weighed the advantages of using one or other of these models as a base to work from, against the disadvantages of such a model stifling originality as it might be seen as a *fait accompli*. A compromise strategy was used in which delegates were given the Talloires and Halifax charters as background with no suggestions for a wholesale adoption of either.

The process of creating the charter involved the following steps:

1. All delegates received copies of the Talloires

- and Halifax declarations and a written questionnaire (see Fig. 1);
2. the declarations and the questionnaire were discussed at a plenary session of the conference early on Day 1 (30 minutes);
  3. each delegate completed the questionnaire and returned it after 24 hours (Day 2);
  4. the responses were summarized and presented in draft form at a plenary workshop session on Day 3 (30 minutes);
  5. a penultimate draft was presented at the Closing Ceremony. Further amendments were made at this time through the use of direct editing of the text on a word-processor linked to an overhead projector (30 minutes); and
  6. the final draft form of the charter was passed formally to a member of the ASAIHL Board for the attention of the Board and hopefully implementation.

#### Creating an Environmental Charter for ASAIHL Institutions

Please list the environmental principles that you believe should be adopted by ASAIHL institutions. You may list principles from the Talloires and Halifax declarations (by number, for example Halifax 1) and/or provide original principles.

#### Possible Specific Actions for ASAIHL Institutions

Please list five specific actions that an institution could take to implement the principles of the Talloires and Halifax declarations (or their modified equivalents).

#### Example

Institutions should: Conduct an energy audit in the university.

Fig. 1 The questionnaire survey.

Fifty-five responses were received. Delegates responded in various ways. Some simply recommended the adoption of one of the model declarations in their entirety; others prepared completely new sets of principles. Most delegates selected some of the principles from one or both declarations and suggested additional principles or rewording of the model declarations provided. Responses to the Talloires and Halifax declarations are presented in Figure 2.

The authors analysed the responses and produced a consistent and coherent draft charter for consideration by the delegates. This process could

A. Talloires Declaration	
Principle	Number of Delegates (x2)
1. Raising opportunities	12
2. All universities	13
3. Literate citizens	21
4. Create programs	12
5. Set example	24
6. Involve government	18
7. Educators and practice	8
8. School partnerships	12
9. UNCED/UNEP	12
10. Establish secretariat	7
B. Halifax Declaration	
1. Ongoing commitment	8
2. Better understanding	13
3. Ethical obligations	12
4. Capacity and understanding	7
5. Revise practices – N/S	5
6. Communicate to UNCED	1

Fig. 2 ASAIHL conference delegates' responses to the Talloires and Halifax declarations.

not be rigorously scientific. However, it was made as transparent as possible to the delegates by presenting data on the range of responses and the additional principles suggested. Consensus was reached as outlined in part 5 above. The final draft of the charter is shown in Figure 3.

## CONCLUSIONS: STEPS TOWARD IMPLEMENTATION

In order to maximize the dissemination of the charter, the conference participants obtained agreement from the president of the ASAIHL Board (Professor Kao) and those members present to promote the charter. The ASAIHL Board will endorse the charter for dissemination to member institutions. The participants requested that:

1. the ASAIHL Board endorse this charter;
2. the ASAIHL Board forward the charter to member Institutions for ratification and implementation; and
3. the ASAIHL Board records the progress in ratification and implementation.

Implementation needs to occur at two levels:

1. at the policy level, each university must make a commitment to the charter through ratification

1. To ensure that the voice of the university is clear and uncompromising in its ongoing public commitment to the principles and practices of sustainable development within the university and at the local, national and global levels.
2. To use the intellectual resources of the university to encourage better common understanding of the inter-related physical, biological and social dangers facing the Earth and of the means of preventing and alleviating these dangers. This is to be achieved through the involvement and partnership with all levels of government, foundations, industry, non-government organisations, environmental practitioners and schools.
3. To emphasize the ethical obligation of the present generation to achieve intragenerational and intergenerational equity and to develop sustainable practices of resource management.
4. To prepare and implement strategies and actions that set an example of environmental responsibility.
5. To enhance the capacity of the university to teach and practise sustainable development, to increase environmental literacy and to enhance the understanding of environmental ethics among faculty, students and the whole community.
6. To employ all channels open to the university to communicate understanding of sustainable development to governments and to the whole community.

Fig. 3 ASAIHL environmental charter.

- and adoption by the university's highest-level governing boards and its adoption by chief executive officers; and
2. at the programme level, university elements must interpret the charter and articulate the charter into actions appropriate to local circumstances.

In addition to the charter itself, participants made many specific suggestions for action that might be taken in implementing it. These are too many to list here but a sample is included in Table 2.

Readers wishing more information on the charter are invited to contact the authors.

**Table 2**  
**Sample of Suggested Actions that Universities**  
**Might Take in Implementing the Environmental**  
**Charter**

- prepare an action plan at each institution;
- adopt a local community;
- capacity building at all levels;
- conduct an environmental audit of each institution;
- support inter-disciplinary teaching programmes;
- develop links with universities in north/south;
- support inter-disciplinary research programmes;
- integrate ESD into all programmes;
- conduct demonstration projects;
- conduct in-service training of university staff.

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## APPENDIX I: University Presidents for a Sustainable Future

### The Talloires Declaration

At Talloires, France in October, 1990, a conference of university presidents from every continent, held under the auspices of Tufts University of the United States, issued a declaration of environmental commitment that has attracted the support of more than 100 universities from dozens of countries.

### University Presidents for a Sustainable Future

#### *The Talloires Declaration*

We, the presidents, rectors, and vice chancellors of universities from all regions of the world are deeply concerned about the unprecedented scale and speed of environmental pollution and degradation, and the depletion of natural resources. Local, regional, and global air and water pollution; accumulation and distribution of toxic wastes; destruction and depletion of forests, soil, and water; depletion of the ozone layer and emission of 'green-house' gases threaten the survival of humans and thousands of other living species, the integrity of the earth and its biodiversity, the security of nations, and the heritage of future generations. These environmental changes are caused by inequitable and unsustainable production and consumption patterns that aggravate poverty in many regions of the world.

We believe that urgent actions are needed to address these fundamental problems and reverse the trends. Stabilization of human population, adoption of environmentally sound industrial and agricultural technologies, reforestation, and ecological restoration are crucial elements in creating an equitable and sustainable future for all humankind in harmony with nature. Universities have a major role in the education, research, policy formation, and information exchange necessary to make these goals possible.

University heads must provide the leadership and support to mobilize internal and external resources so that their institutions respond to this urgent challenge. We, therefore, agree to take the following actions:

1. Use every opportunity to raise public, government, industry, foundation, and university awareness by publicly addressing the urgent need to move toward an environmentally sustainable future.
2. Encourage all universities to engage in education, research, policy formation, and information exchange on population, environment, and development to move toward a sustainable future.
3. Establish programmes to produce expertise in environmental management, sustainable development, population, and related fields to ensure that all university graduates are environmentally literate and responsible citizens.
4. Create programmes to develop the capability of university faculty to teach environmental literacy to all undergraduate, graduate, and professional schools students.
5. Set an example of environmental responsibility by establishing programmes of resource conservation, recycling, and waste reduction at the universities.
6. Encourage the involvement of government (at all levels), foundations, and industry in supporting university research, education, policy formation, and information exchange in environmentally sustainable development. Expand work with non-government organizations to assist in finding solutions to environmental problems.
7. Convene school deans and environmental practitioners to develop research, policy, information exchange programmes, and curricula for an environmentally sustainable future.
8. Establish partnerships with primary and secondary schools to help develop the capability of their faculty to teach about population, environment, and sustainable development issues.
9. Work with the UN Conference on Environment and Development, the UN Environment Programme, and other national and international organizations to promote a world-wide university effort toward a sustainable future.

10. Establish a steering committee and a secretariat to continue this momentum and inform and support each other's efforts in carrying out this declaration.

Jean Mayer, President and conference convenor, Tufts University, USA

Publico Area, Vice Chancellor, Universidad Autonoma de Centro America, Costa Rica

L. Ayo Banjo, Vice Chancellor, University of Ibadan, Nigeria

Boonrod Binson, Chancellor, Chulalongkorn University, Thailand

Robert W. Charlton, Vice Chancellor and Principal, University of Witwatersrand, Union of South Africa

Constantine W. Curris, President, University of Northern Iowa, USA

Michele Gendreau-Massaloux, Rector, L'Academic de Paris, France

Adamu Ngaya Mohammad, Vice Chancellor, Ahmado Bello University, Nigeria

Augusto Frederico Muller, President, Fundacao Universidade Federal de Mato Grosso, Brazil

Mario Ojeda Gomez, President, Collegio de Mexico, Mexico

Calvin H. Pimpton, Present Emeritus, American University of Beirut, Lebanon

Wesley Posvat, President, University of Pittsburgh, USA

T. Navaneeth Rao, Vice Chancellor, Osmania University, India

Moonis Raza, Vice Chancellor Emeritus, University of New Delhi, India

Pavel D. Sarkisov, Rector, D.I. Mendeleev Institute of Chemical Technology, USSR

Stuart Saunders, Vice Chancellor and Principal, University of Cape Town, Union of South Africa

Akilagpa Sawyer, Vice Chancellor, University of Ghana, Ghana

Carlos Vogt, Present, Universidade Estadual de Campinas, Brazil

David Ward, Vice Chancellor, University of Wisconsin-Madison, USA

Xide Xie, President Emeritus, Fudan University, People's Republic of China

## **APPENDIX II: The Halifax Declaration**

From 9–11 December 1991, the presidents and senior representatives of 33 universities from 10 countries on five continents met in Halifax, Canada to take stock of the role of universities regarding the environment and development. They were joined by a number of senior representatives from business, the banking community, governments, and non-governmental organizations. The meetings were sponsored by the International Association of Universities, the United Nations University, the Association of Universities and Colleges of Canada, the Dalhousie University, Canada, which also provided the detailed planning and secretariat support. The Halifax Declaration was released at the conclusion of the conference.

### *The Halifax Declaration*

Human demands upon the planet are now of a volume and kind that, unless changed substantially, threaten the future well-being of all living species. Universities are entrusted with a major responsibility to help societies shape their present and future development policies and actions into the sustainable and equitable forms necessary for an environmentally secure and civilized world.

As the international community marshals its endeavours for a sustainable future, focused upon the



United Nations Conference on Environment and Development in Brazil in 1992, universities in all countries are increasingly examining their own roles and responsibilities. At Talloires, France in October, 1990, a conference of university presidents from every continent, held under the auspices of Tufts University of the United States, issued a declaration of environmental commitment that has attracted the support of more than 100 universities from dozens of countries. At Halifax, Canada, in December, 1991, the specific challenge of environmentally sustainable development was addressed by the presidents of universities from Brazil, Canada, Indonesia, Zimbabwe and elsewhere, as well as by the senior representatives of the International Association of Universities, the United Nations University and the Association of Universities and Colleges of Canada.

The Halifax meeting added its voice to those many others world-wide that are deeply concerned about the continuing widespread degradation of the Earth's environment, about the pervasive influence of poverty on the process, and about the unsustainable environment practices now so widespread. The meeting expressed the belief that solutions to these problems can only be effective to the extent that the mutual vulnerability of all societies, in the south and in the north, is recognized, and the energies and skills of people everywhere be employed in a positive, cooperative fashion. Because the educational, research and public service roles of universities enable them to be competent, effective contributors to the major attitudinal and policy changes necessary for a sustainable future, the Halifax meeting invited the dedication of all universities to the following actions:

1. To ensure that the voice of the university be clear and uncompromising in its ongoing commitment to the principle and practice of sustainable development within the university, and at the local, national and global levels.
2. To utilize the intellectual resources of the university to encourage a better understanding on the part of society of the interrelated physical, biological and social dangers facing the planet Earth.
3. To emphasize the ethical obligation of the present generation to overcome those current malpractices of resource utilization and those widespread circumstances of intolerable human disparity which lie at the root of environmental unsustainability.
4. To enhance the capacity of the university to teach and practise sustainable development practices, to increase environmental literacy, and to enhance the understanding of environmental ethics among faculty, students, and the public at large.
5. To cooperate with one another and with all segments of society in the pursuit of practical capacity-building and policy measures to achieve the effective revision and reversal of those current practices which contribute to environmental degradation, to south-north disparities and to inter-generational inequity.
6. To employ all channels open to the university to communicate these undertakings to UNCED, to governments and to the public at large.

Dalhousie University, Halifax, Canada, 11 December 1991.



# Recent Developments in the Use of Economic Instruments in Environmental Policies<sup>1</sup>

*Khalid Abdul Rahim*

## INTRODUCTION

Recently, there has been a growing interest in the use of economic incentives to achieve environmental quality goals. Among economists worldwide there is near unanimity in preferring economic incentives over direct controls for many types of situations. Within the class of economic incentives, two have received the most analytical attention: price-based controls (pollution charges) and quantity-based controls (marketable permits). Among the basic alternative strategies available for internalizing the various externalities that produce environmental problems are regulation (standards, prohibition, permits, zoning and restrictions), fiscal measures (including various kinds of taxes and subsidies, deposit-refund systems, market creation and financial enforcement incentives), and 'suasive' instruments (involving education and training, environment campaigns, and negotiation) and government production of environmental services.

In practice, a 'mixed' environmental policy often is employed. The choice in a particular policy should be based on the simultaneous consideration of effectiveness, economic efficiency, and political acceptability. For example, there is no system that employs taxes without also maintaining a standard. Nor is there a system that levies a fee which represents the marginal damages from pollution. In the United States, the primary form of regulation of water quality, until quite recently, has been the emissions standard, whereas in the European countries an emission standard often has been combined with fees for water treatment. Neither system results in a fully efficient amount of abatement, but the European system comes closer to providing appro-

priate incentives to abate water pollution at minimum cost. The fee system in the European countries takes a number of forms. In Czechoslovakia, charges have been used to achieve predetermined ambient standards for more than two decades. In the Ruhr Valley in Germany, charges are used as a source of revenue to finance regional or local activities toward meeting water quality goals. In Hungary and former East Germany, charge systems combined with effluent standard have proven more powerful than relying on standards alone. The Hungarian system had little effect initially, but when the charge levels were raised, waste-treatment activities increased (Hahn 1989; Tietenberg 1988).

In general, there is little doubt that all the 24 OECD countries take environmental protection seriously. The OECD countries use a variety of economic instruments in addition to direct controls (i.e. 'command-and-control'). The traditional reliance on the command-and-control is gradually, though perhaps rather slowly, giving way to the economic approach in most OECD countries. Charges are made on effluents in a number of countries; on noise nuisance in some instances; on the collection and disposal of wastewater in virtually all countries; on products (such as bottle deposit systems) in quite a number of countries; and differential taxes are used in a few countries. The idea of charging is not new. However, often the charges are not designed for incentive purposes, or, if they were intended to be, they do not have significant incentive effects. Many, for example, are for revenue-raising which is an altogether different objective. The charges mainly have a revenue raising impact when they are set too low to provide an effective impact on behaviour. The revenues were intended for collection treatment, re-

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search on new abatement technologies or for subsidizing new investment.

Canada, the United Kingdom and the United States differ from other OECD members in that they rely more heavily on the regulatory approach. Nonetheless, economic instruments are being considered under the Canadian Environment Action Plan (Government of Canada 1992).

Command and control approaches are widely used in the Dynamic Asian Economies (DAEs) and the reforming countries of Latin America. However, while the use of economic instruments appears to be increasing in the DAEs, this is not so for Latin America (Margulis 1993).

## MARKET-BASED INCENTIVES

The most desirable feature of the market mechanism is that the price signals provide accurate information to consumers on the full cost of producing a particular product and to producers regarding consumers' relative valuations. There are two ways in which markets can be structured so as to ensure that environmental services enter into the market system more effectively. First is the full privatization option. Under this approach, we could create markets in previously free services: all natural areas could charge entrance fees, coastal zones could be placed under private ownership with the owners charging for the use of coastal waters as sewage dumps, and so on. The second approach is to modify markets by deciding the value of the environmental services centrally and ensuring that those values are incorporated into the prices of goods and services. We refer to this approach as using the market, or establishing market-based incentives.

### Pollution Charges/Taxes

This is the simplest conceptual form of a market-based incentive. Essentially a charge is set on the pollutant, the product or the inputs used to make the product so as to raise the cost of producing that product. The charge should, of course, as far as possible bear some relationship to the value of the environmental services damaged in the process. Ideally, the charge would be set equal to the value of the marginal environmental damage from the production system.

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## Marketable Permits

Marketable permits offer a further market-based incentive system to meet pre-ordained environmental quality standards at lower cost. Essentially, since some damage to the environment is often inevitable in production processes, the rights to engage in activities likely to lead to such damage (e.g. by emitting a certain amount of pollutant into the atmosphere) are sold to the highest bidder. Under this situation producers would eliminate as much of their environmentally damaging activities as they could for a cost lower than the price of the permit.

Marketable permit systems have been tried primarily in the United States. Hahn (1989) reported only four existing applications, and three were in the United States. The best-known of these is the Emissions Trading Program, which was introduced by the United States Environmental Protection Agency (USEPA) in 1974 to deal with a variety of air pollutants. Despite several limitations, the Emissions Trading Program saved industries an estimated US\$1–12 billion in abatement costs by the mid 1980s (Hahn 1989). The only example of marketable permits system for water pollution is the Transferable Discharge Permits programme on the Fox River in Wisconsin, which was introduced in 1981 and was targeted at reducing biological oxygen demand (BOD). Although the first trade under the Fox River programme occurred in 1982, no more use had been made of this potential as of 1989 (Hahn 1989). Thin markets and heavy restrictions have limited the number of trades and thus the magnitude of cost savings.

## POSSIBILITIES AND OBSTACLES FOR INTRODUCING AND IMPLEMENTING THE 'WIN-WIN' POLICIES

Foremost is the realization that a movement from a purely regulatory system to a wider use of economic instruments promises the potential for achieving better environmental quality with a substantially lower commitment of resources to pollution control. Unfortunately, environmentalists and the public at large often perceive market-based measures as implying a 'right to pollute'. However, such criticisms are heard less frequently now as those environmentalists who are not economists have gradually begun to recognize that financial inducements constitute an armory

of weapons which can contribute a good deal toward achievement of environmental goals.

A second important point is that interest in the use of economic instruments in many countries (both in the developed and developing economies) is on the rise in terms of theory, empirical analysis, and policy. As a number of economic instruments are compatible with the existing legislation in many countries, these would represent a modification rather than a radical departure from the current regulatory approach. However, market-based instruments are generally not appropriate for dangerous and toxic pollutants.

A third point is that many economic instruments are designed to provide an incentive for polluters to adopt efficient control technologies which can abate more pollution at lower cost. This in turn stimulates the development of abatement technologies. Marketable permits are attractive and innovative but are relatively new and unfamiliar, therefore untested. The marketable permit system is complicated because the system may not necessarily streamline monitoring with enforcement. The control agency will have to track sales and ensure that a polluter is complying with the terms of his permit. Monitoring and enforcement costs on small polluters may far outweigh the benefits derived from reduced pollution. A thin market in permit trading results in no alternative sellers from which a buyer can choose. Thus, non-competitive markets may lead to high prices for permits and windfall profits to some polluters.

By comparison, pollution charges are relatively attractive to a policy maker. It is simply a tax on unabated pollution. Charges (which is the instrumental variable) can be manipulated to achieve a target variable (environmental quality). Under the pollution charge system, the requirements for new institutional arrangements are likely to be minimal.

The collection of taxes is facilitated by the existence of a tax administration. While administrative and institutional capacities in some developing economies are not as well developed as those in OECD countries, new environmental policy would be more acceptable to the industry if it is phased in gradually.

In practice, standards tend to be preferred by industries because they usually can have more influence on regulation formulation and penalty provisions through political and judiciary processes. In addition, charges are viewed as additional to compliance costs to the industries.

A natural outcome of using economic instruments is that it suggests the clear definition of

property rights. Unfortunately, this solution will not work for certain significant environmental problems because these involve large numbers and/or the suffering from the pollution is in the form of a public good. Many environmental functions simply cannot be handed over to private ownership (e.g. the ozone layer, the oceans, the atmosphere).

Existing regulations in many developing economies are largely based on those of OECD countries. For example, environmental regulations in the Philippines often closely follow United States regulations (Mohamed Ariff 1993). As these regulations have little base in local realities and cultures, they may be difficult to enforce. Polluters' responses to economic instruments in many OECD countries might have had much to do with the low penalties which so far have been common. The polluters might have found it more profitable to pay up the effluent fee, output tax, etc., than to undertake pollution control or wastewater treatment. It is reasonable to think that some of these instruments would work more successfully in the developing economies which are not fully industrialised. This does not mean that polluters in the developing economies are more willing to pay pollution charges than those in developed countries. Rather, this may be attributed mainly to differences in the industrial structure and stage of industrial development.

In virtually all economies, environmental protection competes with other policy objectives for scarce resources. Therefore there are opportunity costs and these costs may be particularly high for developing countries which have more pressing needs to attend to. More efficient environmental policy instruments lower the commitment of resources to pollution abatement and will release these resources for other development needs.

### **Types of Environmental Problems: Economic Instruments Best Suited**

Uniformly mixed, fund pollutants are the easiest to deal with analytically. The damage done by these pollutants depends on the amount entering the environmental media. Such damage is relatively insensitive to where the emissions are discharged. Thus, environmental policy can focus simply on controlling the total amount of the emission in a manner that minimizes the cost of control. A uniform emission charge or an emission permit system could be used to attain the most cost-effective allocation even when the control authority has no information what-

soever on control costs. Uniform emission standards would not, except by coincidence, be cost-effective. In addition, either permits or charges would stimulate more technological progress in pollution control than would emission standards.

The problem becomes more complicated when dealing with non-uniformly mixed surface pollutants. For these pollutants the policy should be concerned not only with the amount of emissions, but also with the location of emissions. For non-uniformly mixed pollutants it is the concentration in the air, soil, or water that counts. The concentration is measured as the amount of pollutant found in a given volume of air, soil, or water at a given location at a given point in time. Since the damage caused by non-uniformly mixed surface pollutants is related to their concentration levels in the air, soil, or water, it is natural that our search for cost-effective policies for controlling these pollutants focuses on the attainment of ambient environmental quality standards (e.g.  $x \mu\text{g}/\text{m}^3$  of an air pollutant). Such ambient standards represent the target concentration levels which are not to be exceeded. This can be accomplished with either an appropriately designed emission permit system or emission charge; either one can result in a cost-effective allocation of the control resources even when the control authority has no information on control costs. A policy based on emission standards cannot (e.g. each emitter being limited to emissions of  $x \mu\text{g}/\text{m}^3$ ).

Some of the examples of economic instruments in use include:

- taxes on fertilizers and pesticides (Austria);
- taxes on CFCs (Denmark);
- taxes on bituminous coal (Ireland);
- carbon tax (Finland);
- effluent tax (Germany, France and The Netherlands);
- taxes on industrial non-biodegradable waste (Italy);
- levy on farm animal wastes (The Netherlands);
- fuel taxes and subsidies (Sweden);
- differential taxation of vehicles according to their environmental impacts (Belgium);
- price differentiation between leaded and unleaded gasoline (Thailand and Taiwan);
- user charge on waste disposal sites (France);
- user charge on vehicles that travel through the city centre at peak hours and high daytime parking fees (Singapore); and
- deposit-refund schemes for used oil and batter-

ies (Norway), for beer bottles and packaging (Japan, Korea and Taiwan).<sup>3</sup>

A pollution tax on stationary and mobile sources of air pollution (Japan) is paid into the environmental funds for the purpose of financing compensation payments to pollution victims and certain other environmental costs. Korea also has such funds financed, in part, from government contributions and, in part, pollution charges. Rights to import and use ozone-depleting substances (CFCs) and the right to own automobiles in Singapore are examples of marketable permits in use in the DAEs (O'Connor 1993). In general, environmental taxation now occurs in fields such as transportation, fuels and energy sources, agricultural inputs, water use, waste management, air pollution, etc.

### Selection, Design and Implementation of Economic Instruments

Economic incentives appear to operate best in combination with, or in support of, other instruments when efficiency, effectiveness and acceptability criteria are considered simultaneously to reduce uncertainty about environmental outcomes. The choice of instruments depends on these criteria and it also depends on the general political context and administrative cultures.

The government must play certain important roles in order to implement systems of marketable permits and charges. Under the system of marketable permits, the government must first establish environmental goals: ambient-based or emission-based. The government must address the geographic extent of the market. Airshed or watershed may be reasonable in some areas. But in many cases the geographic area is predetermined by political boundaries so that the local control authorities have little control over portions of pollution that passes over their boundaries. The coverage of the permits must be determined. Do all polluters need permits, or just the major polluters? Should there be separate markets for firms and individuals (e.g. cars versus power plants)? How will the permits be distributed? Should there be a special branch of the control authority to deal with the purchase and sale of permits, e.g. odd-lot trading as in a stock exchange? The government must determine how to enforce the system and must be able to detect violations; this means that emissions and/or environmental quality must be measured. Once vio-

lations are detected, how does government penalize the perpetrators?

Under the system of charges, the government must set the appropriate charge which can be determined only by an iterative trial-and-error process over time. Without knowing the costs of control, the control authority cannot establish the correct tax rate at the first attempt. Each level of a charge tried will result in some level of emission reduction. To minimize the uncertainty of making a correct guess about initial charge, some information costs have to be incurred. The responsibility for meeting that reduction will be allocated in a manner that minimizes control costs. How high should the charge be set to ensure that the resulting emission reduction meets the desired level? Information costs are not the only source of differences in policy costs. Waste discharges must be monitored. An accurate estimate of the total emission flow must be obtained in order to compute a total tax bill. The total payment any source would make to the government could be found by multiplying the fee with the amount of pollution emitted. The government must assume certain financial functions: total charges must be determined, a collection procedure must be developed, and a legal mechanism must be established to cope with delinquent accounts. An appeal procedure allowing polluters to contest the charge assessed is also a likely component of any effluent charge system.

### The Malaysian Experience in Standards-cum-Charge Approach<sup>3</sup>

Malaysia's experience with regulation in the palm oil industry offers several lessons for pollution control efforts in the country. These are outlined below.

1. Pollution reduction and industrial expansion can occur simultaneously. The fact that an industry is an important one is not grounds for being reluctant to address its pollution problems. One reason for success was the technology which was effective and relatively inexpensive, and the industry was able to develop numerous by-products from the effluent. Another reason was the industry's ability to shift the costs associated with pollution control onto the suppliers of the raw materials.
2. Effluent charges were not responsible for most of the reduction in biological oxygen demand (BOD) discharge. During the first year of implementation, the standards were not mandatory and firms chose to pay effluent charges. After the first year of implementation, the motivation to comply with the standard was not the effluent charge, but rather the risk of being shut down for violating the mandatory standard. The effluent charges were seen as a means of reinforcing a system of uniform standards.
3. Effluent charges offer abatement cost savings compared to uniform standards but the savings can be small. The magnitude of potential savings depends on the degree of variation in the marginal abatement costs across pollution sources. The greater the variation, the greater the scope for efficiency gains through a reallocation of resources for abatement.
4. The industry can be worse off under an effluent charge than a uniform standard. The sum of effluent charges and abatement cost under the former can exceed the abatement costs under the latter. From a social perspective, effluent charges are still better: the objective is not to minimize industry's costs, but to minimize society's. The effluent charges can be interpreted as potential compensation to the victims of pollution. Even if such compensation is not directly paid out, the revenue from effluent charges benefits society if it is used to fund monitoring, enforcement, and clean-up activities. The higher costs understandably make effluent charges less attractive to industry.
5. Effluent charges can result in local pollution problems. The simulation results indicated that some mills would discharge effluent with a BOD concentration well above historical standards if faced with only an effluent charge. Although it is possible to design a cost-effective system of 'ambient charges' whose levels vary across pollution sources and are linked to local ambient conditions. Such a system requires considerable information, is difficult to administer, and in essence may not be much different from a system of firm-specific effluent standards, offers an environmental agency greater certainty about pollution abatement.
6. Malaysia's experience with environmental regulation in the crude palm oil industry offers no lessons about the determination of optimal pollution levels. The effluent charges and standards were not chosen by comparing marginal abatement costs and marginal abatement benefits. Information on the value of environmental benefits is limited in Malaysia.

## NOTES

1. This paper is based on the discussion by Dr Khalid Abdul Rahim for session 1 of the OECD informal workshop with the Dynamic Non-Member Economies on 'The Use of Economic Instruments in Environmental Policies' at Paris, France on 8-9 November 1993. Background papers and room documents for the session are listed in the references.
2. These examples draw upon reviews by OECD (1989), Barde (1993), O'Connor (1993) and Margulis (1993).
3. This section reviews the findings by Khalid (1993).

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# Pollutant Discharge Fees in China: A Case Study of a Factory in Guangdong Province, China

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## ABSTRACT

The Pollutant Discharge Fee Program in China requires the collection of fees when discharge standards are exceeded. Revenues from the Program are used to subsidize wastewater treatment facilities and for support of activities of local environmental protection bureaus (EPB). The incentives provided by the Program to factories to build and operate wastewater treatment facilities are examined through a case study of a factory in Guangdong province. A cash-flow analysis is used to compare the financial decision faced by the factory: pay pollutant discharge fees, or build and operate wastewater treatment facilities. The analysis concludes that the Pollutant Discharge Fee Program does not provide a financial incentive to the factory to build and operate wastewater treatment facilities. However, the Program has had a significant impact on pollution control in some localities by providing an important source of revenue for local EPB operations and growth.

*Keywords:* Pollutant-discharge fees, effluent charges, Guangdong, environmental policy, economic incentives, industrial wastewater treatment

## INTRODUCTION

China's Pollutant Discharge Fee Program provides for the collection of fees when pollutant concentrations exceed the national discharge standards. For wastewater discharges, the fees are calculated based on the multiple by which the standards are exceeded and the volume of wastewater discharged. Payment of fees is in addition to, rather than in lieu of, the responsibility to treat effluent that fails to meet applicable standards. Eighty percent of the revenue from the fees is designated for rebate and subsidy programmes to assist enterprises paying fees with the construction of waste treatment facilities,<sup>1</sup> and the remaining 20% is designated for use by the units

collecting the fees, i.e. local environmental protection bureaus (EPB), for the purchase of monitoring equipment and other designated uses.

This paper introduces the fee schedule and uses a case study of a foodstuffs factory in a city in Guangdong province (in southern China) to explain how pollutant discharge fees are calculated and collected. The extent to which the Pollutant Discharge Fee Program influences the behaviour of factories and environmental regulatory agencies is discussed. The paper concludes that the collection of fees does not provide an economic incentive for the case-study factory to construct and operate wastewater treatment facilities. However, the programme is an important source of revenue for local EPBs.

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The analysis is based on field research conducted in 1990 and 1991. At that time, fees were calculated according to methods established in 1982 (1982b). The changes in the method for assessing fees that were introduced in 1991 are discussed only briefly.

The legal basis for the collection of pollutant discharge fees was established in the Environmental Protection Law of the People's Republic of China (for trial implementation) in 1979 (1979), which specifies that pollutant discharge fees be collected for the discharge of pollutants in excess of the national discharge standards. While some EPBs began collecting pollutant discharge fees as early as 1979, the programme came into widespread use only after the Provisional Measures for the Assessment of Pollutant Discharge Fees (hereinafter referred to as the Provisional Measures) were issued in 1982 (1982b). The Provisional Measures stated that 'pollutant discharge fees should be assessed on any enterprise or other undertaking that discharges pollutants in excess of [national or local discharge] standards.' The Provisional Measures also stated that 'polluting units which pay pollutant discharge fees are not absolved from the responsibility of controlling pollution, compensating for damages caused, or other responsibilities as provided under law.' In other words, enterprises are legally obligated to treat their wastewater to meet discharge standards, independent of the Pollutant Discharge Fee Program. As a result, enterprises are not faced with the simple economic decision: which will cost less, paying pollutant discharge fees, or providing wastewater treatment adequate to achieve the discharge standards?

Because of the unambiguous legal requirement to meet effluent standards,<sup>2</sup> it is difficult to isolate the influence of the Pollutant Discharge Fee Program in motivating wastewater treatment. Pollutant discharge fees are only one of the factors that motivate construction of treatment plants to meet effluent standards. The legal basis for the Pollutant Discharge Fee Program was further strengthened by the issuance of the final version of the Environmental Protection Law of the PRC in 1989 (1989c), in which compliance with the Pollutant Discharge Fee Program is required.

Pollutant discharge fees were collected throughout China after the Provisional Measures were issued in 1982, and the amount collected increased steadily during the 1980s. The amount collected nationally per year has steadily increased from about 427 million yuan in 1981 to 1.75 billion yuan in 1990

(1988b, 1991). During that period, the largest portion of fees collected was for water pollution, and the second largest portion was for air emissions, followed by solid wastes and noise. The remaining portion collected was for the 'four small pieces' (*sixiao kuai*): pollutant-discharge fees collected as interest on late payments, 5% per year additional fees collected beginning in the third year an enterprise pays fees, double fees assessed for violations of standards by new factories, and fines for illegal discharge or failure to operate waste treatment facilities.

After collection, pollutant-discharge fee revenues are placed in Pollutant Discharge Fee Subsidy Funds at various levels of government. The Provisional Measures of 1982 stipulate that 80% of these funds is to be used to subsidize waste treatment at enterprises that have paid pollutant discharge fees, and the remaining 20% is for use by local EPBs. Since 1981, the amount used to subsidize waste treatment has varied from 34 to 84% (1988b, 1990, 1991). Since 1984, the average amount used for waste treatment has been about 70 to 80% of the total collected. The Provisional Measures of 1982 stated that the EPB was to use its portion of the Pollutant Discharge Fee Subsidy Funds primarily for purchases of monitoring equipment (Ross and Silk 1987). In practice, however, these funds have been used for a variety of purposes, including equipment purchase, inspections and other activities.

## POLLUTANT DISCHARGE FEE ASSESSMENT

The method for calculating and collecting pollutant discharge fees followed by the EPB of the city in which the case study foodstuffs factory was located was the one specified in the Provisional Measures issued in 1982. According to this regulation, polluting units should register with local EPBs. At the time of registration, each unit should report the types, amounts and concentrations of the pollutants that it discharges. After this information is reviewed and accepted by the local EPB or its designated monitoring unit, the information and the analyses of samples taken by the EPB's monitoring unit are used as a basis for calculating the pollutant discharge fee for a violation of the effluent standards (Article 4). Unannounced sampling by monitoring units generally takes place on a monthly or seasonal basis (Article 7).

The pollutant-discharge fee calculation is based on the number of times by which a pollutant concentration exceeds the effluent standard for that pollutant. Schedules for calculating pollutant discharge fees were provided as appendixes to the Provisional Measures of 1982. Table 1 contains the fee schedule that was subsequently issued for Guangdong province.<sup>3</sup> If two or more pollutants are subject to pollutant discharge fees, then the fee is based on the pollutant for which the higher rate is assessed, i.e. the fee is collected for only one pollutant (Article 5).<sup>4</sup> After the fees are assessed by the local EPB's Inspection Unit (*jianlisuo*), the fees must be paid by the polluting units in a designated bank account within twenty days. Interest is assessed on delinquent payments (Article 7).

**Cash Flow Model**

Pollutant discharge fees are intended to provide an incentive for factories to treat their wastewater. They are intended primarily for old factories that are not subject to relatively recent, stringent requirements for addressing waste treatment during the design and construction phases of a new factory. Some of the revenues received as pollutant discharge fees provide a basis for grants and low interest loans for subsidizing the construction of wastewater treatment plants by factories. Thus, the pollutant discharge fees provide two forms of financial incentives for factory clean up. First, if a factory treats its effluent and meets the effluent standards, it will no longer have to pay pollutant discharge fees. Second, a fac-

**Table 1**  
**Fee Schedule for Assessing Pollutant Discharge Fees for Wastewater, Yuan Collected Per Ton of Wastewater Discharged**

Harmful material (pollutant)	Number of times, T, by which the discharge concentration exceeds the discharge standard; i.e. T = (discharge concentration/standard)- 1			
	0 < T < 5	5 T < 10	10 T < 20	20 T
mercury, cadmium, arsenic, lead and other inorganic compounds; 6-valent chromium compounds	for T < 1, collect 0.15; for T 1, collect 0.15+0.01T	collect 0.20+ 0.02 (T-5)	collect 0.30+ 0.015 (T-10)	collect 0.45+ 0.015 (T-20), to a max. of 2.00
sulphides, hydrocarbons, phenol, cyanides, organic phosphorus, copper, zinc, fluorine and other organic compounds, nitrobenzene, phenylalanines	for T < 1, collect 0.10; for T 1, collect 0.10+ 0.01T	collect 0.15+ 0.01 (T-5)	collect 0.20+ 0.01 (T-10)	collect 0.35+ 0.008 (T-20), to a max. of 1.00
suspended solids, COD, BOD	for T < 1, collect 0.04; for T 1, collect 0.04+ 0.004T	collect 0.06 + 0.008 (T-5)	collect 0.10+ 0.015 (T-10)	collect 0.15+ 0.002 (T-20), to a max. of 0.30
oils	0.25	0.35	0.50	1.00
radioactive compounds	1.00	3.00	6.00	8.00
pH	for every additional value above or below the range of 6-9, collect 0.04			
pathogens	0.08			

Source: This pollutant discharge fee schedule was issued for Guangdong province in 1982 as part of the Guangdong province method for collection of pollutant discharge fees (1982a).

tory that pays fees may apply to the local EPB for a grant or loan to construct wastewater treatment facilities; if the factory receives assistance, it can reduce its capital investment costs for the wastewater treatment facilities.

Two main questions are examined using the case study analysis:

1. Does it make financial sense for an old factory to build wastewater treatment facilities to avoid paying pollutant-discharge fees?
2. Do the grants and loans from the Pollutant Discharge Fee Program make building wastewater treatment facilities an attractive option?

In addressing these questions, the following parameters need to be considered:

- amount of fees the factory is currently paying;
- amount by which the pollutant discharge fees will increase over the useful life of the proposed wastewater treatment facilities;
- capital investment cost of the proposed wastewater treatment facilities;
- operating and maintenance costs of the facilities over their useful life;
- amount of loans or grants for capital construction costs;
- loan repayment interest rate;
- discount rate (interest rate used for calculating present value);
- inflation rate.

A cash flow model is used to analyse retrospectively the influence of these parameters on the decision of the case study foodstuffs factory. The model compares a *not build* wastewater treatment facilities scenario with a *build* wastewater treatment facilities scenario. In the *not build* scenario, the factory continues to pay pollutant-discharge fees over the next twenty years. The model assumes that the amount of wastewater and the concentration of various pollutants stay the same over this period. Following current regulations, the pollutant discharge fee rate increases by 5% per year beginning in the third year. It is assumed that after ten years there will be a one-time increase of 25% in the pollutant discharge fee rates.<sup>5</sup> In the *build* scenario, actual capital investment costs and actual operating and maintenance (O&M) costs from the case study is used. The model assumes O&M costs increase at the rate of inflation. It is assumed that the useful life for a wastewater treatment facility is twenty years.

For both the *not build* and *build* scenarios, the annual costs are converted to present value and summed. Various discount rates (to convert annual costs to present values) and inflation rates (to model increases in O&M costs) are considered.

Sometimes, in a cost comparison such as this, inflation is ignored because it is assumed that it will affect all costs equally. However, because the pollutant discharge fee rates are not indexed, and therefore do not increase with inflation, the inflation of other costs could be significant in eroding the real cost of the pollutant discharge fees relative to the operating and maintenance costs. While market prices are certainly not the rule in China, energy, labour and materials costs have increased over the last several years. The government has adjusted prices to try to gradually bring them closer to government estimates of market prices, and this model assumes this government practice will continue. The inflation rate accounts for these price adjustments. In contrast, the pollutant discharge fees are only adjusted by periodic legislative efforts. Based on historical experience, these adjustments will be made infrequently and will lag behind price levels for energy, labour and materials.

## THE CASE STUDY OF A FOODSTUFFS FACTORY

The foodstuffs factory was established in 1954.<sup>6</sup> The foodstuffs factory paid pollutant discharge fees from 1980 through 1989, and they averaged 47 800 yuan per year. A wastewater pond for primary sedimentation was constructed in 1979 at a cost of 400 000 yuan, and wastewater treatment facilities for the whole plant were constructed in 1986 at a cost 1 990 000 yuan. The plant received low interest loans from the city EPB of 300 000 yuan and 1 300 000 yuan, respectively. After the wastewater treatment facilities were operating, the plant usually met effluent standards, but it paid pollutant discharge fees for occasional violations. Operating and maintenance costs were 110 000 yuan per year.

The case study consists of a retrospective analysis of the choices faced by the foodstuffs factory: continue to pay fees or build and operate a wastewater treatment plant. Parameter values used in conducting the cash flow analysis are summarized in Table 2. (A detailed explanation for each of the values is given in Sinkule [1993].) Although the

foodstuffs factory received low interest loans from the local EPB, the exact interest rate and loan repayment schedule for these loans were not available. In the analysis, it is assumed that these loans were repaid according to guidelines on repayment of pollution source treatment funds. In these guidelines, interest rates range from 0.24% per month (about 3% per year) to 0.8% per month (about 9.6% per year) and loans are repaid over a maximum of three years (1988a, 1989a, 1989b).

**Table 2**  
**Assumptions for the Cash Flow Analysis for the Case Study Foodstuffs Factory**

Parameter Name	Parameter Value	Units
Interest rate	10	percent
Inflation rate	5	percent
Pollutant discharge fees payment	47 800	yuan/year
Rate increase after 10 years	25	percent
Capital cost for WWT plant, 1979*	400 000	yuan
Capital cost for WWT plant, 1986	1 990 000	yuan
Low interest loan, 1979	300 000	yuan
Low interest loan, 1986	1 300 000	yuan
Loan repayment interest rate percent	0.24	monthly
Operating and maintenance (O&M) costs	110 000	yuan/year

\* WWT = wastewater treatment.

To simplify the analysis, it is assumed that the loan is repaid over a three-year period and that the same interest rate applies over each of the three years. It turned out that the results are not sensitive to variations in the loan repayment interest rate, so these simplifying assumptions do not alter the resulting financial decision on whether or not to build a wastewater treatment facility in order to avoid continuing to pay pollutant discharge fees.

The results of the model calculations are summarized in Table 3. The net present value of the *not*

*build* scenario is 568 000 yuan, and the net present value of the *build* scenario, which includes the capital costs incurred by the factory, the O&M costs, and the loan payments, is 2 270 000 yuan. As shown on the bottom of Table 3, over 20 years, construction and operation of wastewater treatment facilities will cost the foodstuffs factory about four times more (in present value terms) than continuing to pay pollutant discharge fees.

**Table 3**  
**Results of Cash Flow Analysis**

Parameter Name	Parameter Value	Units
Present Value of Not Build Scenario	568 000	yuan
Present Value of Build scenario	2 270 000	yuan
PV Build/PV Not Build*	4.0	number of times

\* PV = present value.

Sensitivity analysis was used to analyse how varying the assumed values in Table 2 affects the results. Reducing the inflation rate improves the relative attractiveness of the *build* scenario, but the net present value of the *build* scenario is still more than that of the *not build* scenario. Reducing the discount rate to zero in addition to using an inflation rate of zero further closes the difference between the two scenarios, but the *not build* scenario remains the preferred financial decision.

The loan repayment interest rate in Table 2 (i.e. 0.24% per month) is the lowest interest rate of all the possible interest rates listed in the guidelines. A higher loan repayment interest rate would be more realistic, but raising the loan repayment interest rate only makes the *build* scenario even less attractive, so calculations with a higher interest rate were not made.

If the loans are treated as grants, i.e. they do not need to be repaid, the difference between the net present values of the two scenarios is reduced, but the *not build* scenario is still less costly. The results of a sensitivity analysis with no loan repayment, and with inflation rate and interest rate both equal to zero, still leaves the ratio of PV *build*/PV *not build* well above 1.0.

The results of the cash flow analysis indicate clearly that there is no financial advantage for the foodstuffs factory in building wastewater treatment facilities to avoid paying pollutant-discharge fees. This outcome is not difficult to explain: O&M costs are much greater than pollutant-discharge fee rates. Thus, it is not to the financial advantage of the factory to build and operate a wastewater treatment plant, even if the capital cost of building the plant is largely subsidized by low interest loans or grants. The foodstuffs factory did, in fact, build and operate wastewater treatment facilities, but it did not do so to reduce its pollutant-discharge fee payments. It was motivated to build treatment facilities by several other factors, including its legal obligation to meet discharge standards.

## CONCLUSION

Although results from one case study provide no basis for generalizing, Sinkule's (1993) interviews with EPB staff in Guangdong province in 1990 and 1991 indicate that the foodstuffs factory results are not anomalous. Indeed, pollutant-discharge fee rates were well below O&M costs for wastewater treatment at many factories in Guangdong province during the 1980s.

Arguing that the Pollutant Discharge Fee Program frequently provides no financial motive to construct and operate treatment plants is *not* the same as saying that the Program has not had a significant impact on pollution control in some municipalities. While the 80% of the pollutant-discharge fees collected that is used for subsidies to factories has not provided a strong incentive for wastewater treatment, the subsidy does assist a factory motivated to install treatment facilities for other reasons. Moreover, the 20% of the pollutant-discharge fees collected reserved for use by local EPBs is providing an important source of revenue for EPB operations and growth in some localities. In one city in Guangdong province, 60% of the EPB's operating budget came from these revenues.

That the Pollutant Discharge Fee Program is

relied upon as a means for EPBs to obtain operating revenues to carry out their regulatory function is not surprising. The practice of using pollutant-discharge fees' to raise revenues to support environmental management programmes is quite common in western Europe (Johnson and Brown 1976). The rationale that charges or fees will provide economic incentives for factories to modify behaviour often serves largely as a justification for a 'pollution tax' to support environmental regulatory programmes. This approach has been followed in China, and it is consistent with the current political climate which favours greater reliance on markets. However, in many cases the economic incentives in the Pollutant Discharge Fee Program are incentives for the EPBs, not factories. The experience (documented by Sinkule [1993]) demonstrates that EPBs have been highly motivated to improve their inspection and monitoring capabilities since that enables them to collect additional fees.

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## NOTES

1. These facilities can be for wastewater, air emissions, or solid waste. The discussion in this paper concerns only wastewater treatment facilities.

2. The term 'effluent standards' is equivalent to 'pollutant discharge standards' when discussing wastewater.
3. The fee schedule for Guangdong province is essentially the same as the fee schedule issued in the original *Provisional Measures*. The Guangdong fee schedule's highest category is for exceeding the standard by more than 20 times, whereas the national schedule had a separate category for exceeding the standard by more than 50 times. However, both have the same upper fee limits for each pollutant category. Because the Guangdong fee schedule explained the fee calculations for each pollutant category in more detail and because this study took place in Guangdong province, this fee schedule is used herein for illustrative purposes.
4. This provision was modified in 1991. According to the new provisions, fees should be assessed for *each* pollutant that is in excess of its respective discharge standard. The fees for each pollutant also changed in the new provisions; fees increased or decreased, relative to the old system, depending on both the volume and concentration of the discharge in violation. Over the period that this study covers, the original fee calculation method is the most applicable.
5. In 1991, which was 12 years after collection of pollutant discharge fees began (and nine years after the fee schedule was issued in the *Provisional Measures* of 1982), the assessment method for pollutant discharge fees was changed. This resulted in an overall increase in the amount of fees collected per violation. This model approximates this and future increases in fee rates by a 25% increase every ten years, either to increase revenues or simply to keep up with inflation. (Fees increased for some violations and decreased for others, so the overall effect of the changes is not simple to determine. The 25% approximation is based on estimates by EPB personnel with experience in collecting pollutant discharge fees). The effluent fees are set at a yuan amount; they are not indexed based on the rate of inflation or in any other way.
6. Originally, malt sugar was the foodstuff factory's only product; production of 'liquid glucose' (*yeti putatong*) was added after a few years. In the mid 1980s the factory developed a new product, a *Lactobacillus* beverage.
7. Pollutant discharge fees for wastewater are also referred to as 'effluent fees' and 'effluent charges' in the literature.

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# Potentials and Practical Limitations for Economic Environmental Policy Instruments in Hong Kong and Elsewhere

Bill Barron

## ABSTRACT

While there is a strong conceptual appeal in the use of market-based environmental policy instruments, it is important to recognize that their application is often limited by practical constraints. This paper briefly notes some of these constraints (e.g. difficulties in compliance monitoring, distributional impacts) and reviews the potential for the use of market-based environmental policy instruments in a number of specific situations in Hong Kong.

In general, economic instruments can and probably should play a greater role in Hong Kong's environmental management system and that of other economies in the region. Careful consideration to the types of factors which may constrain the practical use of market-based environmental policy instruments in certain situations can promote the case for their appropriate application where such constraints are less significant.

**Keywords:** *economic instruments, environment, environmental management, environmental economics*

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## INTRODUCTION

Economists have long urged that a greater role be given to the use of economic policy instruments ('market-based incentives') for environmental management (to list only a few, see Pearce and Turner [1990], Tietenburg [1988], Baumol and Oates [1988], OECD [1966], Seneca and Taussig [1974]). In Hong Kong the question of what role economic instruments should play in the Territory's environmental management efforts has been one of active interest (see for example, Kwong [1990], Barron [1993]). Yet, while the *conceptual* appeal of market-based instruments over command and control approaches is relatively easy to demonstrate, certain crucial limitations often severely constrain their application in practice. This paper briefly reviews these issues and

considers the potential for use of economic instruments to address several important environmental concerns in Hong Kong. A more extensive review of the practical potential for use of economic instruments in Hong Kong along with a detailed explanation for the non-economist of the conceptual advantages and limitations of both market-based and command and control environmental policy instruments may be found in Barron (1994).

## LIMITING FACTORS FOR APPLICATION OF ECONOMIC POLICY INSTRUMENTS

As noted elsewhere in this issue of *AJEM* (see Rahim; Sinkule and Ortolano) the conceptual advantages of market-based policy instruments are

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compelling. Here, we take the overall theoretical superiority of market-based instruments as a given, but note that certain factors, particularly administrative considerations and income distribution effects, may more than offset the appeal of such instruments relative to command and control alternatives when it comes to addressing certain types of environmental concerns.

Crucial administrative concerns relating to the use of any type of policy instrument for environmental management include (i) the ability to monitor compliance and (ii) the reliability of the instrument under uncertain (or highly variable) economic, technological or social conditions. The most commonly discussed economic instruments are taxes and permits. The potential efficiency advantages of taxes or permits are greatest when they are applied as close as possible to the activity which leads directly to the environmental damage (e.g. pollutant discharges to the common air or water streams).

The basic consideration here is that economic efficiency is improved when those causing the damage are given as much flexibility as possible in deciding how to reduce the damage they cause. Since what is the least cost method for one emitter may not be the least cost method for another emitter, such flexibility is essential to attain the overall least cost solution. For example, one emitter of a certain pollutant may find it cheaper to change processes, another to change the type of fuel he uses, and a third to clean-up the flue gases before these are released to the environment. It would be inefficient to make all these emitters undertake a uniform method for reducing emissions.

Yet point-of-discharge monitoring (which would be necessary for a pollutant emissions tax or permit system) may be difficult or expensive and where there are a large number of emitters it simply may be impractical from a regulatory standpoint. Taxes (or possibly permits) might be applied at an earlier stage (e.g. on dirty fuels) but this reduces the flexibility of emitters and, hence reduces the likely economic efficiency gains.

One area where taxes can work is when the activity or material of concern is by its nature damaging to the environment (e.g. smoking cigarettes, lead in fuel) and the activity or use of the material is price elastic (i.e. those who engage in that activity or use that material will do so less often if they face a higher price).

Surprisingly, one feature of economic instru-

ments which appears to have received very little specific comment from advocates is that if applied to *all* units of pollution (as in principle it probably should be), the financial costs faced by emitters typically becomes far higher than they would face under command and control schemes which limit emissions only above a certain threshold (Barron 1994). While this effect may be consistent with the polluter pays principle, it nonetheless represents a real income transfer from industry and other polluters to the rest of society. Some economists may dismiss this as 'a mere transfer payment' without impacts on *overall* social welfare. Yet, it clearly affects the distribution of welfare within society and this consequence may be an important matter of public policy concern (either as one openly discussed or as one affecting decisions behind the scenes).

Another form of economic instrument is deposit-refund schemes to promote waste separation/collection for recycling or safer waste disposal. This approach may be quite useful (and is probably under utilized in most of the world). Yet, here too there are important practical constraints. If the major limitation to recycling or sequestering of hazardous wastes is the cost of material cleaning or reprocessing rather than the cost of collection and separation, then deposit-refund schemes may not contribute much to overall cost reduction.

Economic instruments presently play only a modest role in most countries, including the highest income economies. While this present situation is due in part to inadequate attention to the use of such instruments by environmental regulatory agencies, it is also almost certainly true that there are *valid* reasons why command and control alternatives are preferred by regulators in many specific situations. Following are several selected examples from Hong Kong. This review clearly is illustrative rather than exhaustive.

### Industrial Sulphur Dioxide

While Hong Kong's economy is increasingly shifting to trade and services, the manufacturing base remains important. Much of the territory's industry consists of thousands of small textile, plastic, and metal fabrication firms (*Hong Kong 1993*). These industries are often highly polluting because they are small, use old equipment, and operate in very cramped work spaces which limit in-house effluent treatment possibilities. The effects of this pollution,

particularly air emissions, are made worse by the juxtaposition of industrial and residential areas.

In 1989 the Environmental Protection Department (EPD) decided to severely limit emissions of sulphur dioxide ( $\text{SO}_2$ ) from nearly 1000 industrial users of high sulphur (2.5%) heavy fuel oil (*Environment Hong Kong 1991*). The basic policy options included (i) forcing all industry to switch to low sulphur (0.5%) diesel fuel, (ii) giving companies the option of using either Flue Gas Desulphurization or low sulphur fuel, (iii) requiring those near residential areas to raise their exhaust gas stacks above the height of nearby residential blocks, (iv) a tax on the sulphur content of fuel, (v) a tax on  $\text{SO}_2$  emissions, and (vi) permits for specified amounts of  $\text{SO}_2$ .

The use of emissions taxes and permits (and a number of variants on these) to reduce industrial air pollution in Hong Kong was strongly advocated in a lengthy argument by Kwong (1990). Some industries argued for the right to use FGD, since they felt that it would be cheaper for them.

EPD rejected the call for industrial  $\text{SO}_2$  emission taxes or permits because it could not adequately monitor point-of-discharge emissions from a thousand plus sources. EPD rejected giving industries the choice of FGD because of its concern that if more than a relatively small number (e.g. 50 to 100 establishments) chose it, then the monitoring requirements (to ensure that the FGD system was not only in place, but also used on a regular basis) would be higher than EPD could handle (Barron 1993). Further, if the costs of a comprehensive monitoring programme were passed back to the industries, this would probably have made the FGD option financially unattractive relative to fuel switching for many (Lau 1990).

The option of requiring taller stacks would be inadequate considering that residential blocks are usually much taller than the industrial multi-storey buildings and inversions are not uncommon. Given the relatively small size of the Hong Kong fuel market a tax on sulphur would in effect be a matter of either no change or a complete switching of fuel, since the potential for more than one grade of heavy fuel oil seemed small.

The use of low sulphur diesel fuel was mandated from July 1990 and this measure proved effective in reducing  $\text{SO}_2$  levels by over 80% in heavily industrialized areas (*Environment Hong Kong 1991*). This improvement in air quality led in turn to a measured improvement in the respiratory health

of children in at least one heavily industrialised area of Hong Kong (Hedley *et al.* 1993). The fuel switching requirement increased costs to affected industries by about HK\$500 million/year (US\$64 million). This HK\$500 million cost represented a few percentage points increase in total operating costs of affected industries and in the larger economic framework, a significant proportion of this costs probably has been offset by avoided costs (e.g. doctor visits due to respiratory problems) (Barron *et al.* 1994). Certainly, some direct savings associated with the policy intervention would have been possible had industry been allowed the choice to use FGD where it found this to be cheaper. However, the added monitoring costs would have to be subtracted from any such cost savings and overall the net savings would appear to have been modest.

Considering the practical limitations of the alternatives to the ban on high sulphur fuel oil, its relatively modest cost, and its clear effectiveness, this form of command and control — despite its conceptual shortcomings — probably was the appropriate choice under the circumstances. Indeed, this measure appears to have gained very wide acceptance in Hong Kong and calls for a reassessment of the options for  $\text{SO}_2$  control have been noticeably muted.

### Transport Particulates

In Hong Kong diesel engine vehicles account for about two-thirds of distance travelled and about 40% of respirable particulates (*Environment Hong Kong 1990*). The basic policy options being considered are (i) a mandate to force all new light vehicles to switch to petrol-fuelled engines using unleaded petrol and catalytic converters coupled with an emissions standards and inspection system for heavy vehicles, or alternatively (ii) a system of periodic inspections and strict emissions standards for all diesel vehicles. Improvements in diesel quality are planned regardless of which of the two approaches above is taken.

The inspection programme for all diesels (option ii) offers the prospect of more freedom to vehicle operators (i.e. they could meet the emission standards through either better maintenance and tuning or by switching to petrol whichever was cheapest). This potential advantage was stressed by economists Rusco and Walls (1994) in their analysis and in general form was supported by the Hong Kong General

Chamber of Commerce and the Private Sector Committee on the Environment.

Objections to complete reliance on an inspection programme for all diesels came from the EPD and EPD's concerns were at least partly shared by others (e.g. Barron 1993). These objections are firstly that an inspections programme for all diesels might be of rather modest effectiveness (e.g. if the number of inspections were not frequent enough to ensure reasonable engine performance *between* inspections), secondly that it was not necessarily significantly less expensive than the fuel-switching (after valuing the cost of 'down-time' for vehicles going through inspection and performing the required engine maintenance work), and thirdly that the associated administrative requirements are high, raising the prospect that it would be much less reliable in implementation than a similar programme limited to the much smaller number of heavy vehicles.

The basic trade-off between these two options appears to be one of (a) greater efficiency (lower costs) associated with giving owners the choice of fuel/engine switching versus maintenance against (b) the perceived greater reliability of the forced switching of lighter vehicles to diesel and strict standards/inspections limited to heavy vehicles.

As of the time of this writing (mid 1994) the Hong Kong government has yet to announce formally its choice of policy instrument three years after EPD's proposal was (at least temporarily) rejected by higher levels of government. No steps have been taken while the controversy continues. Meanwhile, particulate levels have become the most serious air pollutant problem in Hong Kong (EPD 1993).

### Construction Waste

Construction waste has been a matter of some concern as existing landfill space is being used up at an alarming rate. In 1992 EPD undertook a pilot study which demonstrated the feasibility of recycling a significant portion of this material.

The options for construction waste minimization include (i) mandatory recycling of construction wastes and (ii) waste disposal charges. The best approach would be some combination of assistance (such as information or publicly owned facilities for recycling) and a disposal charge which provides an adequate incentive to reuse/recycle appropriate components of the construction industry solid waste

stream. EPD is evaluating a charging scheme as an incentive to increase recycling/reuse (*Environment Hong Kong 1993*). Charging the full cost of disposal for construction wastes would be one means of employing market-based environmental policy instruments. The effectiveness of such a measure would depend on the extent to which construction wastes can be recycled or diverted to other uses (e.g. reclamation). The basic questions are whether the government could adequately monitor waste arisings (i.e. to prevent illegal dumping) and whether the government is willing to impose this cost on the construction industry in accordance with its announced commitment to the polluter pays principle.

### Consumer Plastic Bags and Bottles

Plastic bags and bottles present a significant problem in Hong Kong due to their volume, persistence in the environment, and to the frequency with which they escape from the waste collection system. Various efforts have been made to encourage voluntary source reduction or recycling/reuse of plastic bags. Some supermarkets have setup collection centres for the return of used plastic bags and sell reusable cloth bags. Many plastic bags in Hong Kong are made partly from recycled materials. Overall, however, such efforts have not resulted in a significant reduction in the disposal problem in Hong Kong.

In the case of polyethylene terephthalate (PET) plastic containers, a pilot scheme was carried out in which a payment of HK\$0.20 (US\$0.026) was made for each container returned to a reverse vending and crushing machine. The returned bottles were then crushed and given free of charge to a recycler who took them to China for reprocessing (Kwan 1993). The pilot PET collection scheme ended in 1992 without plans for a full programme, apparently due to limited public response and the costs.

For both bags and bottles, Hong Kong has yet to implement an effective control measure. Yet residential consumer plastic wastes would appear to present an attractive opportunity for the use of market-based measures. In the case of plastic bags, at least their use is discretionary and hence would likely be *price elastic*. A modest charge (e.g. HK\$0.50 [US\$0.06]) on each bag at the check-out counter probably would help to reduce consumption of these bags by eliminating the very low-valued single time use of the material for goods which do not really need it.

For PET containers, consumers have relatively limited choice in use of the containers but the containers themselves are easy to separate, collect, and recycle. The reward of HK\$0.20 per container in the pilot study may or may not be an adequate incentive. Whatever the level of the necessary reward, it should be funded from a deposit collected from wholesalers or retailers. Whereas it is the overuse of plastic bags (due to a false cost as seen by consumers), with PET it is the ease with which the material can be collected and recycled. The crushed PET containers have a relatively stable market value, and revenue from such sales could be used to cover administrative costs and perhaps provide additional revenue to government as well while reducing pressure on landfill space.

So far supermarkets in Hong Kong have resisted proposals to charge customers for plastic bags and it is not even clear if a tax imposed by government would be passed on to consumers willingly. Opposition to a PET deposit-refund system would likely come from bottlers and wholesalers or retailers who prefer not to be bothered with participation in such a scheme and who possibly fear consumer resistance resulting in lower sales of their products.

From the standpoint of society, however, both supermarkets which distribute plastic bags free of charge and wholesalers/retailers selling liquids in PET containers are imposing uncompensated costs on the rest of society by their actions. This inequity is an appealing target for action and market-based policy instruments such as a 'pre-disposal charge' for consumer plastic bags and a deposit-refund system for PET container recycling would appear to be attractive in these cases.

## CONCLUSION

Because this paper is short, the treatments given above leave out many subtleties and details, some of which might be important in making a particular market-based measure more attractive or less so in a specific situation. Clearly, in actual policy-making much more in-depth information and analysis would be required. Yet, the examples given above hopefully are suggestive of both the wide scope for market-based measures and indicative of some of the practical considerations which may affect the choices made by policy makers.

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## Environment Research Center of The Korea Institute of Science and Technology

### BACKGROUND

Since its inception as the first multi-disciplinary research institute in Korea in February 1966, the Korea Institute of Science and Technology (KIST) has played a pivotal role in advancing science and technology and has made a substantial contribution to Korea's emergence as a newly industrialized country. KIST's involvement in environmental research began in 1969 with the establishment of the Urban Planning Laboratory and grew in 1990 with the establishment of the Environment Research Center (ERC). ERC was created to facilitate 'integrated research' in which scientists and engineers from various disciplines work closely together on a common project. As of mid 1994 ERC has more than 60 full-time research staff, including 18 who hold doctorates.

### ACTIVITIES

ERC is responsible for developing technologies and techniques to address environmental problems including those relating to air, water and waste. It also undertakes research in environmental biotechnology.

### MANAGEMENT STRUCTURE

The ERC has one director, five principal investigators and one chief senior researcher. All senior principal investigators were trained abroad including the United States, the United Kingdom, Germany, Australia and Japan. As with KIST generally, ERC draws not only on the expertise of its own staff, but also from the resources of Korea's leading universities and from overseas. Project-based specialists are hired as appropriate for specific project work. Within

an average year ERC employs more than one hundred person years of effort, exclusive of administration. Research is carried out by four 'teams' as described below.

### RESEARCH

#### Atmospheric and Global Environment Team

In its relatively short history, the Atmospheric and Global Environment Team has carried out monitoring projects involving international co-operation on the long-range transport of pollutants. The main goal of this team is to develop up-dated technologies for the measurement and control of air pollution. Primary research projects include technology development for air pollution, air pollution monitoring and applications, study of acid precipitation and smog phenomena, development of technology and strategy evaluation in response to global climate change, and air pollution impact assessment and comprehensive air pollution management.

#### Water Environment Technology Team

This team is the oldest within the Center and includes an analytical laboratory and many experienced team members. Research focuses on developing innovative technologies for water and waste water treatment. The final goal of most projects is technology transfer to industry for commercialisation. The major ongoing research projects are process development of biological nutrient removal, technology development for recalcitrant industrial wastewater and water reuse in industry. The team's research programme ranges from fundamental investigations in the laboratory through pilot-plant and full-scale applications. Many technologies are investigated under sponsorship by government and industries.

### **Waste Control Team**

This area is one of those most in demand in Korea. The major ongoing research projects are: development of treatment, recovery and residuals disposal techniques for municipal, industrial and hazardous waste materials; technology development for preventing soil contamination; and recycling technologies for nightsoil and livestock wastes. The research programme ranges from laboratory investigations through pilot and full scale applications. The major purpose of most projects is development of better waste minimization and recycling technologies and restoration of contaminated soils.

### **Biotechnology Team**

This is a new team whose major interests are the selection of appropriate micro-organisms and development of microbial processes useful for the control of air, wastewater and solid waste pollution. Recently, the team developed an electrochemical process to remove sulfur compounds in petroleum using anaerobic microorganisms. Other major research projects include microbial fixation of carbon monoxide in flue gas, control of microbial contamination

in fermentation processes for ethanol fuel, and development of standard test methods for biodegradation of plastics.

### **OTHER ACTIVITIES**

ERC is increasingly active in consultancy and training. ERC's researchers act as consultants for industry and government in Korea and other countries. ERC also provides a number of training programmes in such areas as environmental measurement, management, analysis, assessment and modelling for Korea and countries in Southeast Asia under funding by the Korea International Cooperation Agency.

### **FURTHER INFORMATION**

To obtain further information on the research, consultancy and training activities of the Environment Research Center please contact: Dr Kil Choo (K.C.) Moon, Director, Environment Research Center, Korea Institute of Science and Technology, Cheongryang, P.O. Box 131, Seoul, Korea, Tel (882) 962-8801, Fax (822) 969-0230.



## Economy and Environment Program for Southeast Asia

### BACKGROUND

The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics. EEPSEA provides fellowships and research grants to locally-based Southeast Asian researchers. Its objective is to enhance local capacity to undertake research on the economics of environmental management.

To this end, the programme provides not only financial support but also meetings, resource persons, access to literature, publications outlets, and opportunities for comparative research across member countries. Member countries are Thailand, Malaysia, Indonesia, the Philippines, Vietnam, Cambodia, Laos, China, Papua New Guinea and Sri Lanka.

### STRUCTURE

EEPSEA consists of a Sponsors' Group, a Programme Committee and a Secretariat. The Sponsors Group of participating donors, sets policy, provides financial support, and approves the annual programme of work and budget. As of January 1994, the Sponsors Group consists of IDRC (Canada), SAREC (Sweden), DANIDA (Denmark) and the UNDP. The Programme Committee consists of senior scholars and policy makers from the region and international resource persons. It sets priorities for research and training and recommends to the Sponsors Group the annual work programme. A small Secretariat and library are located in Singapore. It administers the programme and provides technical support to researchers.

### RESEARCH ACTIVITIES

EEPSEA's research programme focuses on the in-

ternalization of external costs. There is widespread interest in minimizing pollution and resource degradation by ensuring that economic agents face the full economic, social and environmental costs of their activities. But many difficult questions tend to arise in efforts to achieve this end. For example,

- what is the economic value of the environmental damage incurred by a given activity?
- what roles should sectoral, macroeconomic and trade policies play in achieving 'full-cost' pricing?
- what roles do community management of resources, changes in environmental property rights and other institutional factors play?
- what factors affect the political and administrative feasibility of price changes?
- does full-cost pricing have negative effects on the poor and how might these be mitigated?
- what are the alternatives to pricing policy? and
- what are the implications of full-cost pricing for economic growth and structural change?

EEPSEA provides grants to Asian scholars to carry out research within the framework described above on topics of the researchers' choosing. Researchers will often investigate one aspect of a problem initially (for example, valuation of environmental costs or benefits) and explore its implications in subsequent phases.

There is no restriction on the sectors or problems that research projects may address. Projects have covered such topics as: least-cost pollution abatement measures for tanneries in Manila; water pricing in Nanjing; and environmental costs and benefits of rural sanitation options in Vietnam.

Grants are normally made for a one-year period and are renewable. The maximum grant size is US\$15 000 and may include a modest honorarium. Projects may be carried out by individuals or by teams, and by senior researchers or those new to environmental and resource economics. Grants may

also be used to cover the costs of Ph.D. fieldwork, though EEPSEA does not pay tuition or residence costs. Applicants should obtain a copy of the *Guidelines for the Presentation of Research Proposals* from the EEPSEA Secretariat in Singapore at the address given below. Research proposals and the results of completed projects are presented for review at EEPSEA's twice-yearly conferences. EEPSEA workshops also include presentations of research results from non-EEPSEA supported projects in Asia and elsewhere.

From time to time, on the advice of the Programme Committee, EEPSEA also initiates *comparative networks*, in which researchers from several member countries carry-out research on a common theme. Topics for networks in 1994-96 include water pricing; economic valuation of the health effects of pollution; and environmental tax reform. In some cases, the grants provided through these networks may exceed the US\$15 000 applied in the open category. Researchers with a specific interest in these topics should contact the EEPSEA Secretariat.

#### FELLOWSHIPS

A limited number of fellowships are available for

researchers who have some training in economics but who would like to become familiar with concepts and methods in environmental and resource economics. The fellowships are used to support the attendance of awardees at short courses (4-6 weeks) offered in Asia or overseas. EEPSEA can assist in identifying suitable courses as well as providing financial assistance. Fellowship recipients are normally expected to join the EEPSEA research network after completion of their training, carrying out research projects approved through the process described above. Applicants for fellowships should submit a curriculum vitae and a letter indicating how they would apply the training received (e.g. in teaching, research or policy analysis).

EEPSEA's Secretariat has also produced a number of working papers, which provide an entry point to literature in this field, and are available on request (i) 'Annotated Bibliography on Economy and Environment', (ii) 'Economic Growth and the Environment: A Debate', and (iii) 'Structural Adjustment and the Environment'. For documents or further information, please contact: Director, Economy and Environment Program for Southeast Asia, c/o International Development Research Centre, Tanglin P.O. Box 101, Singapore 9124, Fax 235-1849, Tel 235-1344.



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