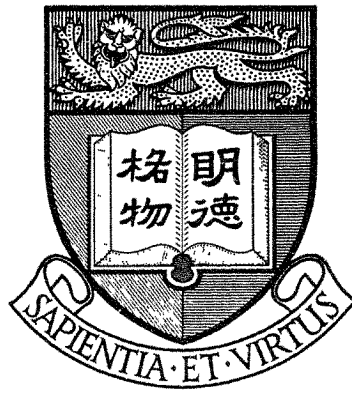


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From the Editor

AJEM is pleased to present this special issue on environmental law in Asia. Law plays a key role in environmental protection and the importance of the “rule of law” is perhaps as crucial for the environment as it is for human rights and the working of modern economies.

Jill Cottrell, Associate Dean of the University of Hong Kong Faculty of Law, serves as Guest Editor for this issue.

Introduction to This Special Issue on Environmental Law in Asia

Jill Cottrell

The first time I attended a conference on the environment most of the other participants were engineers and scientists, and several of them seemed quite surprised that a lawyer should be at the conference at all! Maybe this was because, as Julia Deans observes in her paper in this issue of *AJEM*, lawyers do not seem to be heavily involved in environmental issues in this region. Nor indeed are environmental lawyers in over-supply.

No readers of this journal, I am sure, would feel any sense of surprise that there is any relationship between environment and law. The contributions to this special issue are by a mixture of academic and practising lawyers and show a number of dimensions of legal issues in the region, and also manifest a number of common concerns.

All the papers are, as readers would expect, are by authors who have a real concern for the environment, and who believe that the law does have a positive contribution to make to its protection. The paper by Julia Deans and that by Zhang Hongjun and Richard Ferris draw to a considerable extent on personal experience as lawyers advising foreign companies who have invested in the region, or who wish to do so. Julia Deans covers a number of countries, the other paper concentrates on Mainland China. Cynics may believe that it is the job of lawyers to advise their clients how **not** to abide by the law, but I think that readers will see that the concern of these lawyers is to guide their clients as to how to comply with the law. From the perspective of government and business alike it is obviously a great deal preferable that the latter should plan to meet its legal obligations without incurring the risk of litigation or administrative penalty or 'hassle' rather than be dragged kicking and screaming to compliance.

Tony Oposa writes as a practising lawyer and law teacher. Like Zhang Hongjun from China, he writes as an insider to the country of which he writes, namely the Philippines. He also writes of matters in which, as a practising lawyer, he has been intimately involved. Bryan Bachner is an academic, and takes a somewhat unoptimistic view of the prospects of Hong Kong's working in a very effective way towards sustainable development.

One of the very striking things about these papers is that they all show how much legislation has been produced over the last decade or so in the countries of Asia. Almost every country has been pouring out acts and regulations in a way that presents a threat to the world's forests in itself! It is from the papers of Oposa and Bachner that one gets the strongest impression that passing legislation is no guarantee of the effectiveness of environmental protection. The forces of business and of vested interests, the lack of that elusive quality political will, all too often stand in the way of full implementation even of excellently intentioned and drafted legislation.

Those with a concern for the environment need no reminding that the environment of individual countries cannot be considered as discrete matters. What happens in one place will have all sorts of implications for others. The food tastes of Hong Kong have destructive implications for the coral reefs of Philippines and Indonesia; water and air pollution does not stop at national boundaries; waste from one country may be delivered unintentionally — by wind and water — or intentionally — in the form of traded waste — to someone else's environment. There are a number of reminders of these facts in these papers.

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But there are reminders of the international implications of law, as well. Several of the papers refer to international law — the law of treaties, bilateral or multilateral, or of customary international law, by which individual countries or jurisdictions may be bound to protect the common environment, or the concept of sustainable development, which has received the endorsement of international legal instruments. Readers will, for example, find several references to the Basel treaty on the Trade in International Waste, the Convention on Biological Diversity, the Vienna Treaty on the Protection of the Ozone Layer and the Montreal Protocol to that treaty, the Framework Convention on Climate Change (FCCC), the Convention on International Trade in Endangered Species (CITES), the London Dumping Convention (Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter), the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), or the non-binding Rio Declaration. They may also be interested to know which

of the countries in the region are bound by these various treaties. In fact most of the major ones are parties to the major treaties, as the following table shows¹ (no distinction is drawn between Ratification, Accession or Acceptance or Coming into Force).

There are other international legal ramifications which can be traced in the articles here. Julia Deans points to the influence of models of law from the US, Canada and other countries. These may be copied in the region, as the result of general practices of copying the legislation of certain countries. For example, Hong Kong has very often copied legislation from the UK, and other former colonies may also sometimes look to the UK or other Commonwealth member countries. Others may look to Germany (Japan has taken much of its modern system of law from Germany, though it does not follow that this is true of environmental law, too). Trade, aid and other links may well mean that the law of particular countries has an influence, as may the presence of experts from another country. There is a distinct tendency for lawyers to advocate the adoption of systems of

Table

Treaty	PRC	HK	Japan	Korea	India	Mal'ia	S'pore	Indon'a	Phil's	Cam	VN
Basel ^a	Y	*	Y	Y	Y	Y	Y	Y	Y		Y
Biodiversity ^b	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
Ozone layer (Montreal Protocol) ^c	Y	*	Y	Y	Y	Y	Y	Y	Y		Y
FCCC ^d	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
CITES ^e	Y	*	Y	Y	Y	Y	Y	Y	Y	Y	Y
London Dumping	Y	*	Y	Y					Y		
Ramsar ^f	Y	*	Y	Y	Y	Y		Y	Y		Y

* Referring to Hong Kong means that this treaty was applied by the UK to the territory when it was a colony and has been agreed by the UK and China through the mechanism of the Joint Liaison Group to apply after the return of sovereignty to China. (See http://www.hku.hk/ccpl/mt-subject-order_1Page2.html – website of the Hong Kong Treaty project, Centre for Comparative and Public Law, University of Hong Kong.)

^a Source: <http://www.unep.ch/basel/index.html>

^b Source: <http://www.biodiv.org/conv/ratify.html>

^c Source: <http://www.unep.ch/ozone/ratif.htm>

^d Source: <http://www.unfccc.de/>

^e Source: <http://www.wcmc.org.uk:80/CITES/english/parties1.htm>

^f Source: http://iucn.org/themes/ramsar/key_cp_e.htm

¹ Apart from the other specific sources listed, the following website has information on ratifications etc:
http://sedac.ciesin.org/prod/charlotte?state=BasicQuestions&event=question3&protocol=enri&charlotte_server=sedac.ciesin.org&charlotte_dir=prod&charlotte_db=ENTRI

law with which they are familiar, whether in the constitutional, commercial or environmental field.

Another form of international influence which more than one contributor comments on is the set of international standards known as ISO 14000 series. These do not have the force of law, but they may, as Deans for example points out, have some legal implications. If one company will not contract with another save on the basis that the second adopts an environmental management system, and if the second is keen enough to enter into a contract that it does indeed follow this course, the system has almost the force of law!

Systems that operate a doctrine of precedent, which in this part of the world means the Commonwealth countries plus the Philippines and Hong Kong, may well emulate decisions of other countries operating a similar system. Lawyers may cite in court the decisions of Canadian, US or English courts. One country the decisions of which have been cited with enthusiasm by academics and sometimes by courts in recent years has been India. In this issue more than one article mentions the environmental cases brought especially in the Indian Supreme Court. Particularly influential has been the development of the concept of public interest litigation which has enabled individuals and organisations to bring cases representing the poor and the disadvantaged, in the environmental as well as other contexts, before the highest court in India. This development has inspired lawyers in countries such as Malaysia and the Philippines, among others.

Julia Deans also points to another form of international link: that is cases on environmental issues which are brought, not in the courts of the countries affected, but in those of other countries where it is thought the legal system may be quicker, or give more effective remedies, or bring the issue home to the shareholders in multinational companies. She mentions a case in the USA by Indonesians affected by the Freeport mining company, the Bhopal case which was sought to be brought before the USA courts, the case against the Ok Tedi mine in Papua New Guinea brought in Australia. One might add the case brought in the UK which led to the cancelling of British government aid to the Pergau dam in Malaysia on the basis that the purpose of the aid was not actually the development of Malaysia but the furtherance of British interests (*R v Secretary of State for Foreign Affairs, ex parte World Development Movement*, 1995)! The world is one country,

one might think, not only environmentally, but even to some extent legally!

The contributions here show that both legislatures and courts in the region have been active in the environmental law field. But there is no room for complacency. One of the reasons why courts like the Supreme Court of India are called upon to make revolutionary developments in terms of procedure and constitutional rights, why indigenous peoples or the victims of Bhopal try to bring their cases before the courts of Australia or the United States, is because the law, however good it looks on paper, is not working. The *Minors Oposa* case, and the other cases so interestingly discussed here are apparently rare examples in the Philippines courts (see *Oposa*, this issue). The *Malaysian Rare Earth* case, as Julia Deans says, was reversed by the Court of Appeal, as was the *Kajing Tubek* case brought by longhouse residents in Sarawak over the construction of the Bakun Dam (see Deans, this issue). The Bhopal case did not receive a substantive hearing before the courts of the US — the judge said there was no reason why the case could not come before the courts of India. The *Beanal* case before the Louisiana courts was also ultimately unsuccessful. Litigation before the Hong Kong courts in the field of environmental law is very limited indeed, though no-one claims this means that the law is a resounding success! The Indian developments have been the most sustained in this field, in the region at least. But although the Supreme Court, and to a lesser extent the High Court which operates at the State level, has produced some remarkably sweeping orders, it will not escape the attention of the even slightly perceptive reader that one man seems to bring many of them. M C Mehta's name appears in several of these articles. The cases, though they have the same name — *M C Mehta v Union of India* — are not the same case. Though there are other cases with other plaintiffs, and the citation of these particular cases is partly due to Mr Mehta's international reputation and contacts, it is significant that this one man is so prominent. Nor will the newspaper reader be ignorant that Delhi (with, for example, Beijing and Bangkok) is one of the most polluted cities in the world!

Readers might be interested in a little more information about the *Beanal* case — since they are unlikely to be able to read details of it conveniently. Tom Beanal brought an action originally intended to be on behalf of himself and other indigenous people similarly affected by the Freeport mine. For

reasons connected with the Louisiana requirements as to class actions he ended up suing only on his own behalf. He claimed violation of international environmental law, genocide and torture. On the environmental front the court described his claim thus:

Plaintiff alleges that Freeport's mining operations and drainage practices have resulted in environmental destruction with human costs to the indigenous people. The mine itself has hollowed several mountains, re-routed rivers, stripped forest and increased toxic and non-toxic materials and metals in the river system. Another culprit is discharged water containing tailings from Freeport's mining operations, for it is from this discharge that a stream of environmental and human problems flow, including:

1) pollution, disruption and alteration of natural waterways leading to deforestation, 2) health safety hazards and starvation, 3) degradation of surface and ground water from tailings and solid hazardous waste.

Beanal alleges that the tailings drainage is mismanaged. Beanal further alleges that acid mine drainage is equally devastating, due to resulting sulfide oxidation and leaching, and also inadequately managed. In summary, Plaintiff complains: Plaintiffs specifically allege that defendant corporations have failed to engage in a zero waste policy, unacceptable enclosed waste management system, have failed to maximize environmental rehabilitation, have failed to engage in an appropriate acid leachate control policy, have failed to adequately monitor the destruction of the natural resources of Irian Jaya and have disregarded and breached its international duty to protect one of the last great natural rain forests and alpine areas in the world.

His case was thrown out on what people are inclined to refer to as 'technicalities'. This means the court was never called upon to decide whether there was torture, genocide and environmental degradation caused by the mine. We are concerned here with the alleged environmental crimes. The court said:

Plaintiff states that the allegations support a cause of action based on three international environmental

law principles: (1) the Polluter Pays Principle; (2) the Precautionary Principle; and (3) the Proximity Principle. None of the three rises to the level of an international tort [Sands, 1995: 183-18]. Sands includes the three principles mentioned by Plaintiff in a list of general rules and principles 'which have broad, if not necessarily universal, support and are frequently endorsed in practice.' (Id. at 183). Also listed are (1) the good-neighborliness and international co-operation principle and (2) the following rule, regarded [as] the cornerstone of international environmental law: 'The obligation reflected in Principle 21 of the Stockholm Declaration and Principle 2 of the Rio Declaration, namely that states have sovereignty over their natural resources and the responsibility not to cause environmental damage.' Sands concludes: Of these general principles and rules only Principle 21/ Principle 2 and the good neighborliness/international co-operation principle are sufficiently substantive at this time to be capable of establishing the basis of an international cause of action; that is to say, to give rise to an international customary legal obligation the violation of which would give rise to a legal remedy. The status and effect of the others remains inconclusive, although they may bind as treaty obligations or, in limited circumstances, as customary obligations. (Id.) The three principles relied on by Plaintiff, standing alone, do not constitute international torts for which there is universal consensus in the international community as to their binding status and their content. More to the point, those principles apply to 'members of the international community' rather than non-state corporations. Plaintiff alleges that Freeport's environmental practices reflect corporate decisions, rather than state practices. A non-state corporation could be bound to such principles by treaty, but not as a matter of international customary law.

The other claims, genocide and human rights violations, were finally thrown out in 1998. The Freeport-McMoran corporation was reported to have close ties with lately deposed president Suharto. Maybe politics will at the end of the day be more important for the Amungme people than law, Indonesian or American — or international!

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A Legal Look at Environmental Risks and Liabilities in Asia

Julia Deans¹

ABSTRACT

This paper is intended to provide a general overview of environmental risk and liability assessment in Asia. It begins by considering the extent to which organisations in Asia assess the environmental risks associated with their activities in the region. The paper next examines each of the forces driving the level of risk assessment higher. Those identified by the paper are environmental law trends in other parts of the world, legal developments within countries in the region, public opinion, environmental non-governmental organisations (NGOs), foreign laws and litigation and manufacturing and auditing standards. The paper concludes with a brief discussion of how, from a legal perspective, environmental risks and liabilities can be assessed and dealt with.

Keywords: *environmental law, litigation, enforcement, liability, risk assessment*

INTRODUCTION

While many organisations have downplayed environmental risks and liabilities in Asia in the past, various forces are pushing them higher up the agenda. The potential impact of some of these forces has been dramatically illustrated in a number of recent environment-related situations. Consider, for example, the following:

Bhopal, India, 1984: litigation arising from the Union Carbide toxic gas leak, which killed thousands of people and injured hundreds of thousands, was started in the United States and finally moved back to and settled in Indian courts. The cost to Union Carbide was tremendous: a US\$470 million settlement fund, against which 600,000 claims have been made; an additional US\$20 million payment to construct a hospital; a US\$3 billion debt to avoid an ad-

verse takeover bid; and over US\$50 million in litigation expenses. (Prince & Nelson, 1996: 272 and for court-related materials, Baxi and Dhanda, 1990).

Asian Rare Earth Board, Malaysia, 1993: Mitsubishi Chemical of Japan experienced almost nine years of litigation with Malaysian residents concerned about environmental hazards such as radiation and the release of radon gas (the handling of rare earth substances had been severely restricted by Japanese environmental laws in the previous decade) (*Woon Tan Kan v Asian Rare Earth Sdn Bhd.* 1994; Ichihara and Harding, 1995: 2-3). Malaysia's Court of Appeal overturned a High Court ruling that the joint venture's storage of its waste constituted a nuisance and that many people would suffer irreparably in the future in the absence of an injunction (Ichihara and Harding, 1995: 4).

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Mitsubishi Chemical announced plans to close the facility and pull out of Malaysia within days of the Court of Appeal decision, leading at least one commentator to conclude that, even if Mitsubishi won in court, and perhaps avoided an award against it, the local residents obtained the ultimate victory (Ichihara and Harding, 1995: 5).

- Ok Tedi copper mine, Papua New Guinea, 1994: PNG residents made a US\$3 billion claim in the Supreme Court of Victoria against Broken Hill Proprietors, the mine's Australian shareholder, for environmental damage caused by mine tailings (Prince and Nelson, 1996: 275; *Dagi v BHP (No. 2)* (1997).
- Marcopper Mining Corporation, the Philippines, 1996: after non-toxic tailings leaked from a holding pond into a nearby river, Marcopper, which is partly Canadian-owned, found itself a political scapegoat for public discontent about government inaction on the environmental front. The government charged representatives of Marcopper and threatened to prohibit the company and its shareholders from continuing mining operations in the country. The tenor of the government's response appeared to soften in the face of the company's cleanup efforts (at a cost of US\$40 million), but the matter remains unresolved (*Toronto Star*, 1996; Tauli-Corpuz, 1996).

CURRENT LEVEL OF RISK ASSESSMENT

Many developers and investors in Asia and elsewhere see increased environmental protection and regulation as a threat to economic development, as well as, of course, to their potential profits. Multinationals used to dealing with the burdensome environmental regimes in their home jurisdictions are relieved if they are able to move environmental issues down their Asian agendas, behind concerns relating to joint venture partner relationships, labour, taxes, distribution and other pressing problems.

In the author's experience, companies and other organisations in Asia often devote less attention to environmental risk assessment and management than their counterparts elsewhere in the world. There are, however, exceptions, such as the international development banks and agencies and some multinational organisations. Their example may be

among the forces that lead Asian organisations to increase the time and resources they devote to environmental issues.

International Institutions

International institutions such as the Asian Development Bank and the World Bank have a mandate to promote environmental protection. They have well-developed environmental review programmes in respect of their Asian projects and may impose environmental standards as a condition of their lending, insurance or other participation. These institutions influence the development of environmental standards within host countries, and also provide the international investment community with benchmark environmental guidelines (Esty, 1995: 101). This is important given that private foreign investment flows into Asia are probably three times the size of official funding for environmental programmes in the region, and so have a potentially much greater impact on the environment, be it negative or positive (Esty, 1995: 99). International institutions have refused to participate in several high-profile projects due to their expected environmental implications, among them the United States Export-Import Bank, which provides export finance for American goods and services. In May, 1996, the Ex-Im Bank rejected funding for exporters looking for contracts on the US\$30 billion Three Gorges dam project in China on the basis that the project failed to meet the Ex-Im Bank's environmental guidelines (Export-Import Bank of the United States, 1996).

Generally, development banks categorise a project according to its expected environmental impact and whether it requires an initial environmental examination, an environmental impact assessment, or both (Asian Development Bank, 1993: 2; Mahony, 1995: 98). In the case of the ADB, an environmental assessment must be submitted to the Bank's Board at least 120 days before the Board considers the project. The Bank conducts compliance audits during project implementation and, for environmental programmes, also conducts post-evaluation assessments to determine the programmes' value. The Bank's environmental guidelines apply to its private sector operations as well as to its traditional loan and technical assistance projects. In the case of the Bank's equity investments, environmental issues are primarily dealt with by way of covenants to comply with the environmental requirements of the Bank

and/or the host country (Asian Development Bank, 1993: 9) The ADB has used environmental loan covenants in its loan agreements for over a decade (Asian Development Bank, 1995: 11).

Multinational Companies

Multinational companies deal with environmental issues in various ways: while some simply react to fines or other enforcement actions, others comply with laws in force or even establish company standards that meet or exceed those laws. It is fairly common for multinational companies to establish corporate policies and environmental management standards concerning their operations and to attempt to abide by those policies and standards wherever they do business, even in jurisdictions with less stringent environmental regulations. Most multinationals anticipate increased environmental regulation and enforcement in the future. In addition, they may wish to take advantage of pollution control technologies and management methods they have developed in other jurisdictions. In most cases, using these technologies will also make financial sense for the company, at the very least in terms of improved energy and resource efficiency and reduced waste treatment and disposal costs.

When entering into transactions in Asia, multinationals may conduct environmental due diligence, which may include environmental evaluations of the sites and facilities at issue. Some multinational companies find government officials in Asia more stringent about environmental permitting and other matters involved in project startup than they are in ongoing enforcement matters (although, as discussed below, this may change). Given this perception, some multinational representatives are not as concerned about environmental issues as they might be elsewhere, and thus the depth of their initial investigations may be somewhat lower, in some cases much lower. For example, an international bank that, in other jurisdictions, will not issue loans without considering potential environmental risks associated with the borrower or the object of the loan, may be prepared to lend in Asia without fully considering such risks.

Also in contrast to jurisdictions such as North America, corporate environmental risk management, as well as permitting and other liaison with government officials, is often handled almost entirely by international technical consultants or internal envi-

ronmental health and safety staff. These functions may be performed on a world-wide or regional basis, and those responsible may be assisted by outside technical and legal experts, sometimes retained locally.

In the author's experience, lawyers generally play a relatively limited role in environmental management in Asia. The concept of an Asian environmental lawyer has yet to take firm root: there are relatively few people trained in and familiar with environmental law in Asia, and many of those are academics as opposed to practitioners. In some cases, environmental lawyers from foreign jurisdictions are involved in planning and overseeing environmental investigations in Asian transactions. In others, however, the legal consequences of environmental risks are simply not determined or dealt with during negotiations or in the transaction documentation. If legal advice with respect to environmental issues is sought, it may not be sought until after an agreement is made, when problems arise.

FORCES PUSHING TOWARDS MORE ENVIRONMENTAL RISK ASSESSMENT

Environmental Law Trends Elsewhere

In North America and other jurisdictions where environmental liabilities have taken on a critical role in many business transactions, the experience has been a wrenching one. Some of its extremes are ones that many people in Asia (and elsewhere in the world) definitely *do not* want to go through here. Like it or not, however, the North American experience cannot be ignored. It influences and, in many cases, provides the starting point for developments in Asian environmental law and, therefore, must be considered by companies and others thinking about how to approach environmental risk and liability assessment in Asia. Lender liability is an area that demonstrates the degree to which environmental issues have affected business operations in North America and elsewhere.

Lenders have become very careful about assessing the environmental risks and liabilities associated with the objects of their financing, for two main reasons (see generally Jarvis & Fordham, 1993). First, lenders are concerned that environmental liabilities may reduce the value of their security or

may even exceed the value of the loan. In many jurisdictions, fines for environmental problems may become a charge against the land: even if lenders cannot be forced to pay to resolve environmental problems, the value of their security can be affected. In a project finance situation, environmental cleanup and other requirements may affect project timing and completion and, in some situations, lead to default if there are unexpected liabilities or costs. Lenders involved in long-term financing situations in Asia would be prudent to consider the extent to which their projects may be subject to these environmental risks.

Lenders (and receivers) are also concerned about their potential liability for environmental problems if the borrower defaults. In some jurisdictions, lenders who take action in respect of secured assets or property subject to environmental problems have fallen into the wide net of potentially responsible parties that regulators can cast when seeking funding for site cleanup costs. Generally, this concern arises because environmental legislation imposes liability upon those with 'charge, management or control' of the source of a contaminant (for example, section 7(1) of Ontario's *Environmental Protection Act*, R.S.O. 1990, c.E-19). Although legislation such as the United States' Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (commonly known as the 'Superfund' legislation) generally exempts lenders, the courts have held that this would not protect lenders who were able to influence management decisions at the borrower's facility (for example, *United States v Fleet Factors*, 1990). The uncertainty this caused lenders has, however, been addressed in CERCLA amendments which confirm that lenders will be liable only if they exercise control over actual decision making, not simply because they may be able to influence management (section 2502, *Asset Conservation, Lender Liability and Deposit Insurance Protection Act of 1996*, 110 Stat. 3009-462 (1996)).

Lenders and receivers in other parts of the world have faced similar uncertainty in assessing their potential liability *vis à vis* environmental problems. In 1992, legislators amended Canada's *Bankruptcy and Insolvency Act* to limit the liability of trustees and receivers to matters arising subsequent to their appointment where they are guilty of wilful misconduct or gross negligence (the former standard was due diligence) (now *Bankruptcy and Insolvency Act* s. 14.06(2)).

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Domestic Legal Developments

Legislation

Asian countries have introduced new and amended environmental legislation at a brisk rate. There is public and international pressure on Asian governments to improve the environment now and for the future. In addition, many Asian governments, like those elsewhere in the world, have committed themselves to a growing number of treaties and other international statements of principle aimed at linking environmental and economic development. These include the Basel Convention, the Rio Declaration of principles concerning sustainable development, the GATT and the World Trade Organisation. There have also been similar statements by ASEAN and APEC and other Asia-focused groups, designed to introduce a regional perspective and to advance these issues (see generally Rose, 1995).

An overall trend toward higher fines for environmental offences can be seen across the region. Thailand, for example, has been implementing its *Hazardous Substances Act 1992*, which provides for penalties for non-compliance of up to 1 million baht (*Asia Pacific Legal Developments Bulletin* 1996: 34). Hong Kong's environmental impact assessment legislation, adopted relatively late by a government which had avoided environmental regulation for fear of interfering with the economy, introduced fines of up to HK\$5 million (US\$650,000) for non-compliance (*Environmental Impact Assessment Ordinance* 1997). The depth of environmental regulation, however, ranges widely across the region. While Cambodia was developing its first environmental laws, Japan introduced a Container and Packaging Law, making certain businesses (primarily those involved in packaging) responsible for collecting and recycling waste containers and packaging collected by the government ([1996] 4 (2) *Environmental Liability* CS25).

Enforcement

Levels of enforcement also vary across the region. In some cases, a lack of money, skills, and equipment are to blame for uneven and under-equipped enforcement. In others, enforcement has simply not been considered a priority; given the choice between shutting down a plant for environmental violations and maintaining local jobs, enforcement has tended to lose out. Singapore, of course, is often touted as

an exception to generalisations about environmental laws not being well enforced in Asia.

There have been, however, signs of change in attitudes towards enforcement. In China, for example, there are frequent announcements of crackdowns on industrial polluters. Although the sanctions for these polluters are generally administrative and civil rather than criminal (even when criminal sanctions are available), there have been cases in which Chinese judges have awarded significant damages (Hong, 1995: 29) and, for pollution causing death, the death penalty (Bachner, 1996: 382–3, 388).

Countries without comprehensive environmental law regimes and/or enforcement resources may use alternatives to expensive command and control methods. A Filipino environmental lawyer, Tony Oposa (1996), has suggested that a ‘candy and needles’ approach is also better suited to the culture of Asia, where the threat of losing reputation or face may be a more effective deterrent than the threat of fines. For example, Indonesia’s national environment agency, BAPEDAL, introduced a programme to rate the environmental performance of polluters from black to gold, and then publish the ratings in the media. By the time full public disclosure of the ratings was first made in December, 1995, half of the polluters rated black the previous June had improved their rating. Multinationals were the best performers, followed by public organisations, and then private domestic organisations (Wheeler & Afsah, 1996:12).

Judicial Decisions

In addition to new legislation, important judicial decisions affecting businesses and others have raised the need to consider the possible consequences of environmental actions in Asia. Indian courts, for example, have interpreted the fundamental right to life in Article 21 of India’s Constitution to include a right to a clean environment, which has significantly improved the access of public interest litigation and environment-based claims to India’s highest courts (Lau, 1995: 18–19; an example of this litigation is *Rural Litigation and Enlightenment Kendra v State of Uttar Pradesh*, 1987). In addition, in 1996, India’s Supreme Court issued a directive ordering polluting industries to move out of Delhi and New Delhi, India’s extremely polluted capital and one of the world’s most polluted cities. One hundred and sixty-eight of the most serious polluters were given

notices to vacate, while 762 others received “show cause” notices – in other reasons to make a case for the same treatment not being applied to them (*M C Mehta v Union of India*, 1996). Industries wishing to start operations in the capital were being directed to outlying areas. That directive reportedly resulted in a tripling of prices for industrial land within 40–50 kilometres of Delhi (Nadkarni, 1996).

Courts in Asia have proven themselves willing to deal with environmental claims. In 1995, in Japan, a settlement agreement was reached with victims of Minamata disease, which they caught by eating fish contaminated due to discharge from local chemical companies. The 2.6 million yen per person settlement (plus 4.94 billion yen to cover legal and other expenses) came almost 40 years after the disease was first officially recognised (*Environmental Liability*, 1996).

Even where judicial remedies are available to address pollution problems, however, people have not always been inclined to use them. In theory, for example, Hong Kong people may sue polluters on the basis of such common law theories as negligence, nuisance, trespass, and strict liability based on *Rylands v Fletcher* (1868) but few individuals have brought common law or other actions in respect of environmental matters. This is because of the high cost of legal proceedings in Hong Kong, the disparity of resources between individual plaintiffs and most polluters, and the uncertainty concerning the meaning and application of Hong Kong’s environmental legislation (see generally Bachner, 1996: 404).

Public opinion and Non-Governmental Organisations (NGOs)

The fear that North American protesters may boycott their products or picket their headquarters has caused many a multinational to pay more attention to environmental issues in Asia. As one Hong Kong banker stated, ‘our worst nightmare is protesters marching outside our president’s Park Avenue office.’ In Asia, too, despite a continued focus on achieving economic development, there is a growing public sense within the region that economic gains must not be at the expense of a liveable and sustainable environment. In addition, Asian investors and businesses are now seeing market trends favouring environmentally friendly businesses, such as ethical investing (e.g. ‘green funds’) and the

demand for green products (*East Asian Executive Reports*, 1995).

In part, improved public awareness has come about because people have better access to information about their environmental situations. New technologies such as the Internet have given environmentalists and others easy access to environmental information and strategic advice. In a Filipino case challenging the excessive granting of logging concessions as violating the rights of future generations, the plaintiffs' lawyer developed the catchwords for his case — 'intergenerational responsibility' — in part through e-mail conversations with environmental law contacts in the United States (personal conversations with Tony Oposa, the plaintiffs' lawyer in *Minors Oposa v Secretary of the DENR*, and see Oposa, 1998, this issue of *AJEM*).

Public opinion still plays a relatively minor role in planning decisions in Asia, but this may change. The ADB, for example, has recognised a role for NGOs in its project evaluation process: NGOs must be given access to EIAs or the ADB will discontinue its project involvement (Asian Development Bank, 1993: 4). Projects expected to have significant adverse environmental impacts and other selected projects must develop for external review a summary environmental assessment that considers, among other things, the views of NGOs and affected groups.

In other cases, public interest groups are forcing themselves into the planning process. In Bangkok, for example, some environmentalists overcame their traditional reluctance to speak out concerning various aspects of plans for a new light rail transit system. In July, 1996, Malaysian environmentalists got a court order that stopped work on the US\$4.5 billion Bakun hydroelectric dam project (*Kajing Tubek v Ekran Bhd.*, 1996). Although the order was later overturned, this certainly demonstrates the growing commitment of Asian environmentalists to turn their concerns into action. Finally, under pressure from environmentalists, operators of the PT Freeport Indonesia gold and copper mine in Irian Jaya reportedly stated that they may not have paid sufficient attention to environmental and social matters and established an environmental affairs department as a result (*South China Morning Post*, 26 September 1996). Earlier in 1996, Freeport-McMoran agreed to create a trust fund to finance significant environmental remediation initiatives as part of an agreement to terminate arbitration pro-

ceedings with the American Overseas Private Investment Corporation (OPIC). The arbitration arose out of OPIC's termination of \$100 million in political risk insurance for the company's Grasberg mine in Irian Jaya, Indonesia, in October 1995 (Overseas Private Investment Corporation, 1996).

Even foreign investors have voiced the need for better environmental regulation. In 1996, various chambers of commerce in Manila surveyed their members' attitudes concerning industrial waste disposal regulation in the Philippines. 70% of the respondents said that the government must improve enforcement of its environmental laws and provide facilities for proper waste treatment or disposal. Otherwise, the respondents indicated, the Philippines risked losing foreign investors who feared operating in a way that might violate their organisations' global standards and/or provoke the rage of consumers and the public in their home jurisdictions (Lacsmana, 1996). One respondent wrote in response to the survey, 'We see the blatant disregard for rules & regulations, and the ever present corruption as a major handicap . . . Contractors hired to collect and dispose of industrial waste can be seen dumping the same in nearby vacant lots. A much-needed program, however difficult to control.' (on file with author).

Foreign Laws and Litigation

Foreign environmental laws clearly influence the development of Asian environmental legislation, which is often based on US standards and available technology. This is not surprising, given that many Asian officials and the consultants they work with are US-trained. As discussed above, foreign environmental laws also influence the behaviour of organisations accustomed to operating under those laws.

Foreign *non-environmental* laws may also lead companies to better assess their environmental risks and liabilities in Asia. The general obligation to make full, plain and true disclosure under Canadian securities laws, for example, can require companies to disclose material environmental liabilities. It may be hard to decide whether or not an issue is one that warrants disclosure, but certainly a company must first be in a position to properly assess the liability. Even in countries which do not explicitly require such disclosure, many companies, particularly those in the natural resource and chemicals industries

(Russel, 1995: 138), do so on a voluntary basis, in order to inform investors, consumers, environmental interest groups, and the public (see generally Deegan, 1996).

In addition, foreign courts have increasingly been empowered to pursue citizens for bad behaviour in other parts of the world. For example, witness the growing trend of countries seeking to prosecute residents for their paedophile activities abroad. (e.g. in Australia the Crimes (Child Sex Tourism) Amendment Act 1994 No. 105 of 1994 s. 3; Barnett, 1997). On the environmental front, as well as the case in Victoria about the Ok Tedi mine mentioned earlier, tribal representatives from Indonesia filed a lawsuit in a Louisiana court against the U.S.-based owners of the Freeport mine in Irian Jaya (referred to earlier in this article) alleging violations of environmental laws. Jurisdiction was claimed under the *United States Alien Tort Claim Act (Beanal v Freeport-McMoran, Inc; Prince & Nelson 1996: 302)*. Although cases such as this will inevitably face disputes about forum and the correct law to be applied, the fact that multinationals may be sued in their home jurisdictions for their actions abroad cannot help but increase their desire to know exactly what their exposure is.

Manufacturing and Auditing Standards

Industry associations have environmental codes of practice that their members may voluntarily abide by. In addition, there have been some national and regional attempts to standardise environmental management standards for more widespread adoption (e.g. BS 7750 and the EMAS). The ISO 14000 standards, as the first international standards, are the standards most likely to advance environmental management in Asia (see generally, Cascio & Woodside, 1996; Rothery, 1995; Tibor, 1996, among many other sources).

While adoption is voluntary, Asian organisations will consider complying with the ISO 14000 standards if they perceive that compliance will help them to maintain a competitive advantage, facilitate other business transactions, and save money. In the past, for example, the Hong Kong government has required that its major contractors be ISO-9000 certified, and it may eventually introduce a similar requirement *vis à vis* ISO 14000. In the meantime, some Hong Kong government departments have embarked on the ISO 14000 certification process, and

it is likely that the Environmental Protection Department will be more lenient in terms of checks on companies that are certified.

ISO 14000 organisations may also become more attractive borrowers. As one commentator stated (Fortier 1996: 9):

[a] company that can show that it possesses a systematic environmental management process will always be more open to the financial community because it will have a demonstrated method proving that, beyond a statement of principle, it has taken charge of environmental management in its day-to-day operations. However, insofar as environmental reporting standards are not implemented . . . there will be a great deal of uncertainty regarding the need for an independent review.

In terms of environmental risk assessment, an organisation developing an environmental management system to comply with the ISO 14000 standards will have to identify and interpret applicable legislative and other environmental standards, and to assess the organisation's compliance with those standards. This makes it important for companies wishing to comply with the ISO 14000 standards to understand what they will have to comply with. If they cannot precisely identify what the relevant standards are, or if the practical and prescribed applications of the local laws differ greatly, they will have to determine what standard they will perform to.

Even if environmental problems do occur, it is reasonable to expect that organisations may receive more favourable treatment by prosecutors and judges if they can demonstrate ISO 14001 certification. Due diligence in avoiding the occurrence of the offence is becoming increasingly available as a defence for those accused of strict liability environmental offences throughout the world, including in Asia.² An organisation that has implemented an effective EMS in place will be in a good position to argue that reasonable care was taken to prevent the offence. There have been signs that ISO 14000 certification may evolve into a benchmark standard of care. In a Canadian case, *R. v Prospec Chemicals Ltd.*, 1996, an Alberta court demonstrated its willingness to consider the ISO 14000 standards as establishing a benchmark standard of care. In the case, a company which had failed to comply with a condition of a licence in violation of a provincial law was ordered to obtain ISO 14001 certification by June 30, 1998, failing which it will forfeit a Cdn \$40,000 letter of credit. This penalty was the result of a plea bargain

arrangement, and shows a creative use of ISO 14000 by defence counsel to get a reduced fine.

DEALING WITH ASIAN ENVIRONMENTAL RISKS AND LIABILITIES

Assess the Risks

Risk assessment is not a new concept. The ownership, operation and sale of businesses and property have always involved risk. In very simple terms, environmental liability can arise from two basic sources: the real property itself or from operations conducted on the property. Environmental risks are, however, sometimes difficult to assess with certainty because of the nature of the problems. This is particularly true of risks associated with property itself; operational liabilities are generally easier to deal with, and can usually be corrected by actions that also improve efficiency, so are easier to justify.

Getting information with respect to environmental liabilities early on assists in the structuring of the transaction, and allows the parties to negotiate price, representations and warranties, covenants and any indemnification. Lenders, for example, must take steps to identify a borrower's environmental risks when a loan is made or renewed. Purchasers of a property or business should similarly determine the environmental risks associated with that property or business before they have executed a binding contract.

Environmental site assessments may be used to investigate a site in order to identify existing and potential liabilities in respect of environmental matters. To the extent that problems occur and a due diligence defence is available, an environmental assessment may help to determine who caused the contamination and when. For this reason, it may be prudent to conduct baseline environmental site assessments before and after dealing with a business or property.

The depth of the investigation will depend on the use to be made of the site assessment, the level of comfort required and the circumstances of the particular transaction. In some cases, only a site investigation or a more focused compliance assessment, rather than a full environmental site assessment, may be warranted. Environmental issues which should be considered and which may arise, now or in the future, include the following:

- (a) compliance with environmental legislation, guidelines and policies;
- (b) discharges of contaminants which have occurred on or from the property;
- (c) existence of contaminants on the property;
- (d) storage and handling of waste and hazardous substances (including transportation),
- (e) charges, convictions or penalties for environmental offences; and
- (f) existing or potential civil litigation

Some potential sources of this information include: site visits (to the target site or business as well as neighbours); documentation with respect to environmental matters (if it exists); current owners/operators/tenants; neighbours; public records; and the government.

Before conducting a site investigation, the parties should agree on what tests may be conducted at the site, who may be contacted for information and how any damage caused will be paid for. If the information given or obtained during these investigations reveals serious incidents of non-compliance with environmental regulations, it may, for example, make the organisation vulnerable to attack by stakeholders, the public, the media, and, worst of all, to criminal or civil action, now or in the future. As one financial expert has noted (Fortier, 1996: 1) '[t]he disclosure of environmental liabilities is a moving target because we live in a society of rising standards regarding operations, management, control and communications.'

Given that the disclosure or possession of information relating to environmental problems may have legal ramifications for the parties, either now or in the future, it is advisable to review the planned investigation with a lawyer. The lawyer for a vendor or borrower, for example, will want to confirm why the investigation is being conducted, the purposes it will be used for, where the information will come from (the data must be relevant and reliable), and how the site assessment report will be distributed. A purchaser's lawyer will ensure that his or her client has the right to inspect for compliance and, most importantly, has the right to terminate the transaction if a problem is discovered.

Organisations trying to assess their environmental exposure may find it difficult to determine exactly what environmental requirements are to be met. Environmental requirements may be found in a host of different sources, from national laws and policies to

informal local procedures. They may also be imposed as a matter of international treaty or because of the international institutions involved in the transaction at issue. Finally, as discussed above, environmental requirements may exist as a matter of common or judge-made law.

Determining applicable environmental requirements should also include a bit of crystal ball gazing: trying to assess what legislation is developing and whether the organisation will be prepared to deal with it. Proceeding without certainty is dangerous, as one multinational starting up a manufacturing facility in China found out. Although there were no standards governing the emissions the new facility would create, the multinational proceeded to build while the local authorities conferred with experts to decide on an appropriate standard. In the end, the standard they set was the world's most stringent, and unattainable by the now nearly completed facility.

Having identified what environmental requirements seem to apply, it is necessary to determine how the requirements are applied and enforced, and by whom. In some cases, requirements will fall within the jurisdiction of more than one agency. For example, Thailand's *Public Health Act* provides that the Minister of Health **may** designate certain types of business as 'businesses detrimental to health' and that local public authorities **may** issue licensing and other requirements for designated businesses (*Asia Pacific Legal Developments Bulletin* 1996: 35). Similarly, China has national laws governing environmental protection, but provincial and municipal authorities are the primary enforcers (Bachner, 1996: 383; Zhang & Ferris, 1998, this issue of AJEM). It is obviously important to determine the possible legal consequences of non-compliance and environmental problems which may, for example, include prosecutions, administrative orders and penalties for discharges and other offences, land use restrictions, and directors' and officers' liability.

Who should be charged with conducting these investigations? A comprehensive environmental assessment clearly requires competent technical expertise and input. But, as indispensable as technical experts may be, they are not trained to draw legal conclusions from the information they obtain, nor are they equipped to advise on which legal protections will best protect against the effects of environmental risks. A lawyer should be involved to help plan the investigations to be undertaken, obtain

information as to legal requirements and administration, and draw conclusions as to the degree of environmental risk and possible means for dealing with that risk.

Protect Against Risks

As with any risk, the discovery of an environmental problem need not kill a deal. The tools available to help the parties to allocate risk and responsibility include representations and warranties, covenants, conditions of closing, exclusions, indemnification and termination rights. Of course, these are all subject to negotiation between the parties.

When entering into an agreement for the sale and purchase of land, the purchaser will want to obtain warranties from the vendor with respect to environmental liabilities. The warranties should be absolute, if possible (i.e. 'no environmental problems exist at the property'), and should be backed up by an indemnification. The purchaser will also want to ensure that representations and warranties survive the closing of the transaction for as long a period as possible.

The vendor will want to avoid giving a purchaser expansive rights of termination or assuming a continuing liability itself. The vendor will also want to limit representations and warranties with qualifications such as, 'to the best of its knowledge and belief' and to restrict representations and warranties to 'material' matters. However, the purchaser may insist that the vendor at least provide representations to the best of its knowledge 'after due inquiry'.

If a particular risk is identified as being significant, a purchaser may request security in order to protect itself against this liability. For example, the purchaser may request a covenant or pledge from the vendor to undertake certain work, and/or indemnification with respect to environmental liabilities arising from the environmental problem. The purchaser may even request that an amount be held back to create a fund to be drawn on in order to pay for such liabilities, since an indemnity is only as good as the property or assets backing it up.

The purchaser may also want to make it a condition to the closing of the transaction that the vendor undertake certain work. Without such a condition, the purchaser may not be able to terminate the deal, but may, depending on the jurisdiction, be entitled to claim damages, such as an abatement of the pur-

chase price. The condition should be inserted expressly for the benefit of the purchaser, who should be entitled to waive it unilaterally.

Similar due diligence considerations and contractual protections are applicable in landlord/tenant situations, although of course the need for each must be assessed given the proposed use by the tenant. The landlord will want to ensure that the tenants' use of the property does not create an environmental problem and that, if such a problem arises, it is quickly identified and that the landlord has the power, contractual or otherwise, to compel remediation at the tenant's expense during the term of the lease. As with the landlord, protection of the tenant will include some form of due diligence, together with contractual protection, to ensure that the tenant takes possession of a property free from potential liabilities, environmental or otherwise, flowing with the property. Long-term retail and office leases, as a general rule, do not present the range of potential environmental liabilities typically associated with long-term ground leases.

In financing situations, lenders should, to the extent possible, monitor the borrower throughout the term (and at least from the moment that a loan is identified as troubled). If it appears to the lender that there may be environmental contamination, the proposed loan should be secured with other assets. The loan agreement should also be drafted to include appropriate guarantees, representations and warranties, broad and effective indemnities, and specified events of default. If the risks are too great or too uncertain, the lender should consider refusing the loan. Where the lender is involved in a workout [out of court settlement of affairs of company in trouble] and environmental concerns exist or are suspected, the lender may, depending on the terms of applicable laws, wish to consider taking precautions to ensure that it does not participate in the management of the borrower.

It is crucial, of course, to realise that any contractual assurances given are only as good as the party or security backing them up, which may well pose a problem when blue chip security is not available. For example, one multinational operating in China has found itself bound to pay environmental cleanup costs despite having all the contractual protections one could ask for, and assurances from its joint venture partner that no one would ever enforce the requirements at issue. After this experience, the company's in-house lawyers simply assume that the

company will be held responsible for site remediation and build remediation costs into the budgeted cost of its investments.

To protect against new environmental liabilities arising, organisations should consider implementing an environmental management system, perhaps in compliance with the ISO 14000 standards, which includes a corporate audit and procedures policy. At the very least, organisations should keep track of environmental law developments that may affect their operations (e.g. litigation, new standards, and industry standards), and not ignore NGOs and public opinion.

It is clear that building environmental risk assessment and protections into business decision making will affect the cost of transactions. To the extent that lenders have to obtain independent advice as to the risk and cover the costs of environmental audits, they may have to spread those costs across loans or add premiums to higher-risk loans. Conversely, however, superior environmental performance may improve access to lower-cost financing and insurance. In North America, insurers who may have once seen pollution coverage as a new product, retreated significantly when faced with overwhelming claims in respect of pre-existing contamination. As environmental regulations become stricter in Asia, it is reasonable to expect to see insurers demanding more information and comfort in terms of actual and potential environmental problems at their clients' facilities (see generally McDonald, 1996: 209).

CONCLUSION

If there was ever a time when companies operating in different countries could comfortably treat the legal risks of those operations as distinct and unlikely to affect the company in other jurisdictions, that time has passed. Investors, lenders and others who assume that an Asian country's current environmental law climate will remain static and make investment decisions on that basis are undoubtedly in for a surprise. And if they make long-term investments or financing available on this assumption, they may be in for a rude shock if the investments or loans fail due to increasingly strict environmental regulations or enforcement, or are negatively affected by some of the other forces discussed earlier in this paper.

NOTES

- 1 This article was originally prepared in December 1996, while the author was working in Hong Kong with the Canadian law firm Tory Tory DesLauriers & Binnington, the support of which she gratefully acknowledges. She also wishes to thank the in-house and other lawyers who shared their experiences in dealing with environmental risk assessment in Asia. For confidentiality's sake, this article does not identify them by name or organisation.
- 2 In Hong Kong, section 20G of the Waste Ordinance, Cap 354, Part IVA, includes a defence of due diligence, as do sections 26(3) and 26(5) of the Environmental Impact Ordinance, Cap. 499, passed in 1977 and which came into force on 1 April 1998, and future environmental legislation in Hong Kong may introduce further such provisions.

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Environmental Conflict and Judicial Resolution in the Philippines

Antonio A. Oposa Jr.¹

ABSTRACT

This paper reviews the jurisprudence of the environment in the Philippines. That country has been elaborating its system of statute law on the environment since the 1960s. But this has not meant that these laws were enforced. Crisis has stimulated enforcement, and since the early 1980s the courts have been involved increasingly in environmental issues. The article surveys several important cases from 1982 until the present, showing how the courts have become increasingly sensitised to environmental issues.

Keywords: courts, environmental law, enforcement, local government, intergenerational equity, Philippines

INTRODUCTION

In the panorama of the Earth's geological age of 4.5 billion years, the appearance of the precursors of *Homo sapiens* 2 million years ago was but a micro-second ago. Yet it is alleged that *Homo sapiens* is the species at the apex of the animal kingdom, having risen up the evolutionary ladder because of his cognitive, analytical and creative mental powers.

Anthropocentric humans however, seem to have taken the biblical injunction (*Book of Genesis* I: 28) about subduing the earth too seriously. Since the Industrial Revolution a mere two hundred or so years ago, we have trodden and touched with ruinous feet and hands the farthest ends of the earth. We have traveled far and wide in search of materials to manufacture products for our convenience, comfort and

luxury with little, if any, thought of consequences. In the process, we have over-fished or dirtied our waters, exhausted or contaminated our land, and spoiled the quality of the very air that we breathe. Thus, the statement that man is the most intelligent animal represents at best a *prima facie* presumption that is on the brink of complete rebuttal.

These environmental consequences began to manifest themselves clearly only in this generation, a period of some 40 years, a nanosecond in the Earth's age. In the Philippines for example, with its land area of 30 million hectares, it is said that 40 years ago we had 16 million hectares of virgin forests. In 1988, it was indicated by satellite photography that this forest reserve had been reduced to a mere 800,000 hectares (for details see Kummer, 1992 esp. Chap. 2).

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POLICY, LAW AND THE COURTS

Policy declares the desire and plan to give attention to and address a particular public concern. Laws and regulations are the distillation of policy. Courts interpret those laws when there are ambiguities that arise in a controversy between parties of competing interests.

Policy is generally reactive to concerns facing the body politic, often, indeed, it is crisis-driven. Because of the silently-creeping characteristics of environmental degradation, the world looked the other way as economics took the front seat in the global agenda of development. It was not until the 1972 Stockholm Conference that countries began, even if lackadaisically, to awaken to the issue of environmental damage on a global scale. During those days, people who talked of environmental issues were looked upon as either prophets of doom, alarmists or outright social misfits.

Over the last 20 years, these manifestations of abuse began to become more and more apparent: fish stocks declined, forests were and are being alarmingly depleted, and the air in urban areas became thoroughly unhealthy. Even the very climate and the earth's atmosphere are facing serious threat of potentially disastrous disturbance as a result of human activities, in the name of economic development.

In the Philippines policies were proclaimed, and formalized as a series of laws. As early as 1964, we had a National Air and Water Act (Republic Act (RA) 3931) to control industrial pollution. It was revised and strengthened in 1976 (by Presidential Decree (PD) 984, otherwise known as the Pollution Control Law).

Concern for the degradation and competing interests prevalent in the Laguna Lake (also called the Laguna de Bay) — the second largest inland body of water in South East Asia (after the Tonle Sap in Cambodia) — led to the enactment of the law creating the Laguna Lake Development Authority (LLDA) (RA 4850 as amended by PD 813, and Executive Order (EO) 927). Shortly after the Stockholm Conference, the Philippine Environmental Policy Act (PD 1151 of 1977) was passed declaring it national policy to improve and maintain conditions in which man and nature can thrive in productive harmony with each other.² The Philippine Environmental Code followed (PD 1152 of 1977) outlining the guidelines for the formulation of standards for natural

resources management, land use management, wild-life protection, and air and water quality, among others. In 1978, realizing the need for precautionary planning in industrial projects which have an impact on the environment, the Environmental Impact Assessment System was established (by PD 1586 of 1978). Numerous other laws were passed during the Marcos administration including forestry and fishery laws, laws on vehicular emission control, etc. — laws that for a long while atrophied in the sickbed of non-compliance. (For the text of the Presidential Decrees mentioned in this paragraph, see La Viña, 1991.)

THE SWING OF THE PENDULUM

If necessity is the mother of invention, crisis is the father. The last 10 years saw environmental degradation reach crisis proportions and elicit policy reactions from the Administration and Congress. For the first time, environmental concern was elevated to a departmental level with the creation of the Department of Environment and Natural Resources (DENR) by EO 192 (1987). Budget-wise, however, environmental concern is still a very poor 'second cousin' of natural resources management (forestry, mines and lands).

Congress has since passed two laws of general environmental application: the Toxic Substances and Hazardous Wastes Law (RA 6969 of 1990) and the National Integrated Protected Areas System (NIPAS) (RA 7586 of 1992). Even the landmark Local Government Code (RA 7160 of 1991) which strengthened the autonomy of local government units (LGUs) contains copious provisions on environmental protection including that which gives the local legislative council the final approval before any project which may cause pollution can be implemented (sections 26 and 27). It was also during this period that the term 'Sustainable Development' was coined to attempt the harmonization of the dialectics of environment and economics (for some references on this see Bachner, 1998 (in this issue of *AJEM*) and specifically on the Philippines see Broad and Cavanagh, 1991).

Numerous laws testify to the plethora of policies on environmental concerns (it is estimated that the Philippines has at least 118 environment-related laws). Enforcement is a different matter. After a period of almost total disregard in the 1960s and

1970s, there has been an upsurge of environmental law enforcement, mainly triggered by environmental crises. The activity in the enforcement effort can also be gleaned from the number of cases reaching the Supreme Court resolving questions of administrative supervision of environmental issues and the classic — albeit specious — debate between economics and environment. From almost nothing before 1982, environmental jurisprudence rose exponentially over the last six years, among it the now-famous Children's case on inter-generational responsibility, discussed later.

THE PHILIPPINES' ENVIRONMENTAL JURISPRUDENCE: A TOUR OF THE HORIZON

In this part, we shall survey and analyze briefly the environmental jurisprudence of the country to support the theory that law begins with desire. If the desire of the law and the body politic is geared towards environmental protection, we will see that the Supreme Court of the Philippines has not only moved in step with the times but has even played an almost activist role in advancing the environmental objective.

Administrative Jurisdiction

In 1982, the question arose whether a Provincial Prosecutor had the authority to initiate a criminal prosecution for the violation of National Air and Water Pollution Control Law. In this case (*Mead v Argel*), the Court held that the existence of pollution as defined by law requires specialized knowledge of technical and scientific matters which are not normally within the competence of prosecutors or those sitting in the courts of justice. Where the action is grounded on pollution as defined by law and that law provides for an administrative body to inquire into the existence thereof, the lack of such determination was fatal to the prosecution of the criminal case. Although unsuccessful, this case charted the course by which future actions could be prosecuted. Aside from the Court's reliance on the specific provision of the Air and Water Law, there is a basic rule that requires that administrative remedies should be exhausted before criminal prosecution is resorted to, and this should have been observed by the explored by the plaintiff-complainant. If the administrative remedies to determine the existence

of pollution had been utilised, the administrative agency could have had the opportunity to take action in a more expeditious manner as well as laying the proper basis for the criminal prosecution.

On the other hand, this decision clearly stated that where the action is based on nuisance under the Civil Code, as opposed to a criminal case, the determination by the National Air and Water Commission of the existence of pollution is not a prerequisite.

In the substance of its decision, this case was followed and modified by another case involving the power of a mayor to close down a factory for pollution. In holding that the courts of law are without jurisdiction to hear a case for pollution, even if constituting a nuisance, the Supreme Court said (*Technology Developers Inc. (TDI) v Court of Appeals, et al.* G.R. No. 94759, 1 August 1991):

PD 984 which created the National Pollution Control Commission (NPCC) . . . is the primary agency responsible for the prevention and control of environmental pollution. . . . Evidently, even the provisions of the Civil Code on nuisance, insofar as the nuisance is caused by pollution of air, water and land resources, are deemed superseded by PD 984, which is the special law on the subject of pollution.³

This was decided before the passage of the Local Government Code (RA 7160). It is surmised that under the General Welfare clause and the environmental provisions of RA 7160 (1991) and considering the ruling in *Tano, et al v Socrates, et al* (discussed below), the holding of the Supreme Court might be different if it was faced with the same issue now.

The National Pollution Control Commission, created by PD 984, and the National Water and Air Pollution Control Commission created by RA 3931 were succeeded by the Pollution Adjudication Board (PAB) by the law creating the DENR, of which the PAB is part. Jurisdiction in pollution cases was transferred from the NPCC to the PAB. In 1991, the case of *PAB v Court of Appeals*⁴ put in issue the power of the PAB to legally issue *ex parte* a cease and desist order (CDO) to stop the operation of an industrial establishment polluting the Tenejero-Tullahan River. Upholding the power of the PAB, the Court said that such an *ex parte* order is authorized by law because 'stopping (the) continuous discharge of pollutive and untreated effluents into the rivers and other inland waters of the Philippines cannot be made to wait until protracted

litigation over the ultimate correctness or propriety of such order has run its full course.⁵

Using the State's police powers as its anchor⁶, the Court further stated that the law 'was enacted . . . in the exercise of that pervasive, sovereign power to protect the safety, health and general welfare and comfort of the public, as well as the protection of plant and animal life.' In its own way, the Court went the 'extra mile' to promote environmental law compliance by pronouncing that the company (Solar Textile) could have avoided the effects of the CDO by 'simply absorbing the bother and burden of putting its Waste Treatment Plant on an operational basis'. The Court further indicated, perhaps as a guideline to and for the future reference of industry, that 'industrial establishments are not constitutionally entitled to reduce their capital costs and operating expenses and to increase their profits by imposing upon the public threats and risks to safety, health, general welfare and comfort, by disregarding the requirements of anti-pollution statutes. . . .'

Ecological Sensitivity

In 1994, the authority of the Laguna Lake Development Authority (LLDA) over the Laguna de Bay was put to question (*Laguna Lake Development Authority v Court of Appeals*). The City of Caloocan, which is located within the watershed area of the Laguna de Bay and one of the component cities of Metro Manila, was dumping some 350 tons of garbage a day in an open dumpsite in the village of Camarin.

The LLDA issued a CDO against the City enjoining the latter to desist from the further dumping of garbage. The City claimed that it was acting within its power as a local government unit pursuant to the general welfare provision of the Local Government Code. In finding for the LLDA's power to issue the injunctive order, the Court examined the enabling law which declared it a national policy to promote the balanced growth of the Laguna Lake area. The LLDA's charter mandates that this growth must be 'with due regard and adequate protection for environmental management . . . , preservation of the quality of human life and ecological systems, and the prevention of undue ecological disturbances, deterioration and pollution' (section 1, RA 4850, as amended by PD 813 and Executive Order No. 927, Series of 1983). Its power to issue a CDO is to be found in the provision authorizing it 'to make, alter

or modify orders requiring the discontinuance of pollution.' The cease and desist order, although not specifically mentioned or expressly granted by law, is incidental to the exercise of its express powers and is therefore not unauthorized. 'Otherwise, it may well be reduced to a 'toothless' paper agency' (Justice Florida R. Romero).

Going further, the Court stated that the exercise of the State's police powers necessitates protecting vital public interests. This is what gives vitality to the provision in the 1987 Philippine Constitution, which gives every person the protected right to a balanced and healthful ecology (Article II, section 16, Declaration of Principles of State Policy). It is also 'in consonance with the declared policy of the State to protect and promote the right to health of the people and instill health consciousness among them.' (Article II, section 15).

What makes this decision more significant is the affirmation that the right to health is a fundamental human right. It also draws upon the international commitments of the Philippines as a party to the Universal Declaration of Human Rights, Article 25 of which states that 'everyone has the right to a standard of living adequate for the health and well-being of himself. . . ' and the Declaration of the WHO and UNICEF at the Alma-Ata Conference of 1978, on Primary Health Care, where such a human right is recognized.

When the Local Government Code granted Local Government Units the power to issue fishing privileges, some Mayors of the Lake's riparian towns began to issue fishpen permits indiscriminately to various corporations. In less than five years the area covered by fishpens grew from 7,000 hectares in 1990 to 21,000 in 1995 within a lake surface area of 90,000 hectares.

Upon orders of the President of the Philippines, the LLDA was poised to begin the demolition of the fishpens constructed by virtue of the permits issued by the LGUs. To enjoin the demolition of their fishpens, the fishpen owners instituted an action for injunction against the LLDA which contended that according to its charter, a special law, it had the exclusive jurisdiction to issue permits for the use of surface waters for all activities including the operation of fishpens and fish enclosures (*LLDA v Court of Appeals et al.*, 1995). In a dramatic opening passage, Justice Regino Hermosisima Jr. posed the question that crystallizes the clash of private interests and economic development on the one hand,

and environmental protection on the other, especially in the setting of a developing country:

It is difficult for a man, scavenging on the garbage dump created by affluence, profligate consumption and extravagance of the rich or fishing in the murky waters of the Pasig River and the Laguna Lake or making a clearing in the forest so he can produce food for his family, to understand why protecting birds, fish and trees is more important than protecting him and keeping his family alive.

How do we strike a balance between environmental protection on the one hand, and the individual personal interests of people on the other?

The Court once again examined the LLDA's enabling law and emphasized that this included the exclusive power to issue permits for the use of the lake's waters including, among others, for fishpens and fish enclosures. Ruling for the LLDA, the Court said that the Local Government Code, a law of general application, did not repeal the provisions of the LLDA charter, a special law. What makes the decision more significant is the cognizance of the Laguna Lake as an integral ecosystem. Narrating that the Lake has a surface water area of 900 square kilometers (or 90,000 hectares) with eight major rivers tributaries and several other smaller rivers that drain into the lake, the Court said (at pp. 57 and 58) that this body of water and the 2,920 square kilometer basin or watershed crossing several political boundaries -

... constitute one integrated delicate natural ecosystem that needs to be protected with uniform set of policies, if we are to be serious in our aims of attaining sustainable development. This is an exhaustible natural resource — a very limited one — which requires judicious management and optimal utilization to ensure renewability and preserve its ecological integrity and balance.

Managing the lake resources would mean implementation of a national policy geared towards the protection, conservation, balanced growth and sustainable development of the region with due regard to the inter-generational use of its resources by the inhabitants . . .

Laguna de Bay therefore cannot be subjected to fragmented concepts of management policies where lakeshore local government units exercise exclusive dominion over specific portions of the lake water. The garbage thrown or sewage discharged into the lake, abstraction of water therefrom or construction of fishpen by enclosing (a) certain area, affect not only that specific portion but the entire 900 square kilometers of lake water. The implementation of a cohesive and integrated lake water

resource management policy, therefore, is necessary to conserve, protect and sustainably develop Laguna de Bay.

Thus, the fishpen permits issued by the Mayors were declared void and the structures erected by virtue thereof were declared illegal subject to demolition by the LLDA. Before the demolition could be effected, however, Nature undertook the job. A strong typhoon hit the Metro Manila area and effectively demolished almost all of the illegal fishpens.

Local Government's Power to Protect the Environment

Another dimension — this time more constructive — of the Local Government's power to protect their natural environment very recently found expression in a case involving the country's 'last frontier of wilderness' — Palawan. Legislative policy finally realized it to be of such bio-geographic and bio-diversity values that a special law was passed in 1992 with the declared intent and desire to protect and conserve Palawan (RA 7611 otherwise known as the Strategic Environmental Plan (SEP) for Palawan — see Sandalo, 1996).

Also, the Local Government Code contains explicit language on the power of local government unit to protect their environment. Specifically, the General Welfare Clause and several sections relating to the authority of the local legislative councils⁷ empowered LGUs to protect the environment and impose appropriate penalties for acts which endanger the environment such as dynamite fishing and 'other forms of destructive fishing.' (Sec. 149, 447 (a)(1)(vi), 468(a)(1)(vi), RA 7160).

Alarmed by the increasing use of sodium cyanide to catch live fish from the waters of Palawan for eventual export to the restaurants and banquet tables of the more affluent parts of Asia, the Sangguniang Panglungsod of Puerto Princesa,⁸ the capital city, and the Sangguniang Panlalawigan of Palawan enacted ordinances prohibiting and penalizing the export of live fish such as those caught using cyanide⁹. When violators were apprehended and hauled to court, an action was initiated in the Supreme Court by the accused, joined by other so-called fishermen including the Airline Shipping Association of Palawan, to enjoin their prosecution and to declare the ordinances unconstitutional for alleged deprivation of livelihood without due process of law.

The Supreme Court *en banc* held for the local government unit and said that:

- a) The purpose of the ordinance is to protect the corals in the marine waters of Palawan from further destruction due to illegal fishing activities.
- b) The realization of this objective is within the general welfare clause of the Local Government Code and the express mandate to protect the environment and impose appropriate penalties therefor.

Upholding the validity of these ordinances, the Supreme Court took pains to describe in minute detail the destructive process by which coral reefs are impacted by cyanide fishing, thereby exhibiting its heightened sensitivity to life-support processes and ecological systems. Concluding, the Supreme Court went so far as to commend the local government units for their efforts and called on others to be 'roused from the lethargy' of inaction. Through the pen of Justice Davide, the Supreme Court said (*Tano et al. v Socrates, et al.*, 1997):

In closing, we commend the Sangguniang Panglungsod of the City of Puerto Princesa and the Sangguniang Panlalawigan of the Province of Palawan for exercising the requisite political will to enact urgently needed legislation to protect and enhance the marine environment, thus sharing in the herculean task of arresting the tide of ecological destruction. We hope that other local government units shall now be roused from their lethargy and adopt a more vigilant stand in the battle against the decimation of our legacy to future generations. At this time, the repercussions of any further delay in their response may prove disastrous, if not irreversible.

Responsibility to Future Generations

The Philippine case which seems to have attracted most international attention and become a legal landmark of sorts on the concept of inter-generational responsibility is popularly known as the Children's case (*Minors Oposa, et al. v Secretary of the DENR*). In March 1990, some 40 children — aged from 9 months to 16 years old and from all the geographic regions of the country — filed a class suit in representation of their generation and generations yet unborn. The Government of the Philippines was named defendant and the action sought to force the cancellation of all the country's logging concessions (also known as Timber License Agreements or

TLAs.). The plaintiffs alleged that there were only 800,000 hectares left of virgin forests where commercial logging was taking place. They further alleged that the Government granted 92 timber license agreements covering an area of 3.9 million hectares, an act characterized as a grave abuse of discretion.¹⁰ At the rate of deforestation occurring in the country estimated at 120,000 hectares per year, the 800,000 hectares of virgin forest reserve would be totally decimated in less than 10 years. Thus, there would be nothing left for the plaintiff-children to use, enjoy and benefit from when they come of age.

While the main defendant then Secretary Fulgencio Factoran Jr. agreed with the purpose of the action, the official counsel of the Government, the Office of the Solicitor General, posited the legal issues on the absence of cause of action and on the non-justiciability of the controversy allegedly because it was a political question. Upon motion of the Government, the trial court dismissed the case without hearing on the ground of, among others, lack of cause of action. The Supreme Court unanimously ruled that:

The case . . . has a special and novel element. Petitioners assert that they represent their generation as well as generations yet unborn. We find no difficulty in ruling that they can, for themselves, for others in their generation and for the succeeding generations, file a class suit. Their personality to sue in behalf of the succeeding generations can only be based on the concept of inter-generational responsibility insofar as the right to a balanced and healthful ecology is concerned.

Needless to say, every generation has a responsibility to the next to preserve the rhythm and harmony for the full enjoyment of a balanced and healthful ecology. Put a little differently, the minors' assertion of their right to a sound environment constitutes, at the same time, the performance of their obligation to ensure the protection of that right for generations to come. (Justice Hilario Davide, Jr.)

One of the side issues in the case was whether the children had the right to a balanced ecology even if such right was not contained in the Bill of Rights, but in the Declaration of Principles and State Policies.¹¹ To this, the Court said that:

While the right to a balanced and healthful ecology is to be found under the Declaration of Principles and State Policies and not under the Bill of Rights, it does not follow that it is less important than any

of the civil and political rights enumerated in the latter. Such a right belongs to a different category of rights altogether for it concerns nothing less than self-preservation and self-perpetuation — aptly and fittingly stressed by the petitioners — the advancement of which may even be said to predate all governments and constitutions.

As a matter of fact, these basic rights need not even be written in the Constitution for they are assumed to exist from the inception of humankind.

If they are now explicitly mentioned in the fundamental charter, it is because of the well-founded fear of its framers that unless these rights . . . are mandated . . . by the Constitution itself . . . the day would not be too far when all else would be lost not only for the present generation, but also for those to come — generations which stand to inherit nothing but parched earth incapable of sustaining life. (pp. 804–805)

It may be noted that the resolution of the case was not on the merits and but merely on technical legal issues. While the case was pending, however, the DENR issued an administrative order prohibiting further commercial logging in the country's virgin forests (by DENR Admin. Order No. 24, Series of 1991).

Although hardly known in the country's own legal community, the case has been the subject of extensive citation, analysis and comment in international law circles (for example Popovic, 1996). Perhaps because it is the first case decided by the highest court of a country which discussed and implemented what had heretofore been a rhetorical call for responsibility to future generations for the world's natural resources. Furthermore, it brings to the fore — in the personal voice of our children — the imminent likelihood that our generation's wanton use of the earth's resources will inevitably adversely impact our children's generation and generations yet unborn.

Intra-Generational Responsibility in the Animal Kingdom

Another interesting case was filed on 21 July 1997 by fisherfolk and the fish fry of a tourism town against the DENR and the National Power Corporation (NPC) (*Bangus (Milkfish) Fry Fisherfolk, Bangus fry, and children v DENR, et al.*) The action is the first case of its kind seeking the annulment of an environmental permit granted by the DENR to the NPC to construct a mooring facility to be used

by a power barge in an ecologically sensitive area protected by a special law.

The petitioners rely on the special law (PD 1605-A (1980) as amended by PD 1805 (1981)) which protects the coves of the town for tourism purposes because of their spectacular underwater natural beauty. It also prohibits the construction of wharves and other commercial establishments without a permit from the Office of the President upon recommendation of the Philippine Tourism Authority (PTA). It has been agreed by the parties that the NPC does not have such a permit. However, NPC defends its position with the allegation that it is not covered by this law. The case is also grounded on the Local Government Code which prohibits the implementation of projects that may cause pollution without the prior approval of the local legislative council (sections 26 and 27 of RA 7160). Since 1991, the local legislative council had designated the area as an eco-tourism zone and has expressed its disapproval of the power barge project in numerous resolutions.

Perhaps the interesting feature of this action is that it tests the new theory of 'intra-generational responsibility in the animal kingdom.' While the bangus¹² fry are named as co-petitioners, they are joined and represented by *Homo sapiens* petitioners. The fisherfolk contend that as the species belonging to the apex of the animal kingdom, humans have the responsibility to care for the welfare of the lesser life forms that exist within this generation, such as the fish and their fry. So far, the legal personality of the fish — specifically whether they can bring a legal suit — has not been put in issue.

The trial court is called upon to issue an injunction against the DENR, the NPC and the Provincial Government, among others, from proceeding with the construction of the mooring facility (which, incidentally, was constructed without even a building permit) or alternatively for its demolition, and from operating the power barge. The petitioners, after the trial court refused to issue a second restraining order after the former brought in another party in an amended petition, initiated an action for certiorari alleging grave abuse of discretion. The incident, and the denial, was recently taken to the Court of Appeals on a writ of certiorari. To enjoin the demolition of their fishpens, the fishpen owners instituted an action for injunction against the LLDA.

When eventually decided on the merits, the case presents among others, possibilities for the clarifica-

tion on the site-specificity of an environmental permit (in the Philippines, called the Environmental Compliance Certificate or ECC), the power of the local government units to deny or approve of environmentally-sensitive projects and ground-breaking statutory construction for environmental objectives.

THE ROLE OF THE COURTS

The formal role of the courts is to interpret the laws in controversies where questions of jurisdiction arise by and between government agencies and/or private interests. Traditionally, this role is played at the national level to remedy perceived or real . . .

. . . imperfections in the legislative and administrative processes. The central imperfection is that self-interested and powerful minorities have an undue influence on the public resource decisions of legislative and administrative bodies and cause those bodies to ignore broadly-based public interest. The courts, through various techniques and mechanisms, democratize legislative and administrative procedures by giving adequate representation to exponents of environmental quality. It continues to be the forum where (acts of) administrative agencies are reviewed to see to it that they perform their function in a proper manner. (Tolentino, 1997)

This is not to say, however, that environmental litigation and the courts should be the primary or principal recourse for the resolution of environmental issues. Environmental controversies generally have three dimensions: (a) technical, (b) legal and (c) socio-political. Undue emphasis on one dimension results in the imbalance of the triangular stability necessary for a feasible and sustainable solution to

the controversy. Pure reliance, for example, on legal avenues is not only costly, it is also very time-consuming and highly-adversarial. As such, it is inappropriate to the socio-cultural characteristic of Filipinos and of Asians in general which value the consensual mode of conflict resolution. To be sure, it is an avenue whereby the legal and socio-political aspects are crystallized and put in issue on the table of organized and formal debate. Ultimately, however, it becomes a socio-political question which must be resolved by society at large and the administrative organs of the body politic pursuant to the articulated environmental policy and 'requisite political will'.

CONCLUSION

In these decisions, the Philippine Supreme Court has exhibited a sensitivity to environmental issues at par with, or better than, many of the courts in the world. Perhaps the only other court in Asia which has been as direct and activist in the handling of environmental law cases is the Supreme Court of India.¹³

Without a goal in mind at the outset of an environmental controversy, the interpretation of laws is nothing more than a mechanical and lifeless exercise of a technician aimlessly tinkering with the nuts and bolts of human imperfection. However, with a good faith desire to achieve the end of a declared environmental policy as distilled in legal form, otherwise technical and voluminous laws begin to breathe life.

Then, Law, as a thinking profession, can make a valuable contribution to humanity's role as the thinking part of Nature.

NOTE

- 1 Excerpts of this paper were first presented before the LAWASIA Conference in Manila, 30 August 1997.
- 2 While the thought that man is a part of nature has been articulated by sages of old, man's anthropocentrism is such that he views nature as separate from man and is meant to serve his needs, comforts and pleasures. This is reflected in PD 1151, the National Environmental Policy Act. It was a milestone, however, in that it began to realize the importance of respecting and protecting natural resources.
- 3 This is an unpublished resolution on the motion for reconsideration filed by TDI which reversed the original decision contained in 193 SCRA 147. The Resolution was penned by Justice F. Feliciano.
- 4 It was also written by Justice Florentino Feliciano, now Justice of the World Trade Organization (WTO) Appellate Body.
- 5 Note for non-lawyers: an ex parte order is one made in the absence of the other party to the case.
- 6 On the inherent police power of the state see Fernando, 1974, 514; in fact there is now a constitutional provision on this: Article II sec. 15 and 16, though the court did not rely on this.
- 7 The Sanggunian (legislative council) Bayan (town), Lungsod (City) and Lalawigan (Province).

- 8 The incumbent Mayor of Puerto Princesa, Mr. Edward Hagedorn, is a 1997 UNEP Global 500 Laureate for being the first Filipino local government official to pursue an environmental platform.
- 9 Cyanide is squirted into and around the corals stunning the coral-dwelling tropical fish. The fishermen then scoop the live but immobilized fish and dump their catch in a submerged net attached to the *banca* (small boat with outriggers). Twenty minutes later the fish can swim again and are stored for a few weeks to expel the cyanide from their system. Thereafter, the live fish are transported by water and oxygen-filled plastic bags and shipped by airfreight to major markets for live fish. While the fish are meant to survive, the once living corals, which provided food (algae) and habitat to the fish, begin to expire. Eventually, the coral reef becomes an underwater graveyard; its skeletal remains brittle, bleached of all color and vulnerable to erosion. For an expression of concern in Hong Kong, one of those more affluent parts of Asia, see Hong Kong Government, 1996.
- 10 Statistics on the forest reserve, number and area of coverage of the logging concessions, and the rate of deforestation were contained in various government documents.
- 11 The device of Directive Principles, first adopted in the Constitution of Ireland in 1937 and then in that of India in 1950, is now common. Sometimes it is provided that these are not justiciable. No such statement appears in the Philippines Constitution.
- 12 Bangus (milkfish) is the country's national fish.
- 13 In, for example, the *M.C. Mehta* cases. In one of these cases, the Supreme Court of India ordered the closure of hundreds of industrial plants and forced the Government to find a relocation site for the industries located in the vicinity of the Taj Mahal. These industries were found to be emitting noxious substances causing 'marble cancer' to one of the seven wonders of the world (*M.C. Mehta v Union of India* (1997)). (Another case of the same name in 1996 concerned the Delhi greenbelt.) For his work, Mr. Mehta received the Asian equivalent of the Nobel Prize, the Ramon Magsaysay Award, on September 1997 in Manila.

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The Risk of Wealth: Determining a Sustainable Development Law and Policy for Hong Kong

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The purpose of this paper is to argue that, due to the failure of the Hong Kong economic system to cope with environmental decline, it is essential that government and corporations expedite the establishment and implementation of a sound sustainable development policy. The paper considers how to induce firms to modify their corporate behaviour in order to achieve socially acceptable standards of sustainable development. First it defines the concept of a law of sustainable development in global terms. Second it discusses why, theoretically, a law of sustainable development is so important and so difficult for Hong Kong. Third it explains the practical complexity associated with the integration of the concept of sustainable development into the regulatory framework of environmental law in Hong Kong.

Keywords: *environmental law, corporate behaviour, international law, Hong Kong, sustainable development*

The recent economic and environmental deterioration that has beset Southeast Asia has compelled policy makers to rethink their long-term strategic planning, methods of governance and, most importantly, their approaches toward sustainable development. Given Hong Kong's considerable position as an international financial centre and precarious ecological balance, the policy of sustainable development is emerging as a contentious issue for the territory's lawmakers (see Bloch, 1994).

SUSTAINABLE DEVELOPMENT

There is no formalized definition of sustainable development; it is very much an emerging concept in international environmental law (Caldwell, 1996: 275-277). Its definition has been evolving through the decisions of national and international environmental cases, the negotiation of environmental treaties, the establishment of international, national

and sub-national legislation, *inter alia*. Sustainable development is a phrase that is generally understood to have originated in the 1987 Brundtland Report which defined it as development that meets the needs of the present without compromising the capacity of future generations to meet their own social and economic needs (WCED, 1990). In particular the Brundtland definition underscores that sound environmental policy will keep in mind the problem of poverty, the efficacy of state organizations and the constraints of technology.

The *Trail Smelter* decision (1939 and 1941), by an international arbitration tribunal, is recognized as a primary source for the jurisprudence related to sustainable development. Air fumes from a Canadian smelter crossed the border into the United States causing environmental harm. The United States sought legal redress from Canada for the harm done. The tribunal concluded that no state has the right to allow its own territory to be used in such a manner as to cause harm by air pollution in the territory of

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another state. Although the tribunal's decision is not binding in future international cases, it sets out the durable principle that states have the responsibility to take care that economic activities occurring within their territory do not injure parties or property within another's territory.

The principle has evolved into a duty to prevent environmental harm to reduce and control pollution and to remedy any environmental harm caused to neighbours. The law was embodied in Principle 21 of the Declaration agreed to at the 1972 United Nations Conference on the Human Environment in Stockholm (see, e.g., Birnie & Boyle, 1995: 1–8). This recognizes that a sovereign state has the right to exploit its natural resources as it sees fit and that the state has a responsibility to assure that activities within its territory or under its authority do not cause harm to other states or areas beyond its own territory.

International environmental treaties including the Ozone Layer Convention, the MARPOL Convention, the London Dumping Convention (Birnie & Boyle, 1992: 92, and see references to Zhang & Ferris in this issue) endorse these basic principles. Article 194 of the United Nations Convention on the Law of the Sea is illustrative:

1. States shall take, individually or jointly as appropriate, all measures consistent with this Convention that are necessary to prevent, reduce and control pollution of the marine environment from any source, using for this purpose the best practicable means at their disposal and in accordance with their capabilities, and they shall endeavour to harmonize their policies in this connection.
2. States shall take all measures necessary to ensure that activities under their jurisdiction or control are so conducted as not to cause damage by pollution to other states and their environment. . . . (United Nations 1982)

More recent examples of this concept include the World Conservation Strategy that promotes the sustainable utilization of species and ecosystems which was adopted by International Union for the Conservation of Nature in 1980 (IUCN, 1980). The United Nations General Assembly adopted the World Charter for Nature, which called for sustainable productivity for all resources, in 1982. In 1987 the United Nations Environmental Programme endorsed the notion that the integration of environmental and

natural resource policies in the planning of economic activities likely to have a considerable impact was essential (UNEP, 1987).

In 1992 considerable progress in terms of refining the meaning of sustainable development was achieved at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil. UNCED's practical contribution to sustainable development was the adoption of three non-binding instruments and the opening for signing of two treaties. The Rio Declaration on Environment and Development (see Birnie and Boyle, 1995: 9–14, and Zhang & Ferris in this issue), a statement of principles endorsed by all parties attending UNCED, reveals the emerging modern definition of sustainable development. Principle 1 while not recognizing the absolute right to a clean and healthy environment (Sands, 1995: 50) does claim the relative right for people to have a healthy and productive life in harmony with nature. Principle 2 further states that:

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.

According to Principle 3, the state's right to development must be achieved in such a way as to equitably meet developmental and environmental needs of present and future generations. Principle 4 states that sustainable development can only be achieved where environmental protection constitutes an integral part of the developmental process and is not considered in isolation from it.

In comparison to Principle 21 of the Stockholm Conference that confirmed the state's sovereign responsibility over environmental protection, the Rio Declaration has proven controversial. It has been argued that the expansion of Principle 21 to include 'developmental policies' has been a step backwards for the cause of sustainable development. The argument goes that it disrupts the carefully crafted balance established between sovereign and environmental responsibilities established in the Stockholm Conference as well as dilutes the relevance of environmental protection in national economic policies. Counter arguments suggest that the inclusion of 'de-

developmental policies' in effect compel states to take a more realistic approach to environmental policy by recognizing the impact of unbridled economic growth on the environment. This viewpoint claims that environmental considerations should be moved from the international relation's margin to its economic centre (Sands, 1995: 51).

Over the last half-century or so the scope of international environmental law has changed considerably. Initially international law stipulated that the state had the obligation to make sure that economic activities within its territory did not precipitate environmental decline across the nation's border. Over the last decade or so lawmakers have realized that sound environmental protection law is not *simply* a matter of getting the extent of administrative discretion and the level of environmental quality standards right. Accordingly sound law-making in sustainable development is determined by its efficacy in protecting the environment, and its ability to promote equitable economic development. It appears that, whereas international environmental law used to apply a re-active approach to solving problems, modern sustainable development law advocates that governments implement a pro-active strategy.

HONG KONG'S PROBLEM

As the international community struggles to come to terms with the appropriate balance between economic growth and environmental protection, Hong Kong is no exception. Some might even argue that Hong Kong is exceptional when it comes to the debate concerning sustainable development (see generally Hills & Barron, 1990). For example, the Hong Kong public must tolerate a situation where the Environmental Protection Department claims that a permanent smog hanging over Hong Kong is safe; where the Drainage Sewage Department fails to inform the public that a sewage pipe has burst and polluted the area where the bathers were swimming (*Sunday South China Morning Post* 13 July 1997, p. 1); and where policy makers struggle to come to terms with a hazy smog besmirching our skyline (Palpal-Latoc, 1997; *SCMP* 2 March 1998).

The rationale for this neglectful approach to environmentalism may be traced back to the origins of Hong Kong's environmental system (see generally Bachner, 1993). The consultant hired to establish the territory's first environmental system admitted

that vigorous environmental standards were never contemplated because they would be neither enforceable nor politically possible (Bidwell, 1990). The relevance of this perception is shown by the legislative debates leading to the enactment of the original pollution control legislation. One legislator stated that:

... I bring out the question of cost implications to the community because it is very important that we know what type of water we are getting into. The momentum of implementing the concept of environmental protection gathered steam only in the more affluent OECD countries during the past two decades ... These OECD countries can of course afford the luxury of imposing expensive measures onto their community. We in Hong Kong unfortunately cannot. Hence we must guard against importing on a wholesale basis such standards and ideas from affluent countries without taking serious consideration of our own circumstances. I have no doubt the Administration will assure us that local conditions will be taken into consideration. Yet this issue of whether we can afford it or not is of such paramount importance that a cautionary note, if needed, can only be of long term interest to the community of Hong Kong. Let us not lose sight of the fact that our survival is very much dependent on whether or not we can continue our progress on the economic front (Cheong, 1983).

The fear that strict environmental regulation would impose stifling economic burdens on business was perhaps second only to the anxiety that more environmental regulation would mean greater interference by the government with the operation of business. Another legislator sarcastically added:

It is now possible to imagine, theoretically at any rate, the men of the Air Pollution Control Division of the Labour Department dealing wisely and impartially with all complaints of pollution ... These wise men will advise the ancient hawker expertly and patiently to extract chestnuts from the fire ... and take on the Chief Secretary and advise him on the type of HKD120 million precipitator to be installed ... I find it very difficult to believe that the passage of this Bill will give us clean air, less dirty air, or even controlled polluted air. Very likely it will interfere with people making a living (Lee Tak Shing, 1983).

With such a legislative history, it is not surprising that, as late as 1992, government authorities responsible for environmental law enforcement were expressing frustration with their *own* slow rate of enforcement. One official asserted that:

The slow pace of implementation is also consistent with the government's policy of minimal interference with industry. It intended the law to be applied flexibly in response to specific needs. In the event, Hong Kong's success in other areas has led to such rapid development that pollution controls have been quite unable to keep up with the problems (Holmes, 1992).

An old Cantonese expression perhaps best captures why Hong Kong has been resistant to improving its environmental regulatory system and why its improvement is so necessary. It is *Deng, You, Foh, Lahp*, literally 'Light, Oil, Fire and Wax'. The meaning is best explained in English by an example: small business operators might respond plaintively to consumers complaining about the high price of their products: 'Even the price of *Deng, You, Foh, Lahp* is rising. How can I afford to keep my prices down?' The maxim refers to the primary costs of living and provides a profitable analogy to examine the 'internal costs' necessary for a manufacturer to operate a business. The price of the product manufactured accounts for the internal costs (plus of course other necessities such as labour, rent, etc) plus a margin of profit. By keeping the prices as low as possible, the manufacturer would be able to sell more of the product. It follows that the higher the price, the higher the profit margin as well as the risk that the consumer will purchase less of the product.

Naturally the rules of private property compel the manufacturer to take these internal costs into account. For example, if the manufacturer wishes to enjoy the benefit of using electricity, the manufacturer must pay for this right to use it. The question arises, however, whether those internal costs are the only costs that the manufacturer should be compelled to take into account in the pricing procedure.

Ordinarily the manufacturer is also using public natural resources such as the air or water. The use exists when the firm emits smoke or discharges effluent. The government has the discretion to determine whether the government will absorb the cost of the clean-up or the polluter ought pay for it. The issue for the government is whether the use of public natural resources should be free to the polluter. At a superficial level, the answer is yes because no one possesses private property rights in natural resources. This, nevertheless, does not mean that the maintenance of the water or the air is without cost. For instance the pollution may impose considerable social costs such as respiratory diseases or the poi-

soning of fish. This in turn will lead to declines in labour productivity, malaise in public morale or the desire to leave Hong Kong.

Does this discounting of the value of natural resources make economic sense or does it simply distort the actual value of a manufactured product? The free market can not work properly if the price of a product is calculated incorrectly. If particular costs of a product are ignored, it follows that the price of the product will be cheaper than it should be and that consumers will purchase too much of it. In order to correct such a market failure, it is necessary for the implementation of a re-assessment of the value of all the natural resources that are used in the manufacturing process (for an extreme market environmentalist approach to environmental protection in Hong Kong, see Kwong, 1988).

If the manufacturer internalizes the price of the use of the natural resource or the actual price of cleaning up the pollution, he will increase the price of the product. As a result of the higher price, which more accurately reflects the true cost of manufacturing the product, consumers will demand less. The manufacturer will consequently generate less of the product and use less of the natural resource. The free market now rather than distorting the pricing of the product by suppressing the external costs of pollution actually conveys the true cost of the product and facilitates a more rational decision-making process by the consumer.² The best economist I have read on this topic, Kenneth Arrow (1985), asserts that where firms are not held accountable for the pollution they impose on a neighbourhood, the firms will likely pollute more than is desirable. In other words, the costs accrued by forcing the neighbourhood to deal with the pollution is not less than the benefits to the firm or its customers for the expanded activity.

Policy makers must consider the action necessary to account for the costs and induce the firms to pollute at acceptable levels. The state is an appropriate candidate for this task, because of its powers to legislate, to impose taxes and punish wrong-doers. The state may also employ a wide variety of economic measures to create incentives for firms to change their conduct. These include tradeable permits, tax credits or subsidies as well as the encouragement of voluntary corporate environmental strategies such as ISO 14001.

Sound sustainable development policies, at a minimum, require the accounting of environmental

costs. Indeed the determination of which environmental costs ought be accounted for is a complex political question probably best left for the legislature. International environmental law, however, quite usefully, provides benchmarks to facilitate the establishment of good law. Such standards include public participation, intergenerational equity and, of course, a reasonably clean environment (Sands, 1995: 183–237). It is essential that Hong Kong come to terms with these standards in order to avoid the possibility of being black-listed as an environmental underachiever or, worse, being internationally sanctioned.

A SUSTAINABLE RESPONSE?

Hong Kong has recently inaugurated an interesting debate on an appropriate sustainable development policy for the territory. The actual achievement of sustainable development in Hong Kong will be complicated by the fact that the establishment of policy in Hong Kong is largely led by the executive and involves limited public participation (Lo, 1995). The government endorses a *laissez-faire* model or at most a “positive non-interventionist” approach (Campbell, 1993; generally Hills, 1985) and is reluctant to implement policies that may be perceived to undermine business. The lack of any direct elections during most of the colonial period largely precluded any meaningful public accountability for environmental decline. It is doubtful whether the new electoral system will provide a better system because it only allows for a minority of popularly elected legislators (for a brief description see Hong Kong Government, 1998).

Having said that, it appears that grass roots pressure, international trading partner’s expectations and the fear of losing tourists to cleaner jurisdictions has driven the development of a nascent environmental consciousness amongst government and corporate leaders. Fortunately, the recently initiated, executive-led, Territorial Development Strategy (TDS) Review recognizes that the economic development of Hong Kong cannot be achieved without some environmental risk and raises the issue as to how much environmental risk is acceptable.³ The need for a reasonable policy of sustainable development was further underlined when the government launched a consultancy study on Sustainable Development for the 21st Century (SUSDEV 21). The purpose of the study is to

1. define the meaning of the term ‘sustainability’ for Hong Kong;
2. develop guiding values, sustainability indicators and criteria covering the economic, social and environmental aspects of development;
3. conduct baseline economic, social and environmental studies for Hong Kong;
4. establish a ‘sustainable development system’ that could be applied on a corporate basis;
5. test and refine the sustainability indicators, criteria and the Sustainable Development system using the TDS as a reference;
6. identify policy and/or institutional areas that may need to be improved so as to facilitate the taking of decisions relating to sustainable development in a more informed and balanced way; and
7. obtain the widest possible public participation throughout the study process and bring the attention of the community to the importance of sustainable development.

One of the major goals of the review is to determine a satisfactory method to identify, apply and monitor sustainable development in the territory (Liu, Atkinson and Van Toen, 97). The study hopes to improve environmental decision-making in both government and firms (Fung, 1997). The project is expected to be completed in the year 2000.

Pollution control laws in Hong Kong are largely command-and-control measures modeled on the contemporary legislation of the early 1980s. Public participation is limited to the extent that public hearings or third party litigation is virtually non-existent. A number of managers of smaller industries have commented to the author informally that larger industries often endorse the government’s enactment of stricter environmental laws because of the competitive advantage this affords them over the smaller industries that will have trouble paying any fines.

The policy branch responsible for the environment is the Planning, Environment and Lands Branch (PELB). It is arguable that the accumulation of such disparate departments under one office does not bode well for the environment. When disputes arise between the different departments, the Secretary for PELB must settle the conflict. This is unsatisfactory because this leads naturally to conflicts of interest between development and the environment for which no mechanism exists, that I am aware of, that will assure fair consideration in the resolution of such a

dispute. The policing and policy arm for environmental protection in PELB is the Environmental Protection Department. The Advisory Council of the Environment (ACE), a quasi-governmental board composed of representatives from industry, government, green groups and academia provides oversight authority for the implementation of the environmental law.

The environmental regulatory and institutional framework in Hong Kong is designed to control pollution. It is not intended to sort out the causes of pollution and legislate ways to control the reasons why Hong Kong generates excess pollution in the first place. (Nor is it designed to deal with pollution in its complex material existence; pollution control laws, artificially, tend to compartmentalize pollution in terms of media such as air, water or land ignoring the integrated nature of the problem, and perhaps the solution. An integrated approach to pollution control is certainly preferable.) Ordinarily, the legislation is meant simply to define and establish what is a safe level of pollution (Epstein, 1993). There are indications, however, that Hong Kong's law may be changing from a re-active to a pro-active approach that seeks not only to clean-up pollution but also to prevent it through economically sensible methods. (For an interesting discussion of how the common law of environmental protection in Hong Kong may have taken a step backwards, see Glofcheski, 1994. See generally, Bachner, 1996b.) For example, the recent enactment of an Environmental Impact Assessment Ordinance (Cap. 499) and Technical Memorandum (Hong Kong Government, 1997a) provides for the internalization of environmental costs arising from most major developments (Lam & Brown, 1997). Having said that, the decision in the Waste Reduction Study not to recommend legal measures at this stage is less encouraging (HKELA, 1997: 6-7, but see Ng, 1997).

One of the more controversial aspects of the legislative debate concerning the EIA Bill centred on whether or not the government would allow for third party lawsuits, brought by independent parties to assure that the government and proponents were complying with acceptable standards (Holland, 1997). On the one hand, the decision to exclude third party lawsuits certainly pre-empts a potential useful measure of public accountability. On the other hand, given the government's limited financial and human resources to implement such comprehensive regulation, the money may be more productively spent on cre-

ating satisfactory management systems and cleaning up the pollution rather than attributing blame for neglect. The government also claims that third party lawsuits are redundant, as judicial review would allow for any necessary accountability (*id*). Public lawyers have disputed the government's faith in judicial review as a suitable alternative on the grounds that judicial review is far too costly to prove viable. (See also Woolf, 1992: 7-8.)

Furthermore, the Sewage Services Ordinance adopted in December 1994 (Cap. 463) effectively incorporates the concept of the Polluter Pays Principle (PPP) into some aspects of Hong Kong's environmental policy. Under this system, the government charges the public, commerce and industry for collection, treatment and disposal of sewage (Chung, 1997). The intention of the programme is to induce consumers to generate less waste by charging for its disposal. The Sewage Services Trading Fund, financed by the charges, was the management institution responsible for the administration of the sewage strategy. Complaints arose that the fund was inefficiently managed and that the charges were inequitably applied. In 1997 the Government, though denying these charges and, despite allegations to the contrary (Citizens Party, 1997a, 1997b), asserting that their commitment to PPP is strong (Hong Kong Government, 1997b) wound up the Fund (Hansard, 19 November 1997).

The new Chief Executive Tung Chee Hwa illustrated the complexity of implementing a policy of sustainable development in the territory, during his first address to the Provisional Legislative Council. He stated that 'waste and environmental degradation represent inefficiencies that are costly to our health, our business and our community. Sensible planning and action to reduce them is good for our competitiveness as well as our enjoyment of our city' (Tung, 1997: 27). In the same speech he also called for a dramatic increase in the construction of housing in Hong Kong. This in turn could lead to the need for greater land reclamation. More construction will result in the generation of more construction waste. More reclamation will lead to greater disturbance of an already fragile marine environment. More housing developments will lead to the creation of more domestic sewage. Indeed the honourable goal of improving Hong Kong's housing situation must be carefully planned.

The extent to which Hong Kong will be able to control its own sustainable development policy *vis à*

vis the development of its constitutional role within the People's Republic of China will also be interesting (Mushkat, 1990). The Basic Law regrettably does not clarify the extent to which central government authorities may assert authority over Hong Kong's environmental regulatory framework. According to Article 119, the government of the HK Special Administrative Region must 'pay regard to the protection of the environment'. The government has a clear mandate to formulate appropriate policies to promote and coordinate the development of various trades such as manufacturing, commerce, tourism, real estate, transport, public utilities, services, agriculture and fisheries. One commentator has argued that the limited powers of autonomy envisioned in the Basic Law will undermine the effectiveness of the enforcement of environmental law in the territory (Liebman, 1998).

It should be noted, however, that China has taken considerable steps to assure its compliance with the law of sustainable development as outlined in UNCED. One of the UNCED documents, Agenda 21, appeals for all nations to develop a national strategy of sustainable (For the primary work examining China's environmental law, see Ross & Silk, 1987). China's Agenda 21 was adopted by the 16th Executive Committee Meeting of the State Council and serves as a guiding framework for the PRC economy (China Government, 1994:1). In an effort to implement sustainable development, the Chinese government has also amended national legislation, such as the Air Pollution Prevention and Control Law, the Criminal Code, the Civil Law as well as applied new policies such as the 'polluter pays principle' (Alford & Shen, 1997: 130).

In addition to these domestic developments, Hong Kong's commitment to sustainable development will be revealed by its efforts to meet international obligations (Hong Kong Government, 1996). Hong Kong does not have the political authority of a state to negotiate its own international obligations (unless it is so delegated by the sovereign). As a unique jurisdiction with special international trade relations, however, it has certain international obligations, in accordance with the Basic Law, to respect (Ghai, 1997: 439). Hong Kong's past practice has been to accept its international environmental legal obligations (Mushkat, 1997: 106) by incorporating them into domestic legislation. Legislation has been established for marine pollution control, ozone depleting substance reduction, endan-

gered plant and animal species protection and natural habitat preservation (id: 99). Also a greenhouse gas inventory has been prepared by the Environmental Protection Department, a Coordinating Group on Global Climate Change has been established and an Energy Efficiency Advisory Committee has been instituted by the Secretary for Planning, Lands and the Environment (id: 101).

However, when it comes to the obligation, to incorporate express international obligations meant to achieve the policy of sustainable development, Hong Kong demurs. Hong Kong would not explicitly adopt the UNCED agreements. Hong Kong argued that due to its uncertain economic status as a developed or developing jurisdiction, the impending 1997 transition and Hong Kong's unclear political status (ibid), it would be inappropriate to participate formally in UNCED. SUSDEV 21, however, should provide useful insights into how the government intends to come to terms with the aspirations of Agenda 21 of the Rio Conference. Hong Kong's slow response, far behind that of the People's Republic of China, reflects either its constitutional caution or its simple neglect of the issue.

For instance, the programme that has attracted the most attention from the business community has been the Environmental Management Systems (EMS) approach. EMS is a policy implemented by institutions in order to regularize its commitment to environmental protection and set out procedures that will allow for the continuous evaluation and improvement of the programme. The International Organization for Standardization approved 'ISO 14001 Environmental Management Systems — Specifications with Guidance for Use' in September 1996, one of the primary standards of certification for an acceptable EMS in Hong Kong. The basic objectives of ISO14001 are to promote 'compliance with environmental regulations as a minimum standard; commitment from management to prevent pollution and a goal of continued environmental improvement' (ISO). Specialists assert that the government and service-oriented businesses have not wholeheartedly endorsed EMS (Wan, 1997). To date, eleven firms in Hong Kong have been certified.

It has been argued that government ought take a pro-active step to inducing business to adopt EMS by reducing environmental regulatory burdens, lowering inspection or reporting requirements and consolidating licenses into 'bubble permits' for a group of developments. While economic incentives

that serve to reduce bureaucratic costs ought be considered, law makers must be careful not to dilute further the environmental quality standards that the EMS was designed to defend and promote in the first place. In addition to potential governmental inducements, firms should be motivated to adopt EMS due to the reduction in costs that should arise from banks and insurance companies. The adoption of EMS will serve to reduce environmental risks and hence the considerable environmental liability that may arise from the violation of pollution control laws. As a result insurance companies should have reason to decrease premiums on insurance policies and banks should lower interest on loans (id).

Other market-driven alternatives to regulation include the implementation of eco-labelling and life cycle analysis as a means to improve a consumer's decision-making process. According to the International Organization for Standardization, environmental labeling is designed to communicate honest, clear and non-deceptive data on ecological aspects of products and services. This labeling should increase demand for and supply of these products and services, and thereby induce continuous environmental improvement. Presently, however, eco-labeling in Hong Kong has had limited application. So far only the Electrical and Mechanical Services Department has initiated an energy efficiency-labeling scheme for household appliances. Also a private textile eco-label called 'eco-tex' and a building eco-label entitled 'Hong Kong Building Environmental Assessment Method' has been started (Poon & Wan, 1997). The recent Waste Reduction Plan Consultancy Study by the government encourages the development of eco-labeling and life cycle analysis.

Finally it is worth mentioning the corporate sector initiatives that are actively promoting the adoption of sustainable development within firms with relevance to Hong Kong. Locally, the Private Sector Committee for the Environment, administers the Centre for Environmental Technology, a facility donated by the Hong Kong Jockey Club. China Light and Power is the first Hong Kong corporation to my knowledge that has published an environment, health and safety review (CLP, 1997); the fact that it is the only publication of its kind that I am aware of reflects poorly upon the community's commitment to corporate environmental responsibility.

Additionally the Global Environmental Management Initiative (GEMI) has been adopted by

a number of multi-national corporations, including Eastman Kodak, Apple, Coca-Cola and Johnson and Johnson, *inter alia*. GEMI devises administrative guidance programmes and tools for firms interested in applying sustainable development principles to their management. Some Hong Kong companies have also signed onto the International Chamber of Commerce's Business Charter for Sustainable Development (ICC). The Charter sets out a number of principles deriving from sustainable development which firms should follow, including categories such as research and development, law and education. Interested parties are also provided a self-assessment examination to help companies determine the extent to which they have incorporated the principles arising from sustainable development and ISO14001.

Despite the development of an environmental consciousness in executive, legislative and corporate initiatives, recent case law suggests that any consideration that the judiciary continues to limit the scope of contemplating the importance of environmental protection within the Hong Kong development policy. The Hong Kong court's approach seems vulnerable to the same criticism that Sir Harry Woolf leveled against the High Court of England. He stated that 'the High Court has consistently turned its face against considering the merits of [the environmentally related] decision, but instead has confined its attention to scrutinizing the procedural process adopted by Ministers in reaching their decision' (Woolf, 1992: 5).

For example in the 1980's case *Attorney General v Melhado Investments Ltd* (1983), the government attempted to prevent a business from using private land as a waste dump. The government sued arguing that the dumping must cease because the land was not being used in accordance with the original lease conditions. The lease stated that the land was to be used for agricultural purposes. The Court of Appeal adopted a strict interpretation of the lease condition, however, holding the dumping was permissible on account that the lease condition was merely descriptive and not obligatory. The judicial decision to endorse dumping and neglect environmental considerations, precipitated a comprehensive reform of planning legislation (Cooray, 1992).

One might detect some scope for optimism in the dissenting judgement of a recent Privy Council case. In *Henderson Real Estate Agency v Lo Chai Wan* (*for and on behalf of the Town Planning Board*)

(1997), the Privy Council held that where planning legislation did not expressly authorize the protection and conservation of the ecological value of a fish pond under threat by the construction of a residential development and golf course, the town planners could not read in such an environmental intention (Mehta, 1997). An independent study authorized by the Town Planners specifically stated that no further marsh areas should be reclaimed because the fishponds were an essential eco-system vital for many rare birds that spend the winter in the area. The Privy Council reversed the decisions of the Court of Appeal and the Town Planner and re-instated the decision of the Planning Appeal Board. It was agreed that the Planning Appeal Board had the discretion to determine the environmental grounds of the complaint by the appellant. Their decision that, despite the independent study, the fishponds had no environmentally intrinsic value and should be destroyed was therefore affirmed.

The dissenting judgment, however, reveals quite clearly the tension elucidated by Sir Harry Woolf (1992: 14–16). The two dissenting judges agreed with the decisions of the Hong Kong Court of Appeal that the planning guidelines intentions were primarily to restrict development to agricultural and recreational uses only and that the Planning Appeal Board's decision to allow development undermined such intentions. The dissent approvingly quoted Bokhary JA (Justice of Appeal) in the Court of Appeal who stated that the planning intention was to preserve wetlands against large scale development, and Ching JA to the effect that the purpose of the guidelines was to protect the treasured Mai Po Nature Reserve in its present undeveloped state. It is to be hoped that the Court of Final Appeal, which has now replaced the Privy Council at the apex of the Hong Kong legal system, will adopt the approach of the minority rather than the majority in any future case.

Finally, pollution control regulation is designed to deter firms from polluting by imposing fines for violation of the environmental standards. Rational economic thinking suggests that a firm will not comply with the legal standards where it is cheaper to pay the fine than to adopt the necessary environmental technology. Courts in Hong Kong have been generally speaking reluctant to impose the fines allowable under the regulations. Often they have been considerably cheaper. I have been told informally that magistrates will normally ask the EPD what is

the average fine that the courts have imposed and apply that. Having said that, it is worth mentioning that a Hong Kong court has recently imposed a one-month prison sentence suspended for one year against a bean curd factory for violation of the Water Pollution Control Ordinance (HKELA, 1997: 7). This is the first time that imprisonment has been imposed for an environmental transgression.

Hong Kong's executive, legislative, corporate and judicial responses to sustainable development and environmental protection are at an early stage of development. Needless to say, considerable pressure exists to speed this work. It is essential that present and future environmental regulatory work not only controls pollution but also continue to respond to the core cause of excess pollution. The work on the Environmental Impact Assessment Ordinance, the gradual incorporation of the Polluter Pays Principle, the voluntary corporate programmes and the promotion of eco-labeling signals the community's appreciation that pollution is not simply an end of the pipe problem. It reflects an awareness that sound environmental law should not only induce appropriate corporate management practices but also provide adequate environmental information to consumers so that consumers can make sound market decisions. The different stakeholders affected by the implementation of the environmental law complicate the solution to the problem of sustainable development. These stakeholders include consumers, taxpayers, firms and government to name but a few. The answer lies in finding the right balance between regulatory and market-driven environmental measures that will induce these stakeholders to act rationally.

To take one example: for years, Hong Kong has struggled to establish an acceptable transportation policy that balances the territory's considerable demand for the use of cars and the generation by the cars of unacceptable levels of air pollution. To the government's credit, a number of executive and legislative initiatives have been implemented, which over the years, has resulted in the generation of less noxious emissions from each car. At the same time, however, the government has continued to build more roads and issue more vehicular licences: by the year 2000, the Hong Kong government intends to spend over HK\$30 billion on the construction of new roads. At the end of 1995, Hong Kong had approximately half a million licensed vehicles (Hong Kong Government, 1996b: 226 & 234). Not only has traffic

congestion increased but any marginal benefit derived from the improved air pollution standards, must be discounted by the accumulative pollution effect of the increased number of cars on the road.

For the transportation policy to be, at least, rational and, at most, sustainable, the government must clearly set out a sensible transportation policy goal. Then it must establish and implement sound regulatory and economic measures that will induce the various stakeholders to achieve these goals. In the case of an acceptable transportation policy, I have heard argued persuasively that, in light of the pollution and congestion caused, the value of a car licence should be set at HK\$10,000,000. Of course this just brings into contrast the important issue of equity: should the ownership of a car be simply a preserve of the elite? There are no easy answers to the establishment of a sound sustainable development policy, only hard decisions.

The concept of sustainable development seeks to mediate the tension between environmental protection and economic development. The law offers the most effective tools (ranging from the creation

of voluntary economic incentives to compulsory administrative regulations) to facilitate the achievement of sustainable development. Despite an institutional prejudice against pro-active legislation, the Hong Kong community has taken a number of constructive, if (relative to the international community) late, preliminary steps toward the implementation of a sound sustainable development policy. For the law to work effectively legal measures must not only deter serious environmental wrong-doing through committed enforcement but also create appropriate incentives to encourage businesses to operate in an environmentally acceptable way. The central issue that will determine whether or not Hong Kong's progress will be successful depends upon whether the community has outgrown the notion that the free market can work if it ignores environmental costs. The extent to which the law and policy is willing and able to account for these costs and induce appropriate corporate behaviour will reveal, to a considerable extent, the efficacy of Hong Kong's commitment to sustainable development and a practicable free market system.

NOTE

- 1 Earlier versions of this paper benefited from comments received during its presentation at a Conference entitled 'One Country Two Systems: Theory and Practice' held at the City University of Hong Kong, July 1997 and the POLMET '97 Conference entitled 'Sustainability in the 21st Century: The Challenge for Asian Cities' held in Hong Kong in December 1997. I would like to express my appreciation to the City University of Hong Kong for providing me a Strategic Research Grant to support the research for this chapter. I would also like to thank Anne Copeland and Meredith Berkman for comments on earlier drafts. I would also like to thank Jill Cottrell for her editorial comments and for bringing relevant resources to my attention.
- 2 I have argued elsewhere that the extent of government involvement ought be somewhere between the extremes of exclusively administrative regulations and economic measures. See Bachner, 1993: 650; Bachner, 1996: 408; Bachner, 1997: 388.
- 3 Legislation illustrating the public's concern about 'over-development' is the 'Protection of the Harbour Ordinance' (Cap. 531) which was recently re-approved by the Provisional Legislative Council. The law is intended to create a presumption against non-essential reclamation in the Central Harbour. (See Pang, 1998; Pryor and Chu, 1997.)

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Shaping an Environmental Protection Regime for the New Century: Environmental Law and Policy in the People's Republic of China¹

Zhang Hongjun and Richard J. Ferris Jr.

Abstract

At the heart of China's economic development boom lies the investment of an expanding number of foreign companies. China's transition to a more market-based economy, however, has brought about swift administrative and regulatory changes that serve to confound the investment community, particularly in the environmental arena. The transition is also working immeasurable changes in the economic, social and cultural landscape as Chinese citizens search for answers to the questions: 'How much environmental protection do we need and how much can we afford?' This article seeks to provide a foundation for discussion of these issues by describing China's environmental regulatory regime, Chinese perceptions of this relatively new area of law, and key topics of particular concern to foreign investors, such as access to environmental laws and related information, enforcement burden reduction, environmental crimes, citizen-suit and comment provisions, judicial review of administrative decisions, liability for historical contamination of land, availability of waste-disposal facilities, and basic environmental requirements for foreign investment projects.

Part I introduces the scope of China's environmental legislation and the structure of the Chinese legal system. Part II provides an overview of the environmental regulatory system. Part III includes a discussion of China's environmental 'Legislative Plans' for the periods 1993–1998 and 1998–2003. Part IV describes practical issues related to Chinese environmental laws that may concern foreign investors such as those operating or contemplating the establishment of commercial enterprises in China.

Keywords: *China, environmental law, law enforcement, government, foreign investment*

Throughout modern history, China placed little emphasis on the development of a comprehensive legal system for various philosophical, political, economic and cultural reasons. Since the late 1970s, however, law has acquired greater importance and become a

considerable factor in the economic, political and social transformation of the country. The proven benefits of a stable legal system have not been ignored by China's leaders and the public at large. The development of China's various environmental

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regulatory regimes has played a prominent role in the evolution of the country's overall legal system and is increasingly seen as integral to China's future prosperity. China's well-publicized economic development boom is fueled, in large part, by the investment of an increasing number of foreign companies. The rapid pace of development in China, however, has been matched by equally swift administrative and regulatory changes that serve to confound the investment community. The authors hope that the information provided in this article will assist those interested in China's environmental protection regime understand the origins, current situation and future directions of these changes.

I. ENVIRONMENTAL LEGAL FRAMEWORK OF CHINA

A. Summary: Law-Making Institutions

The principal organs responsible for the enactment of laws and policy documents are identified in the Constitution. (*[Xianfa]*, Constitution, arts. 58, 62, 64, 67, 89, 100, 116 (1982, as amended, 1988, 1993)). The National People's Congress (NPC) is the highest-level legislative institution in China. The NPC has the power to enact and amend 'fundamental' national statutes, such as the Civil Law (*[Min Fa Tong Ze]* (adopted 12 April 1986, effective 1 January 1987)), including statutes related to the establishment and organization of other government institutions. The NPC may also amend the Constitution via a procedure that requires a two-thirds majority of the legislators. The Standing Committee of the NPC is authorized to enact and amend all laws with the exception of those 'fundamental laws' that may only be enacted by the NPC itself. During times when the NPC is not in session, the Standing Committee may supplement and amend laws enacted by the NPC only insofar as these supplements and amendments do not contravene the law's 'fundamental principles.' (art. 67 §3) The State Council² may enact administrative regulations in accordance with the Constitution and applicable law. The provincial people's congresses, the people's congresses of special municipalities (Beijing, Chongqing, Shanghai, and Tianjin), and the standing committees thereof, may enact local regulations provided they do not contravene the Constitution and applicable national laws and administrative regulations. Lastly,

the people's congresses of national autonomous regions may enact autonomous region regulations and specific regulations, the latter covering more specific subject matter than the former.

B. National Environmental Administration

At the highest level are the NPC, the newly formed Environmental Protection and Natural Resources Conservation Committee, and the State Council, all of which serve advisory, as well as drafting and oversight roles with respect to environmental legislation and regulations. The NPC and the Standing Committee are also responsible for legislative matters related to international environmental agreements. The National Environmental Protection Agency (NEPA), an administrative entity under the State Council, was elevated to ministry-level status and renamed the 'State Environmental Protection Administration' (ASEPA) on 27 March 1998; it is responsible for formulating national environmental rules, methods and standards.

Most important for those investing or contemplating investment in China, are the ministries under the State Council that wield significant influence on the implementation of environmental statutes and regulations enacted by the NPC and the State Council, respectively. Each industrial ministry has an environmental protection department, office, or division responsible for overseeing and issuing approvals for industrial operations and other foreign investment projects within their jurisdiction. The total number of specialized administrative entities changes frequently as the result of government restructuring initiatives.

In what may be China's most significant restructuring initiative of this century, on 6 March 1998, the State Council formally announced plans to reform the country's complex administrative structure. These plans are part of a far-reaching economic reform package. The reform plans were approved by a majority of the delegates to China's Ninth People's Congress on 10 March 1998. Among other things, the reform plans will require the closure of 11 of the country's approximately 40 ministry-level entities. Many of the remaining entities will be reorganized. It is estimated that the resulting changes in the administrative landscape will precipitate a 50% reduction in the current number of administrative personnel. Most of the entities slated for closure or reorganization have environmental protection divi-

sions or offices that influence environmental regulatory programmes affecting industry sectors within their jurisdiction. In the near term, these profound changes will likely detrimentally affect the efficiency and efficacy with which these programmes are implemented. Ministries targeted for closure that have significant environmental responsibilities include:

1. the Chemical Industry Ministry;
2. the Coal Industry Ministry;
3. the Metallurgy Ministry;
4. the Machinery Ministry;
5. the Domestic Trade Ministry;
6. the Posts and Telecommunications Ministry;
7. the Geology and Mineral Resources Ministry;
8. the Forestry Ministry; and
9. the Electric Power Ministry.

Administrative responsibilities of many of the closed ministries will be assumed by new bureaux under reorganized ministries. For example, administrative responsibilities of the Chemical Industry Ministry will be assumed by a new State Petroleum and Chemical Industry Bureau under the State Economic and Trade Commission, which will also take over administrative responsibilities once held by the China Petrochemical Corporation (Sinopec) and the China National Petroleum Corporation (CNPC). The closures, reorganizations and personnel reductions will likely be implemented among line agencies and subnational-level administrative entities as well.

C. Local Environmental Administration

At the local level, provincial environmental protection agencies, as well as county and municipal environmental protection bureaux (EPB), oversee compliance with national environmental statutes, regulations, rules, methods, and standards, as well as local counterparts enacted by local people's congresses and standing committees.

As discussed later in this article, local governments have been identified as the keys to the success of the country's environmental protection programmes. Former premier Li Peng and other senior government officials have admonished local officials for their apathy towards environmental protection.³ Because the results of industrialization severely impact the quality of life in China's municipalities, it is likely that national government and citizen pressure to overcome this indifference will increase.

D. National Legislation⁴

A chart indicating key environmental protection, resource conservation, worker safety and consumer protection initiatives is included as an appendix to this article. This chart is not intended to be comprehensive, but merely reflects fundamental developments and highlights significant trends.

*Environmental Statutes.*⁵ In 1979, the Standing Committee of the NPC enacted China's first major environmental statute, the Environmental Protection Law (EPL).⁶ This law brought China's environmental protection work under the aegis of the infant legal system and laid the foundation for future environmental legislation. Although far too lengthy to be summarized in detail in this article, the EPL essentially provides the general framework for allocating administrative responsibilities, identifies target areas for environmental protection and natural resources conservation work, specifies measures for the control of environmental pollution and other public hazards, and outlines legal liabilities for violations. The EPL is potentially applicable to all regulated entities, and thus should be consulted in conjunction with subsequent media-specific legislation. If a media-specific piece of environmental legislation does not address subject matter contained in the EPL, the relevant EPL provisions will apply by default.

Since 1979, sixteen laws dealing with pollution control and natural resource conservation have been enacted by the NPC. They are listed here, and their Chinese names in pinyin, and fuller dates, are given in the notes:

- The Air Pollution Prevention and Control Law, 1987⁷
- The Energy Conservation Law, 1997⁸
- The Environmental Noise Pollution Control Law,
- The Environmental Protection Law, 1996⁹
- The Fisheries Law, 1986¹⁰
- The Flood Prevention Law, 1997¹¹
- The Forestry Law, 1984¹²
- The Grasslands Law, 1985¹³
- The Land Administration Law, 1986¹⁴
- The Law on the Prevention of Environmental Pollution Caused by Solid Waste, 1995¹⁵
- The Marine Environmental Protection Law, 1982¹⁶
- The Mineral Resource Law, 1986¹⁷

- The Water and Soil Conservation Law, 1996¹⁸
- The Water Law, 1988¹⁹
- The Water Pollution Prevention and Control Law, 1984²⁰ and
- The Wildlife Protection Law, 1988.²¹

Environmental Regulations. At the next level of authority below the statutes are regulations issued by the State Council, which are generally more technical and specific. These are in fact 'implementing legislation' setting forth legally binding requirements at a greater level of detail than is provided in the statutes themselves. The State Council has issued more than 20 regulations specifically addressing environmental protection and natural resource conservation since 1979. Examples are the Implementation Regulations for the Water Pollution Prevention and Control Law²² and the Provisional Regulations for Environmental Management in Economic Development Zones.²³

*Environmental Rules, Methods, and Standards.*²⁴ In addition to the system of regulations, at still a lower level of authority, are the rules, methods, and standards documents formulated by SEPA, other ministries and agencies under the State Council. Broadly speaking, rules are more administrative, whereas methods are more technical in nature. Standards documents generally provide numerical bases for compliance that must be used in reference to regulations, rules, and methods. Without accompanying legislation, standards documents do not have any independent legal meaning. Rules and methods, however, prescribe conduct for the regulated community and have independent legal relevance. The terms 'rules' and 'methods' are often used interchangeably in Chinese environmental legislation. Foreign investors may be accustomed to using the terms 'rules' and 'regulations' interchangeably, while in China, according to the Provisional Regulations on the Procedure for the Enactment of Administrative Regulations (*Xing Zheng Fa Gui Zhi Ding Cheng Xu Zan Xing Tiao Li*) (adopted 21 April 1987, effective 21 April 1987)), normative legal documents issued by the State Council ministries and agencies may not be designated 'regulations.' 'Regulation' is a term reserved for the normative legal documents enacted by the State Council itself.

To date, well over 100 environmental rules and methods and 350 standards have been issued. Examples of rules, methods, and standards are the

Management Methods for Environmental Impact Statements Pertaining to Construction Projects (*Jian She Xiang Mu Huan Jing Guan Li Ban Fa*) (adopted 26 March 1986, effective 26 March 1986) (governing the management of the environmental impact statement process)); the Rule on Reporting of Environmental Monitoring (*Huan Jing Jian Ce Bao Gao Zhi Du*) (adopted 21 February 1991, effective 21 February 1991) (regulating the means by which local environmental monitoring stations submit reports to NEPA (now SEPA)) and the Technical Standards for Groundwater (*Di Xia Shui Zhi Liang Biao Jun*) (GB/T 14848-93) (technical standards for groundwater quality)).

E. Local Environmental Regulations, Rules, Methods, and Standards

At the local level, the people's congresses of provinces, autonomous regions, and special municipalities formulate local environmental protection regulations that must be based on national environmental statutes but can address the unique social and economic conditions of the localities.

Local EPBs, commissions, and sometimes offices are delegated the authority to enact rules, methods, and standards. SEPA's general standards for environmental protection, quality, and pollutant emissions to be applied nationwide and to particular regions, serve as guidelines to local environmental protection administrations. Localities are allowed to set emission standards for pollutants not covered by the national laws, as well as to set more stringent standards for those pollutants already covered. Local standards must be forwarded to SEPA for review.

The local legal systems are playing an increasingly important and positive role in protecting and improving environmental quality, as localities are bearing the brunt of some of the country's most severe environmental problems related to rapid development. These problems include increased contamination of agricultural water sources and noise control in urban areas. Important examples of local-level legislative activity include the enactment of legislation banning or mandating recycling of certain materials deemed 'pollution intensive,' such as polystyrene foam, polyethylene or polypropylene packaging. In 1996 and 1997, such bans or recycling requirements were promulgated by the following municipalities: Beijing; Dalian (Liaoning Province); Guangzhou (Guangdong Province);

Qiqihar (Heilongjiang Province); Shijiazhuang (Hebei Province); Wuhan (Hubei Province); and Xiamen (Fujian Province). China's highly developed municipalities are also at the forefront of a national movement to ban leaded gasoline by the year 2000. Among the municipalities that initiated or completed bans on sales of leaded gasoline during 1997 were: Beijing; Guangzhou; Shanghai; Tianjin; Shenzhen (Guangdong Province); and Shijiazhuang.

Along with increased legislative activity at the local level, has come more investor confusion regarding national-local environmental requirements. Officially, the national legislation limits the legislative acts of local authorities. Local governments are authorized under Chinese law to pass more stringent environmental standards but may not enact more lenient standards. In reality, investment goals of local governments and other pressures may result in great variations between local and national environmental regulatory requirements. Such discrepancies continue to hamper efforts of regulators and foreign investors. These problems will likely be part of the price of China's rapid development for some time to come. Nevertheless, heightened national government scrutiny of local-level implementation, of at least the minimum standards imposed by national laws, can be expected as China moves forward with policies that favour economic growth while decreasing environmental degradation and resource depletion.

F. International Environmental Agreements

China is a party to over 30 multilateral legal instruments affecting environmental protection, such as the Vienna Convention for the Protection of the Ozone Layer (1985), the Montreal Protocol on Substances that Deplete the Ozone Layer (1989), the International Convention for the Prevention of Pollution from Ships (1973), the Convention for Prevention of Marine Pollution by Dumping of Wastes and Other Matter (1972), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975). As a result of participation in the United Nations Conference on Environment and Development in Rio de Janeiro (See Rio Declaration on Environment and Development (1994)), China signed the Conventions on Climate Change (United Nations 1992a) and Biological Diversity (United Nations 1992b). According

to the Chinese Constitution and relevant treaty law, and as specifically provided for by the EPL,²⁵ if an international treaty regarding environmental protection signed or acceded to by the People's Republic of China contains provisions differing from those contained in national laws, the provisions of the international treaty shall apply, unless the provisions are ones as to which the People's Republic of China has announced reservations. As mentioned earlier, the NPC and the State Council have primary authority regarding accession and related policy concerning international environmental agreements. SEPA, as the highest-level environmental entity under the State Council, is authorized to accede to multilateral and bilateral environmental agreements on behalf of the People's Republic of China. For the most part, the impetus behind China's accession to these international instruments lies in the country's desire to become more fully integrated in the world community, and to avail itself of the global support — financial and otherwise — that can then be accessed for critical domestic environmental projects and policies.

II. OVERVIEW OF THE ENVIRONMENTAL REGULATORY SYSTEM

National environmental statutes, regulations, rules, methods, standards, and local legislation, and international treaties to which China has acceded, form the body of the Chinese environmental regulatory regime. In the period following the Cultural Revolution of 1966–76, China experienced a burgeoning of legislation and regulatory organs directed at environmental protection. Much of the fundamental environmental legislation includes broad terminology that is difficult for the regulated community to decipher, or follow in the way that environmental legislation guides regulated entities in, for example, many Western countries. Nevertheless, as a result of the legislative reforms that began with the establishment of specialized law drafting committees under the NPC in 1993, implementing regulations and standards tailored to the particular industrial pollution sources, pollutant loads and regulatory capacities of localities are being formulated at an unprecedented rate. Although more law does not necessarily mean more enforcement in these early stages of regulatory development, the increase in media attention focused on environmental legislation and the avail-

ability of the legislation in bookstores has had a profound effect on the Chinese populace. A two-fold increase in the amount of civil cases reaching the courts has occurred over the past decade, including, but not restricted to, environmental cases. Environmental issues have been hot topics of debate in recent congressional meetings at both the national and local levels. Consequently, legislative proposals related to environmental protection are being reviewed with an exceptional level of attention by government authorities and citizens.

Even so, it is obvious that certain environmental media and protection issues have yet to receive sufficient attention from legislators and relevant drafting committees. This is in part a result of the complexity of issues that must be addressed, such as solid and hazardous waste management in a country with the waste-production capacity of one-fifth of the world's population. It is also a result of the weighty mandate of the drafting committees, which are charged with the creation or amendment of a comprehensive set of statutes, regulations, rules, methods, and standards to keep pace with China's breakneck economic development. Before legislative reform in 1993 (discussed below), it usually took several years to adequately draft one amendment to an environmental law, and a substantial amount of time is still required to draft legislation for environmental issues that are entirely new to the body of existing national statutes, such as radioactive pollution prevention. These regulatory gaps frustrate comprehensive management of environmental pollution and, until the missing links are forged, environmental law and policy goals will be undermined.

Law drafting is also made more difficult by the fact that most of China's early environmental laws and policies were drafted to accommodate a planned economy. Currently, however, China is promoting a series of reforms aimed at introducing market-based mechanisms into these statutes. While these changes may be welcomed by foreign investors, the fundamental reforms and substantial political and financial commitments that will accompany these changes are being met with dread or apprehensive acceptance by China's new class of entrepreneurs.

The early stages of the legislative reform process have made critically evident the awesome task that lies before the law drafters. For example, many of the concepts that are to be introduced into the new generation of legislation, such as the 'Polluter-

Pays-Principle', cannot be readily adapted to government work units or *dan wei*. Applying such concepts to a state-owned entity has a dubious deterrent effect. In a sense, it is the functional equivalent of 'slapping the right hand with the left hand'

The Chinese law drafters' goal of creating workable environmental law and further thwarted by the enormity of the geographical area to be regulated. China is slightly larger than the United States but only has a fraction of the regulatory staff. For example, NEPA (now SEPA) had 250 full-time staff in 1997.²⁶ By comparison, the United States Environmental Protection Agency (US EPA) Headquarters currently has a staff of 6,098 permanent and temporary employees.²⁷ Moreover, the concept of an advanced legal system that can work independently of central government directives is of relatively recent origin in China and enforcement of legislation is still sporadic in many areas. Traditional aversions to the use of law to contest authority will not be easily overcome. Enforcement power is also fragmented among many administrative entities with often conflicting environmental protection and development goals. Much of China's recent legislative activity has been directed toward these serious issues so that plans for comprehensive management of environmental pollution and natural resources degradation can be acted on and realized.

III. CHINA'S ENVIRONMENTAL LEGISLATIVE REFORMS

A. China's General Regulatory Approach

To facilitate the transition to a more market-based economic system and enhance investor confidence, China is giving priority to the development of a legal and policy framework that demonstrates a commitment to the establishment of effective environmental protection laws and policies that function in a market economy. The country is now undergoing the laborious process of revising earlier statutes and regulations that do not adequately reflect current social and economic realities.

Intense legislative activity in the area of environmental protection during the past decade has helped build a critical consensus at the top levels of the Chinese legislature that there is a need for environmental laws and policies that will not only protect public health and welfare, but will also preserve the

country's resource base in favour of development patterns that are environmentally sustainable. As reflected in the Priority Programme for China's Agenda 21, organized in 1994 to implement the country's commitment to the United Nations Conference on Environment and Development, the NPC formally declared that preference will be given to the development of a comprehensive set of environmental laws and policies that can actually be implemented, enforced, and complied with as opposed to noble-sounding but hollow 'statute book laws' (see State Planning Commission and State Science and Technology Commission, 1994, at 1-1A). As a result, China is trying to accelerate the pace of the environmental legislation and policy making process, while recognizing the need for a concurrent increase in implementation capacity.

Although not yet a routine part of the legislative drafting process, the views of foreign specialists are increasingly being sought by the Chinese government. Many of China's law drafting initiatives involve participation by foreign lawyers, scientists or other experts. This participation is often realized through the support of international institutions, such as the United Nations and multilateral or regional development banks. Although this is by no means an official method for input into China's legislative process, it represents a greater realization by China, that it is not legislating in a vacuum, and that any laws it passes may have profound effects on the international community and its own development success.

B. Legislative Procedure Reform

In order to spur the pace and efficacy of legislative drafting activities, China is undertaking massive procedural reforms. Before 1993, legislative drafts were prepared by different governmental ministries and agencies under the State Council, such as the Agriculture Ministry and SEPA. The drafts would then be reviewed by the State Council's Bureau of Legislative Affairs, which would, in turn, consult other governmental ministries and agencies depending on the subject matter of the proposed legislation. After approval by the State Council, the legislative draft would be submitted to the NPC for consultation and, potentially, passage into law.

The drawback of this legislative practice was that each government ministry or agency often attempted to assure that its own interests were reflected in the draft law. Thus, protracted negotiations fre-

quently delayed the passage of legislation. It was common for a piece of legislation to take several years to go from the governmental ministries or agencies charged with drafting the law to the NPC for final consultation.

In 1993, a more streamlined legislative procedure was introduced to provide a route by which primary drafting, consultation, and supervisory authority for certain areas of law would be accorded to special committees of the NPC. These committees would then prepare legislative drafts for review by the Standing Committee thereby by passing repetitive and time-consuming consultations with each and every subsidiary ministry and agency. In the NPC, there are presently nine such committees. Each committee has the power to draft or revise new legislation employing the technical expertise of specialists appointed as its members. Legislative drafts provided by the committees can be directly submitted to the Standing Committee of the NPC for approval and passage into law. Nevertheless, although the special committees can directly submit legislation to the Standing Committee during the drafting process, it is still common practice to obtain comments and suggestions from relevant government ministries and agencies. Thus, while drafting responsibilities are concentrated within the committees, involvement of ministry and agency representatives is still necessary to build sufficient consensus for passage and sound implementation of the legislation in question. The overall effect of the input of these committees, however, is that greater deference is accorded to the legislation drafted by the highly specialized committee members and a relatively faster track for the passage of legislation is established.

The committee with responsibility for legislation related to the environment was established in April 1993 and appropriately named 'The Environmental Protection Committee' (EPC). The Committee was renamed 'The Environmental Protection and Natural Resources Conservation Committee' in April 1994, to better reflect the breadth of its tasks, although it is still commonly referred to as the 'EPC'. The EPC is charged with the following responsibilities:

- Providing legislative proposals on environmental protection and natural resources conservation (EPNRC) to the Standing Committee of the NPC;
- Preparing draft revisions of existing EPNRC laws to the Standing Committee of the NPC;

- Reviewing legislative proposals from the State Council on EPNRC;
- Reviewing regulations from local congresses regarding EPNRC;
- Providing comments to other special committees of the NPC on their legislative proposals impacting on or related to EPNRC; and
- Supervising the implementation of EPNRC legislation by national government ministries and local government counterparts.

Thus far, the work of the EPC is quite promising. For example, the Law on the Prevention of Environmental Pollution Caused by Solid Waste was first proposed in 1988. The proposal then mouldered in various ministry and agency drafting committees for seven years. In the summer of 1995, the draft law was submitted to the EPC, was passed on 30 October 1995 and came into effect as of 1 April 1996. The Environmental Noise Pollution Control Law (1996) and the amendments to the Air Pollution Prevention and Control Law (1995) and the Water Pollution Prevention and Control Law (1996) were also drafted by the EPC.

C. Environmental Legislative Plans

Based on the grave need for environmental legislation that is better adapted to China's emerging market economy, and in light of the environmental media and related issues that are yet to be addressed by the current regulatory regime, the EPC submitted a Five-Year (1993–1998) Legislative Plan to the NPC in 1993. The Plan was approved shortly thereafter.

According to this Plan, approximately seven environmental protection and natural resource conservation statutes will have been created or amended by June of 1998, and a total of 17 such statutes will be created or amended by the end of the century. Thus far, EPC work appears to be progressing on schedule. Seven new or amended environmental protection and natural resource protection statutes will have been enacted by the close of the 1993–1998 Plan period in June 1998. Specifically, these statutes are:

1. the amended Air Pollution Prevention and Control Law (1995);
2. the Environmental Noise Pollution Control Law (1996);
3. the Flood Prevention Law (1997);
4. the Forestry Law (1998);

5. the Law on the Prevention of Environmental Pollution Caused by Solid Waste (1995);
6. the amended Mineral Resources Law (1996); and
7. the amended Water Pollution Prevention and Control Law (1996).²⁸

As early as late July 1998, a new Environmental Legislative Plan will be announced by the NPC. This Plan, even more ambitious than the 1993–1998 Plan, will cover the 1998–2003 period. At the time of writing, the NPC is soliciting recommendations from relevant ministries and agencies regarding legislation that should be drafted over the next five years. Soon after the new Plan is announced, the EPC will commence a new legislative drafting programme based on the Plan. New statutes that may be proposed under the 1998–2003 Plan include:

1. a 'Clean Production Law';
2. an 'Industrial Waste Reutilization Law';
3. an 'Environmental Impact Assessment Law'; and
4. a 'Renewable Energy Law'.

Added to these legislative proposals will likely be most or all of the amendments and initial drafts included under the 1993–1998 Plan that were not previously completed for review by the NPC. These include:

- The Chemicals Management Law (planning process for initial drafting underway);
- The Desertification Prevention Law (initial draft);
- The Environmental Protection Law (amendment work underway);
- The Fisheries Law (amendment);
- The Grassland Law (amendment);
- The Land Administration Law (initial draft);
- The Marine Environmental Protection Law (initial amendment work currently under way);
- The Natural Resource Conservation Law (initial draft); and
- The Radioactive Pollution Prevention and Control Law (planning process for initial drafting underway).

D. Considerations During the Amendment or Drafting Process

China's legislators, law drafters and policymakers have determined that administrative responsibilities,

internationally accepted environmental protection principles, administrative controls, and economic incentives should be considered in the initial drafting process and amendment of environment and natural resource legislation and policies. Accordingly, those interested in China's environmental protection regime may expect the following fundamental issues to be addressed in new or amended legislation:

- Clarification of institutional responsibilities and liabilities arising from violations of environmental protection and natural resources conservation laws;
- Establishment of basic, internationally accepted environmental protection principles such as the Polluter-Pays-Principle, the Preventative Principle,²⁹ the Precautionary Principle,³⁰ and provisions requiring violators of China's environmental protection laws to restore polluted areas to their pre-degraded status;
- Incorporation of legal administrative controls, such as permits, registration and reporting requirements, and deadlines for compliance; and
- Enhancement or addition of economic incentives, such as effluent fees, emissions trading, and pollution taxes.

IV. PRACTICAL CONCERNS OF FOREIGN INVESTORS

A. Access to Environmental Laws and Related Information

Foreign investors often cite difficulties in accessing information on Chinese environmental laws and policies. Although laws are published with relative frequency and are made available in State bookstores, they are usually published in Chinese and great vigilance is required in order to ascertain the publication dates. Many electronic, loose-leaf, and hardbound references are available, but few provide the timeliness, comprehensiveness, critical commentary, and reliability required by strategic planners and legal practitioners. No matter what the form of the reference, additional information is always needed to bridge the gap between the publication time and the current date, as well as between regulatory language and actual practice. Although China is increasing regulatory transparency, the Chinese legal system is historically an authoritarian system that does not accommodate the need for information

required by those attempting to gauge the efficacy of their environmental compliance programmes or the prudence of investment plans.³¹ The long-term prospects for increased information access in China, however, are not bleak (the US Embassy in Beijing recently reported that 'fading environmental secrecy appears to be part of a general opening trend' that is being encouraged by the Chinese government to improve environmental law enforcement through heightened public scrutiny of polluters — see US Embassy-Beijing (1998) Legislative proposals are in play that may eventually enhance the transparency of the Chinese legal system. One such proposal is the draft 'Law-Making Act.' (literally, '*Li Fa Fa.*') One component of this proposed Act would require law makers to take into account the views of the regulated community through public meetings. Unfortunately, the Law-Making Act proposal is still subject to extended debate and will not likely be enacted in 1998.

Investors are best advised to forward specific questions or information goals through individuals with local language expertise who also have a demonstrated history of contacts within relevant government units. Such individuals may be attorneys, academics, consultants, or entrepreneurs. Local private practitioners do exist, and their numbers have been on the rise in recent years. In 1996, China adopted a new law that attempts to harmonize China's regulation of lawyers with international standards applicable to the legal profession (*[Lu Shi Fa]* adopted 15 May 1996, effective 1 January 1997). China has also cut the ranks of government-sponsored law firms to encourage private practice. Significantly, Beijing's Bar Association, previously commanded by 'people's lawyers' from State law firms, recently held elections that resulted in a governing council dominated by private practitioners. Nevertheless, experience among China's private practitioners in specific issues related to environmental compliance is still rare, and difficult to identify. Frequently, because of the great demand for individuals with environmental experience, environmental specialists may wear many 'hats', at various times providing advice as a legal practitioner, academic, development bank consultant, or technical advisor.

Fortunately, work is being done to alleviate the difficulty of information access within the Chinese regulatory community. The EPC is developing an internal database network to link all relevant gov-

ernment bodies for the transfer of environmental information. Support for this project may include funding from the Asian Development Bank. This database should enhance uniformity of information access and supervision of legislative and administrative actions at the national and local levels. As a result, use of the network by regulators may enhance the uniformity of compliance-related information accessed by regulators and provided to the regulated community.

International institutions, such as the China Council for International Cooperation on Environment and Development (CCICED), formed in 1991, are also fostering the dissemination of information on Chinese environmental laws, policies and plans. CCICED advises the Chinese government at a very senior level and is made up of approximately 50 Chinese and international members. It also promotes cooperation between China and the global community on environmental issues.³²

Public- and private-sector efforts at increasing information access, although generally not focused on environmental information, are also under way. For instance, Internet use in China is increasing.³³ While members of the Chinese government remain wary of the potential abuses of this technology, some members of China's environmental regulatory regime use the Internet to facilitate their work.³⁴

B. Enforcement

Broadly speaking, environmental protection agencies at the national and provincial levels, and EPBs at the local level, are authorized to determine, on a case-by-case basis, the enforcement or compliance measures that will apply to a particular violation. SEPA's responsibilities in this area are somewhat limited. SEPA implements national environmental policies, regulations, methods, rules, and technical standards pursuant to the authority granted by the State Council and oversees local government implementation of regulatory compliance measures.³⁵ Local EPBs, on the other hand, typically deal directly with the regulated community and are required to enforce both the national and local environmental requirements. Each EPB may act independently, although they are subject to the guidance of superior-level entities, such as SEPA, or provincial counterparts. In the event that a superior-level agency is not satisfied with the decision made by the inferior-level agency, the superior-level agency may

overturn the inferior-agency's decision, substitute its own decision, or send the case back to the inferior-level agency with a request for a re-hearing on the issue. For each violation, environmental agencies are required to speak with 'one voice' (i.e., under Chinese law, the various line agencies should not issue conflicting demands on the regulated community).

As a result of the historical development of China's legal system and the infant stage of the environmental regulatory regime, China maintains a complicated distribution of environmental enforcement power. Usually, decisions related to enforcement actions are made by environmental authorities at the national and local levels. Occasionally, these authorities will consider the comments of industrial ministries and general companies with administrative responsibility over the facilities concerned. The resulting decision making delay frequently undermines the efficacy of eventual enforcement action, and this is a primary reason behind the Chinese government's decision to clarify institutional responsibilities in new and revised legislation.

Other enforcement-related problems mentioned by Chinese officials include: legislation-related difficulties such as vaguely drafted provisions allocating responsibility and liability; capacity-related difficulties such as personnel and finance limitations; culture- and development-related difficulties associated with varying concepts of ownership under the Socialist system; low environmental awareness among the populace; and bureaucracy-related difficulties stemming from overly complex procedures and unwarranted interferences with investment projects.

Foreign investors frequently complain of corruption as a factor that adds to regulatory confusion and frustrates uniform enforcement in rapidly developing countries such as China. Environmental legislators are well aware of the fact that greater regulation can also lead to increased opportunities for corruption. An increasing trend in corrupt activities was recently acknowledged by the Supreme People's Procuratorate, the highest legal supervisory organ in China.³⁶ The national government has adopted provisions, such as the Provisional Procedures on the Rotation of the Jobs of State Council Servants (*[Guo Jia Gong Wu Yuan Zhi Wei Lun Huan Zan Xing Ban Fa]* (adopted 31 July 1996, effective 31 July 1996)), with the intent to deter corruption by requiring that senior officials who maintain the same job for five years or more rotate

to new jobs. Law drafters are also considering what types of regulations may create more opportunities for bribery, and whether there are ways in which environmental legislation and administration can minimize these opportunities.

Enforcement of environmental legislation has traditionally suffered from the problems mentioned in Part II. Presently, China is trying to link its legislative reform programmes with new enforcement initiatives that will allow the implementation of new environmental laws to be bolstered with new levels of compliance. Since 1993, supervisory programmes have been initiated in which oversight groups are designated to assess local compliance records. For example, the EPC and the Environmental Protection Commission of the State Council now frequently send delegations to the provinces, municipalities, and autonomous regions to review the compliance records of local industries and residents. The results of these reviews are then compiled in a report and sent to the NPC and relevant central government authorities, such as the Construction Ministry and the State Economic and Trade Commission. Failure to comply with stipulated standards can result in the issuance of enforcement orders. Naturally, this methodology results in sporadic enforcement. Moreover, localities targeted by the supervisory programmes are usually forewarned.

In spite of these new initiatives, an investigation by SEPA (when it was still NEPA) indicated that about one-third of the environmental technology used in China is operated 'inefficiently' (operated only during inspections and shut down at other times), one-third is simply not operating (shut down by the operators of facilities because of views that the technology resulted in cost overruns and other inefficiencies), and one-third is operated within the standards prescribed by relevant legislation. The problem of forewarned inspections has been partially overcome through faster, 'surprise' visits from the local EPBs. Nevertheless, variations in enforcement practice continue to vary from locality to locality. Moreover, while the perceived gap in technological, financial and management abilities between domestic and foreign enterprises persists, enforcement will likely focus on those foreign firms. This is perhaps, in part, a result of the view among regulators that the 'more advanced' foreign enterprises are more able to shoulder environmental compliance financial burdens and are better equipped to meet the demands of the regulatory regime.³⁷ This

view is echoed in negotiations between developing and developed countries related to obligations of parties to international environmental agreements. The Chinese government is currently aware, however, of the need for improved enforcement methods and is working on means by which to support these methods with constant and consistent environmental monitoring.

C. Enforcement Burden Reduction and Compliance Techniques

Generally, the administrative aspects of China's newer environmental regulations, such as the permitting and approvals related to environmental impact assessments (EIAs), are enforced more stringently. This reflects an increasing emphasis on preventative procedural controls for activities with potential for adverse environmental impacts, as opposed to remedial measures that are often more technical and costly. China often combines impact assessment requirements with other compliance techniques. These techniques include permits, taxes, bans, warnings, fines, compliance orders, inspections, suspension or cessation of operations orders, and environmental technology requirements. To combat the potentially overwhelming enforcement demands placed on environmental protection authorities by the country's burgeoning environmental degradation, China is introducing these and other creative environmental law compliance and enforcement techniques into its pollution prevention legislation. Among the measures contained in newly promulgated, amended, or draft environmental legislation are incentives for waste-materials recycling, such as government tax reductions for enterprises that practice waste reutilization, subsidies for coal-washing facilities and the use of green technologies, restrictions on sulphur dioxide emissions at new power stations and promotions for the use of unleaded petrol. The use of operations cessation orders, an enforcement measure with severe economic consequences, has been used to combat severe pollution at the local level. For example, all plants in the Huai River Basin that were identified as creating severe water pollution were ordered to cease operations.³⁸ The Huai River Basin plant closures are a focus of recent SEPA enforcement and monitoring activities. It is unlikely that foreign investors with highly developed environmental compliance programmes will warrant such severe sanctions.

D. Environmental Crimes

The spread of severe small-scale rural industry pollution in China, and the problems associated with managing countless numbers of backyard polluters, may be the reason for China's use of extreme measures under the Criminal Law (*Xing Fa* (adopted 1 July 1979, effective 1 January 1980, amended 14 March 1997)), such as capital punishment. A section on environmental crimes is included in the new amendment to the Criminal Law, including, among other things, provisions applicable to:

1. unauthorized imports of solid wastes;
2. introduction of radioactive, toxic, or infectious substances into the natural environment;
3. violation of aquatic resource protection regulations;
4. preservation of rare and endangered wild animals and prohibition of commerce in related products;
5. violation of land administration regulations;
6. breach of mineral resource regulations;
7. violation of forestry regulations, including destruction of rare trees and illegal logging; and
8. dereliction of duty on the part of environmental personnel.

The provision in the Criminal Law addressing the unauthorized import of solid wastes appears to have been foreshadowed by a judicial interpretation applicable to such cases issued by the Supreme People's Court (1996) as a result of controversies surrounding the import of hazardous wastes into China by foreign nationals (as in the case of William Ping Chen, an American businessman and former President of a joint-venture Shanghai recycling company, fined RMB 500,000 yuan and sentenced to a ten-year jail term for illegally importing 238 tons of medical and household waste into Shanghai, see *Daily Environmental Report* 1997 and Korski 1997). Among other things, the Supreme People's Court interpretation provides that persons who import without authorization (i.e., who engage in the crime of smuggling) over 200 tons of general wastes, or over 100 tons of hazardous wastes, may be subject to capital punishment.

E. Citizen Suit and Comment Provisions

Citizen suits to seek remediation of environmental pollution or damages therefrom are provided for in

the Chinese environmental regulatory system. An example of this is Chapter I, Article 6 of the EPL which reads: A[a]ll units and individuals shall have the obligation to protect the environment and shall have the right to report on or file charges against units or individuals that cause pollution or damage to the environment'. The draft amendment to the EPL retains this provision and will provide needed details as to the statute of limitations, burden of proof, and availability of injunctions and damages.

China appears to be committed to preserving and enhancing citizen involvement *vis-à-vis* activities that may impact the environment. For example, the recently amended Water Pollution Prevention and Control Law (*[Shui Wu Ran Fang Zhi Fa]*, art. 13, para. 4 (adopted 11 May 1984, effective 1 November 1984, amended 15 May 1996)) provides for the consideration of public comments related to construction, reconstruction or demolition projects that will impact water quality. Interestingly, China's EIA regulations currently contain no provisions for public commentary. The addition of this provision to the Water Pollution Prevention and Control Law may be the harbinger of similar reforms to EIA regulations and other environmental legislation.

It is important to note that citizen suits in China bear little resemblance to those that arise in the United States. The nongovernmental environmental advocacy community in China is virtually nonexistent and the legal culture does not encourage challenges to government decisions (this may change, however gradually, in the future. See generally, US Embassy-Beijing (1997) (providing a listing and descriptions of existing environmental NGOs in China)). The establishment of indigenous nongovernmental environmental organizations has been authorized by the government in the past, although the organizations' goals do not include locking horns with the government on environmental issues. Environmental and legal awareness in China, as compared to the awareness of enforcement-oriented societies such as the United States and Canada, is still at a nascent stage. As a result, very few cases exist in which citizens sue companies or regulatory agencies for damages stemming from environmental violations. It is more common for a citizen to write a letter or make a telephone call to a local environmental bureau complaining about a particular instance of environmental pollution. It is safe to say that in recent years, such complaints have been increasing.

F. Judicial Review of Administrative Decisions

The Administrative Procedure Law (*[Xing Zheng Su Song Fa]* (adopted 4 April 1989, effective 1 October 1990)) delegates to the regulated community the right to sue administrative agencies to protect their legal rights. According to SEPA statistics, in 1994, out of 228 cases entertained by Chinese courts, the environmental agencies prevailed in 212. A great deal of deference is given by the courts to administrative agency decisions, and only certain administrative activities are subject to judicial review. Rulings by environmental agencies and activities in which environmental agencies have been delegated the right to make final judgment, are not reviewable by the courts (art. 12). Administrative acts or omissions, other than those specifically identified by law, that are subject to judicial review include: (1) administrative penalties for environmental infractions; (2) denials of permits or licences related to activities with environmental impacts; (3) nonfeasance with regard to administrative duties; and (4) refusing to authorize a regulated entity to perform environmental protection activities (art. 11. see Zhang ed., 1993: 235–47).

When a court determines that a particular environmental agency's decision is reviewable, it can revoke the agency's decision and request a rehearing and a new decision, or require that the agency take a certain action within a specified period of time. Typically, the courts only review whether the agency properly performed its authorized functions rather than the legitimacy of the administrative activity itself. The courts, nevertheless, may supplant an agency decision with their own where they find that the administrative activities in question substantially lacked fairness (see The Environmental Protection Law of 1989, arts. 43, 44). Administrative agencies can also resort to judicial means to enforce administrative decisions if the violator neither appeals to a superior-level administrative agency for review of the decision, nor files suit against the agency within the legally prescribed period.

The courtroom is the last resort for regulators, the regulated community, and the public-at-large when seeking redress for various environmental transgressions or relief from administrative action. The most outspoken victims of pollution, usually individual farmers and urban residents, will file complaints to force polluters to redress harm through remediation or compensation of losses. Resort to the

court system is seen in China as a decidedly adversarial approach to a problem that usually signals the end of a relationship, and is therefore not the best course of action for parties that wish to continue a business alliance, the more so because judicial decisions in environmental cases are now frequently reported by the Chinese media. Foreign investors frequently use mediation or arbitration to resolve disputes where possible, though this has the disadvantage that administrative arbitration is not binding on the parties. In short, many Chinese view contractual relationships as evolving, and not static. A stable business or regulator-regulatee relationship may be best achieved through continuous communication and negotiation. This often requires great patience, even in the face of stockholder trepidation over the stability and predictability of the Chinese market and the underlying legal system.

G. Liability for Historical Contamination of Land

Historical contamination of land, a major problem that looms over China's development successes, is a topic that may be addressed within the draft amendment to the EPL. An environmental protection fund will likely be established and used for remediation of contaminated sites. Additionally, while China does not yet contemplate liability as extensive as the US Superfund system (under the Comprehensive Environmental Response, Compensation and Liability Act 1980) liability in relation to toxic waste remediation, various liability and compensation plans are currently being discussed in government and academic circles. There are currently no provisions in environmental laws or regulations that specifically address environmental due diligence or historical contamination. Nonetheless, in addition to endorsing a wider use of pollutant-fees and taxes to help curb environmental degradation, the Chinese government will reportedly adopt a policy of requiring that polluters restore degraded property to its pre-degradation status. How this policy will impact foreign-investor liability for historical contamination of land is yet unknown. Article 184 of China's Company Law (*[Gong Si Fa]* (adopted 29 December 1993, effective 1 July 1994)) however, provides that 'the claims and debts of the parties to a [corporate] merger shall be succeeded to by the absorbing company or the newly established company when the companies are merged.' This would cover a merger between a foreign and a Chi-

nese company, and many Chinese regulators and academics opine that historical contamination falls within the category of 'debts'. Thus, if foreign investors wish to purchase land for construction projects, they are best advised to conduct environmental audits to define the liabilities associated with the land. Moreover, if foreign investors wish to purchase land for construction projects that may affect or diminish land used for agricultural purposes, they are subject to a new requirement that they post a bond or reclamation fee, which will be used to finance a national land-reclamation programme (*Tu Di Fu Ken Gui Ding*) Regulations on Land Reclamation, issued by the State Council, 1988).

H. Availability of Waste Disposal Facilities

Qu Geping, Chairman of the EPC of the NPC,³⁹ in a recent conversation with the authors, noted that the issue of the lack of proper solid and hazardous waste treatment facilities was considered critical to China's environmental protection and development efforts. The lack of such facilities is a problem that daunts many foreign investors with operations in China. In 1994 alone, the Chinese government estimated that approximately 820 million tons of solid waste were generated domestically, an amount that does not include waste produced by locally based, state-owned industries. (For a good, current and general overview of waste management issues in China, see Spitalnik, 1997.)

Although officials from the local government are actively promoting international joint ventures to construct and operate waste treatment and disposal facilities, few, if any, facilities exist that roughly meet developed-country environmental protection standards. Nonetheless, relatively modern waste management facilities are being constructed. These are primarily located in the more developed eastern region of China. A major wastewater treatment plant is planned to serve facilities along the upper reaches of the Huangpu River in Shanghai. Two major projects for the treatment and incineration or disposal of household waste, however, are planned for Heshan Town and Donghu Village in the Xiamen area in Southeast China. Other facilities in the vicinity of Xiamen are under construction and will reportedly be available starting in various years from 1996 to 2010. These facilities will reportedly only be authorized to receive waste for 3–10 years, depending on the particular capacities and usage rates.

In spite of the overall lack of hazardous waste disposal facilities, China requires, in the new Law on the Prevention and Treatment of Environmental Pollution from Solid Waste, that measures be taken for the 'safe disposal' of waste. Companies are therefore often forced to deal with the risks associated with stockpiling wastes on site, employ what disposal resources exist in the vicinity of their facilities, or grapple with the complexities associated with transporting waste across provincial or international borders for burial or destruction at 'better' waste sites. In conducting due diligence investigations associated with new facility planning, it will be important to monitor the progress of facility construction projects such as those mentioned in Xiamen and the new Hazardous Waste Treatment Facility (HWTF) in Shenyang, the capital of Liaoning Province in Northeast China. The HWTF is a component of the World Bank-sponsored Shenyang Industrial Reform Project.

I. Basic Environmental Requirements for Foreign Investment Projects

Companies contemplating or acting on investment plans in China are urged to keep in constant contact with the relevant ministries governing the industrial activity. In addition, investors should maintain contact with SEPA, the State Economic and Trade Commission, the Construction Ministry, the local planning commission bureau and the EPB, as these entities govern most activities by companies that are embarking on investment projects with environmental impacts in China.

In some cases, it will be unclear as to the particular industrial ministry or related entity that has jurisdiction over the contemplated or ongoing investment project. In fact, it is not uncommon for administrative authority to vest in the ministry that provides authorization for the initial investment. Therefore it is important to clarify administrative jurisdiction through consultation with local Chinese authorities before commencing with construction plans. Although two (or more) ministries may seem to regulate the same products or resources, no two actually cover the same plants or facilities. In such cases, it is always advisable to seek the advice of those who are intimately familiar with the national and local regulatory and administrative framework, who can communicate in Chinese with the authorities involved to help overcome ambiguities,

jurisdictional disputes, and regulatory vagueness that can frustrate investment decisions and wreak havoc on project schedules.

Under Chinese environmental law, foreign-investment projects are required to comply with national and local environmental laws and regulations. For example, Chinese law stipulates that contracts related to the management of foreign-owned construction projects shall not contain provisions that contravene Chinese national or local environmental protection laws (*[Jian She Xiang Mu Huan Jing Bao Hu Guan Li Cheng Xu]*, Management Procedures for Environmental Protection in Construction Projects, art. 4, issued by NEPA (now SEPA) (June, 1990)). These provisions normally reinforce China's overall desire to have foreign-owned operations maintain compliance programmes that respect China's own regulatory requirements. Based on the 'letter of the law', Chinese environmental requirements are to be applied equally to domestic and foreign-owned operations with provision for site-specific differences in treatment based on the location of the particular project (e.g., in an industrial zone or in proximity to designated wildlife protection or residential areas). Nevertheless, as mentioned earlier, local enforcement practices may vary the application of the law with respect to domestic and foreign-owned operations, or even between foreign operations owned by different companies. This is a problem that is acknowledged by Chinese environmental officials and warrants increased scrutiny from national regulators.

General industrial or service-oriented investments that may result in the discharge of pollutants should look to media-specific statutes as a starting point for determining potential regulatory obligations and liabilities. As mentioned earlier, most important is the EPL, as provisions of this statute potentially apply to all instances of environmental pollution. For example, Article 13 of the EPL provides the basis for requiring that EIAs be conducted for certain projects. Nevertheless, it is also prudent to focus on local environmental regulatory practices and regulations, as local regulations or standards may include more — but not less — stringent provisions than the national counterparts. Environmental protection, state planning and industrial bureaus with local control over a foreign facility will provide a much more realistic view of the state of compliance and enforcement in the area. Although a review of relevant statutes is important, at this transitional stage in en-

vironmental law implementation and enforcement, it is critical to also monitor official *practice* with regard to legislation as opposed to merely reviewing legislation as it appears 'on the books'. The views of local officials, as also mentioned earlier, may vary from those expressed at the national level. It is thus important to solicit the views of national-level officials involved in the project approval and environmental compliance process. Foreign investment projects are almost always monitored at the national level. This is because of the widely acknowledged fact that local regulators may be overly sensitive to the need to attract outside investment, a situation that is also cited in support of federal oversight of state regulatory activities in the United States.

In addition to the EPL, the Management Methods for Environmental Protection in Construction Projects (*[Jian She Xiang Mu Huan Jing Bao Hu Guan Li Ban Fa]*) jointly issued by the Environmental Protection Commission under the State Council, the State Planning Commission, and the State Economic Commission for Construction Projects, 26 March 1986), the Management Procedures for Environmental Protection in Construction Projects (*[Jian She Xiang Mu Huan Jing Bao Hu Guan Li Cheng Xu]* issued by NEPA, now SEPA, June 1990), and the Technical Guidelines for Environmental Impact Assessment (*[Huan Jing Ying Xiang Ping Jia Ji Shu Dao Zi]* (HJ-T2-93) technical standards for EIA comprising HJ-T2.1-93 (general principals), HJ-T2.2-93 (atmospheric environment guidelines) and HJ-T2.3-93 (surface water environment guidelines)) are arguably the most important legal documents for companies building facilities in China; this situation may change if a new, national EIA Law is enacted pursuant to the 1998-2003 Environmental Legislative Plan. The documents listed incorporate the important components of EIA regulations.

In brief, under the provisions of the above-mentioned documents, representatives of all construction, technological renovation, and regional development projects must submit an environmental impact *statement* (EIS) for projects contemplating major environmental impacts or environmental impact *forms* (EIF) for projects contemplating minor or no environmental impacts, to the competent authorities. This is significant in that the EIS must contain the results of the lengthy EIA and the EIF a short-form declaration of the investor that constitutes the basis for decisions by the competent authorities. If the investor is unsure of whether its potential environ-

mental impacts are sufficiently large to warrant an environmental statement, the investor should consult with the competent authorities involved in the EIA process before proceeding.

The assessments required to complete the EIS are conducted by an institute certified to perform the requisite studies. A list of certified institutes is available from SEPA in Beijing. Foreign investors are allowed to choose the institute that will perform the EIS. Nevertheless, they are advised to consider the recommendations of the local EPBs in this regard. A foreign investor may also wish to retain its own consultant to perform an 'independent' EIS to ensure consistency with its own corporate environmental assessment requirements.

As stipulated in the Management Procedures for Environmental Protection in Construction Projects, SEPA will generally be responsible for the examination and approval of the EIS or EIF process for 'mega projects' representing investments larger than 200 million RMB (approximately US \$24 million). Such projects must be approved by the State Planning Commission, or indirectly through the endorsement of a project proposal submitted to the State Council by the State Planning Commission. SEPA also retains primary examination and approval authority for (a) projects that cross provincial, autonomous zone, and special municipality (Beijing, Chongqing, Shanghai, and Tianjin) boundaries; (b) projects with 'special characteristics' (e.g. nuclear facilities and sensitive government operations); and (c) projects in which the environmental impacts are disputed by provincial environmental protection authorities.

Local EPBs are authorized to approve EIAs for projects representing investments of less than 200 million RMB. SEPA should still be consulted where foreign investments are concerned, however, in order to ensure that the facility is in compliance with national environmental provisions. The fluctuating nature of Chinese environmental law, and the potentially vague provisions in the major EIA legal documents, necessitate constant communication between the regulated entity and the regulators.

All construction projects are also required to comply with the 'Three Synchronizations Policy', under which pollution-control facilities associated with the project must be designed, installed, and operated in conjunction with the design, construction, and operation of the project as a whole (see Lai *et. al.*: paras 57-9)

Essentially, the EIS for a construction project

contemplating large environmental impacts must describe the pollution that is likely to result and assess the exact nature of the potential impacts on the surrounding environment, as well as stipulate possible preventative or curative measures. Additionally, the EIS must, after initial examination by authorities with administrative jurisdiction over the project, be submitted by specified procedure to the competent department of environmental protection for approval. The Planning Commission or its local counterpart will not provide the necessary ratification of the design plan for the construction project until the EIS is approved.

The timing for the EIA review process and application of the Three Synchronizations Policy to construction projects varies from about 3 days to 1 month in the case of an EIF, and roughly 2 months to 32 years or more in the case of an EIS. A synopsis of the information that may be required of foreign investors by authorities responsible for the EIAs is provided in items 1-6:

1. General Information.
 - name, location, and nature of the construction project and information related to the size of the investment;
 - product mix and main technical purpose;
 - quantity of major materials to be used, including fuel and water resources;
 - types of wastes (including waste water, waste gas, solid waste, dust, radioactive waste, etc.), discharge amount and patterns, indices of noise and vibration;
 - plans, facilities, and major technical processes for recycling, comprehensively utilizing wastes and treating pollutants; and future development plans of project.
2. Specific Environmental Information.
 - geographic location of project;
 - conditions of topography, land formations, soil, geology, hydrology, and meteorology at construction site;
 - mineral deposits, forest and grassland cover, aquaculture, flora and fauna, as well as agriculture;
 - natural resources, scenic and/or tourist areas, historical sites, hot springs, sanitariums, and important political and cultural constructions;
 - distribution of residential areas, population density, health conditions of residents, epidemic diseases, etc.;
 - environmental quality of air, surface water and groundwater;
 - transportation and traffic conditions; and

- data on environmental pollution and damage caused by other social and economic activities in the area.
3. Analysis and Prediction of Short-Term and Long-Term Impacts of Construction on the Surrounding Area.
 - data regarding potential impacts on the geology, hydrology, and meteorology of the surrounding area, as well as measures to prevent or mitigate the impacts;
 - data regarding potential impacts on nature reserves, scenic and/or tourist areas, historical sites, and sanitariums in the surrounding area, as well as measures to prevent or mitigate the impacts;
 - data regarding potential pollution discharge quantities and the extent or degree of their impact on the quality of air, water, and soil in the surrounding residential areas;
 - data regarding the potential noise, vibration, and electromagnetic wave impacts on nearby residential areas, as well as measures to prevent or mitigate the impacts;
 - data regarding required afforestation to mitigate the impacts of the construction, including the planting of trees (including tree belts) and grasses; and
 - estimate of the cost of environmental protection facilities.
 4. Proposals Concerning Environmental Monitoring Systems, Including the Construction of Monitoring Stations, Monitoring Organizations, Staffing and Equipment, and Related Items.
 5. Economic Profit and Loss Analysis Regarding Potential Environmental Impacts Resulting From Construction Project.
 6. Concluding Remarks Regarding the Construction Project's Overall Impact on Environmental Quality.

Foreign investors should submit the completed EIS or EIF for review through the local EPB and the relevant local industrial ministry bureau. Final project approval lies with the local bureau of the Planning Commission. Thus, investors should involve this entity in the assessment process from the beginning. As mentioned earlier, enforcement of EIA requirements is receiving greater scrutiny from the Chinese government. New, national EIA legislation is also planned. Rejection of an EIS or EIF will likely result in a request for improvements in the proposed facility's environmental protection technology and

related measures. Such an action on the part of Chinese authorities can result in serious delays of construction projects.

CONCLUSION

China is a country of paradoxes. A brief tour of modern China presents the traveler with antiquities against a backdrop of modern skyscrapers and cranes, thousands of years of history but relatively little experience in dealing with the international community, and a policy of opening to the outside world, but remaining inscrutable on many subjects. The fluctuating state of China's environmental regulatory regime also presents the foreign-investment community with many paradoxes. During this period of great changes, the environmental regulatory system can appear both simple and complex, or lenient and severe, to those observing it from afar, and especially to those working 'in the trenches' at facilities in China. For example, although in many cases local officials may seem anxious to attract investment regardless of environmental consequences, strengthened environmental policies have led cities, such as Yantai City in Shandong Province, to reject many foreign-investment projects that were deemed pollution intensive and have induced some regulators to more stringently enforce environmental laws against domestic companies (inciting the company representatives to remark that they are 'amputating their limbs for the good of all'⁴⁰). Nonetheless, when the rapid changes are observed with the goal of identifying trends, many of the environmental initiatives currently underway provide strong indicators of the future course of China's environmental requirements. To ignore these indicators given the fact that China's future ability to sustain itself depends on the establishment of an effective and comprehensive environmental regulatory regime is folly.

To emphasize China's earnestness in forging such a regime, Qu Geping, Chairman of the EPC, in a conversation with the authors, recently provided the following advice to foreign investors with operations in China:

Investors have essentially two options when establishing facilities in China. They may comply with Chinese environmental requirements, or their own [foreign] environmental requirements. If they decide to adopt the Chinese environmental requirements, this is fine. They should, however, be aware that these requirements will be changing, and that the

cost of revamping compliance programmes to reflect these changes will be great because of the intensity of reforms planned for the environmental regulatory area. Foreign companies may also transplant their own [foreign] environmental compliance programmes to their China-based facilities. This will ensure that most of the operations will comply with

Chinese environmental law. Nevertheless, investors should still monitor Chinese environmental regulatory requirements. The pace of China's reforms is so great, that even if only a portion of the reforms are realized, it will not be long before China's system adopts many of the characteristics of the regulatory regimes of relatively more developed countries.

NOTES

- 1 Portions of this article are drawn from Ferris (1997) and Zhang and Ferris (1997). The views of the authors are their own and do not necessarily reflect those of the Chinese government, Beveridge & Diamond, or CIEL.
- 2 The State Council is the highest administrative organ of the People's Republic of China and the executive body of the NPC. Its functions and powers are listed in Article 89 of the Constitution, and include the power to adopt administrative measures, enact administrative rules and regulations, issue decisions in orders in accordance with the Constitution and other laws, submit legislative proposals to the NPC or its Standing Committee, and to oversee the work of the ministries and commissions. The State Council is composed of the Premier, the Vice-Premiers, the State Councilors, the Ministers in Charge of Commissions, the Auditor-General, and the Secretary General. It includes a special office in charge of legal issues—the Bureau of Legislative Affairs. The Bureau prepares the State Council's annual legislation drafting plan.
- 3 See e.g. Agence France Presse (1996), reporting Li Peng's comment that much of China's deteriorating environmental situation was the result of local officials' 'loose and inadequate' application of the laws.
- 4 Note that there are many significant sources of law in the Chinese legal system, such as Standing Committee interpretations of the Constitution and fundamental laws and Supreme People's Court interpretations and decisions that are outside the scope of this environmental law primer. For a more in-depth discussion of the range of Chinese sources of law, see Chen (1994). For an excellent review of the challenges confronting the legal system in addressing China's environmental problems, see Alford and Shen, (1997).
- 5 Although statutes such as the Food Hygiene Law [*Shi Pin Wei Sheng Fa*], (adopted 19 November 1982, effective 1 July 1983) are within the purview of environment, health and safety legislation, the authors have limited the scope of this Article to environmental and natural resources protection issues. Within Chinese jurisprudence, health and safety legislation relates to the 'indoor' environment, while environmental legislation relates to the 'outdoor' environment. Thus, the two are separately addressed in the Chinese legal system.
- 6 *Huan Jing Bao Hu Fa* (adopted 'in principle' and promulgated for trial implementation on 13 September 1979, abrogated by implementation of the Environmental Protection Law of 1989, effective 26 December 1989). 'For trial implementation' is a phrase appended to legislation that is viewed as 'experimental' at the time of passage and is still subject to revision. The terms 'provisional' and 'interim' are also used and carry the same meaning. Generally, the duration of the period of trial implementation is not identified within the statute, and ends only when the legislation for trial implementation is revised. Generally, the duration of the period of trial implementation is not identified within the statute and ends only when the legislation for trial implementation is revised to remove the 'trial' designation.
- 7 *Da Qi Wu Ran Fang Zhi Fa* (adopted 5 September 1987, effective 1 June 1988, amended 29 August 1995).
- 8 *Jie Yue Neng Yuan Fa* (adopted 1 November 1997, effective 1 January 1998);
- 9 *Huan Jing Zao Sheng Wu Ran Kong Zhi Fa* (adopted 29 October 1996, effective 1 March 1997).
- 10 *Yu Ye Fa* (adopted 20 January 1986, effective 1 July 1986).
- 11 *Fang Hong Fa* (adopted 29 August 1997, effective 1 January 1998).
- 12 *Sen Lin Fa* (adopted 20 September 1984, effective 1 January 1985, amended 29 April 1998).
- 13 *Cao Yuan Fa* (adopted 18 June 1985, effective 1 October 1985).
- 14 *Tu Di Guan Li Fa* (adopted 25 June 1986, effective 1 January 1987, amended 29 December 1988).
- 15 *Gu Ti Fei Wu Wu Ran Huan Jing Fang Zhi Fa* (adopted 30 October 1995, effective 1 April 1996).
- 16 *Hai Yang Huan Jing Bao Hu Fa* (adopted 23 August 1982, effective 1 March 1983).
- 17 *Kuang Chan Zi Yuan Fa* (adopted 19 March 1986, effective 1 October 1986, amended 29 August 1996).
- 18 *Huan Jing Zao Sheng Wu Ran Kong Zhi Fa* (adopted 29 October 1996, effective 1 March 1997).
- 19 *Shui Fa* (adopted 21 January 1988, effective 1 July 1988).
- 20 *Shui Wu Ran Fang Zhi Fa* (adopted 11 May 1984, effective 1 November 1984, amended 15 May 1996).
- 21 *Ye Sheng Dong Wu Bao Hu Fa* (adopted 8 November 1988, effective 1 March 1989).
- 22 *Shui Wu Ran Fang Zhi Fa Shi Xi* (adopted 7 July 1989, effective 1 September 1989).
- 23 *Dui Wai Jing Ji Kai Fang Di Qu Huan Jing Guan Li Zhan Xing Gui Ding* (adopted 4 March 1986, effective 15 March 1986).
- 24 Although a detailed discussion of the nomenclature and relevance of Chinese normative legal documents is beyond the scope of this article, the authors note that documents with English-language designations such as 'orders,' 'directions,' 'decisions,' 'resolutions,' 'notices' and 'circulars,' may also be issued by State Council departments and

- local people's congresses. Significantly, however, these documents do not necessarily establish legal norms for the regulated community. For this reason, the authors have limited their discussion to the most commonly encountered legal norm-setting documents: statutes, regulations, rules, methods, and standards.
- 25 *Huan Jing Bao Hu Fa*, chap. VI, art. 6 (adopted in principle and promulgated for trial implementation on 13 September 1979, abrogated by implementation of the Environmental Protection Law of 1989, effective 26 December 1989).
 - 26 The total number of SEPA staff (per orders of the State Council formerly applied to NEPA) is limited to 261. This number will likely be reduced in order to fully implement personnel reductions and related administrative changes required of all ministries at the national level. Reportedly, SEPA may face personnel reductions of roughly 30 percent.
 - 27 Telephone Interview with Paulette Everson, Information Management Specialist, US EPA, Office of Administration and Resources Management (28 April 1998). The comparison with the number US EPA headquarters staff is provided merely as a general reference to underscore the serious issue of SEPA resource limitations. Naturally, US EPA is responsible for managing a comparatively more comprehensive and detailed environmental legal regime within an enforcement-oriented legal culture.
 - 28 This number does not include the Energy Conservation Law, which was not included in the original 1993–1998 Environmental Legislative Plan.
 - 29 According to the Preventative Principle, regulated entities should try to avoid environmental harms instead of combat the effects thereof. The principle requires, among other things, that the environmental impacts of projects be considered as early as possible in the planning process.
 - 30 Generally, the Precautionary Principle requires that action be taken, even in the face of scientific uncertainty, to control or reduce potential environmental degradation (see e.g. Cameron & Abouchar, 1991).
 - 31 The Chinese government has, quite recently, enhanced the perception of non-transparency among investors. On 21 April 1998, the Chinese government suddenly announced that all 'direct marketing' sales activities were banned. Although the ban targeted illegal 'pyramid sales' activities, it also prohibited the legitimate activities of foreign direct marketing firms that had invested roughly US\$120 million in the market based on previous Chinese government authorizations. Investor dissatisfaction with the secrecy surrounding the marketing-ban decision will likely be addressed in the talks between the US Trade Representative and Chinese counterparts. (See Forney, 1998.)
 - 32 CCICED has a site on the Internet at the following address: <http://iisd1.iisd.ca/trade/cciced>.
 - 33 This includes use by government units. For example, the Xinjiang Environmental Protection Bureau has established a fledgling English-language Internet site at: www.xjwlppt.net.cn/xjepb/epb-en.htm.
 - 34 See Hutchings, 1998 and Fluendy, 1996.
 - 35 Naturally, given the very real personnel restrictions mentioned earlier, SEPA's ability to efficiently and effectively implement national environmental policies, regulations, methods, rules, and technical standards is questionable.
 - 36 In China, the procuratorate (or procuracy) essentially serves the following four functions: (1) to approve arrests made by public security authorities, review cases to make decisions on whether to prosecute, and to conduct the actual prosecution; (2) to conduct investigations into 22 kinds of criminal cases and receive complaints and accusations from citizens in response thereto; (3) to supervise the work of the courts in criminal cases (and in civil cases though the procuratorate is not party to the litigation); and (4) to supervise the activities of public security and prison authorities.
 - 37 There is evidence, however, that the Chinese government understands that the 'more advanced' or large-scale foreign commercial enterprises are not the source of many of China's environmental ills. Note, for example, the recent enforcement initiatives targeting small-scale enterprises along the Huai River. See following note. In addition, on 16 July 1997, the Chinese government announced that inspections would be conducted at certain small-scale, joint-venture enterprises to determine compliance with Chinese environmental law-see [*Guan Yu Dui Wai Shang Tou Zi Qi Ye Huan Jing Bao Hu Zhi Fa Qing Kuang Jin Xing Jian Cha De Tong Zhi*], Circular on the Examination of Foreign-Invested Enterprise Environmental Protection Law Enforcement Situations, promulgated and effective 16 July 1997.
 - 38 See e.g., BBC, 1998 ('10.4 percent of [the 1,500 factories discharging pollutants into the Huai River in Henan, Anhui, Jiangsu and Shandong Provinces] have been closed down') and Hutzler 1996 ('although much of the 10 billion yuan, cleanup [of the Huai River] is still being planned, officials in the four provinces straddling the [River basin] began closing down the worst polluters last year to force them to clean up').
 - 39 Chairman Qu Geping has been involved in China's environmental protection efforts since he began working on such issues under the late Premier Zhou Enlai in the 1970s. For more information on Qu Geping and his environmental agenda, see Becker, 1998.
 - 40 This remark was voiced during many conversations held by the authors with the domestic Chinese business community. The remark was also captured during a recent interview conducted in China by National Public Radio (United States) reporters. See *All Things Considered: Cleaning Up the Huai* (National Public Radio Broadcast Transcript, 7 April 1998).

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APPENDIX

Key Environmental Protection, Resource Conservation, Worker Safety and Consumer Protection Initiatives The People's Republic of China 1979–1998 and Beyond

Year	Focus of Initiative(s)	Description
1979	Environmental Protection and Natural Resource Conservation	<ul style="list-style-type: none"> • Environmental Protection Law adopted on trial implementation basis¹ • Forestry Law adopted on trial implementation basis
1982	Natural Resource Conservation and Consumer Protection	<ul style="list-style-type: none"> • Food Hygiene Law adopted on trial implementation basis • Marine Environmental Protection Law adopted
1983	Environmental Protection	<ul style="list-style-type: none"> • Government establishes environmental protection as 'fundamental strategy'
1984	Environmental Protection, Natural Resource Conservation, Worker Health and Safety	<ul style="list-style-type: none"> • Forestry Law adopted • Water Pollution Prevention and Control Law adopted • Fire Protection Regulations promulgated
1985	Natural Resource Conservation	<ul style="list-style-type: none"> • Grasslands Law adopted
1986	Environmental Protection and Natural Resource Conservation	<ul style="list-style-type: none"> • Fisheries Law adopted • Land Administration Law adopted • Mineral Resource Law adopted • Management Methods for Environmental Protection in Construction Projects promulgated (environmental impact assessment regulation) • Regulations for Environmental Management of Foreign Economic Development Zones promulgated (on trial implementation basis)
1987	Environmental Protection	<ul style="list-style-type: none"> • Air Pollution Prevention and Control Law adopted • Regulations on Management of Municipal Radioactive Waste promulgated
1988	Natural Resource Conservation	<ul style="list-style-type: none"> • Land Administration Law amended • Water Law adopted • Wildlife Protection Law adopted
1989	Environmental Protection	<ul style="list-style-type: none"> • Environmental Protection Law amended

¹ China generally 'adopts' laws, regulations and standards on a particular date that may be different from the 'entry into force' date for the same law, regulation, or standard. Chinese laws, regulations and standards often do not differentiate, as is done in the United States, between the terms 'adopt,' 'promulgate' and 'announce.' Hence, English translations of these laws, regulations and standards may include any of these terms to refer to the date that the official version of the law, regulation or standard was approved by the government and published for public inspection.

Year	Focus of Initiative(s)	Description
1990	Environmental Protection	<ul style="list-style-type: none"> • Management Procedures for Environmental Protection in Construction Projects promulgated (environmental impact assessment regulation) • Regulations on Prevention and Control of Pollution Damage to the Marine Environment from Land-Based Sources promulgated
1991	Natural Resource Conservation	<ul style="list-style-type: none"> • Water and Soil Conservation Law adopted • Management Methods on Environmental Radiation promulgated
1992	Worker Health and Safety	<ul style="list-style-type: none"> • Mine Safety Law adopted
1993	Natural Resource Conservation and Consumer Protection	<ul style="list-style-type: none"> • Agriculture Law adopted • Law on Protection of Consumer Rights adopted (including provisions upholding right of consumers to obtain truthful information on purchased commodities and services) • Management Methods on the Certification of Environmentally Friendly Products ('Labeling Methods') promulgated • National People's Congress creates supervisory program to enhance environmental law implementation (Environmental Protection and Natural Resource Conservation Committee established)
1994	Environmental Protection, Natural Resource Conservation, Worker Health and Safety, and Consumer Protection	<ul style="list-style-type: none"> • Advertisement Law adopted (including provisions whereby advertisements are prohibited where, among other things, they will 'hinder protection of the environment or natural resource' and where they may 'mislead consumers') • Labor Law adopted • Regulations for Environmental Management of the First Import of Chemicals and the Import and Export of Toxic Chemicals promulgated • China's 'Agenda 21 — White Paper on Population, Environment and Development' approved by State Council
1995	Environmental Pollution and Consumer Protection	<ul style="list-style-type: none"> • Air Pollution Prevention and Control Law amended • Food Hygiene Law adopted • Law on Prevention of Environmental Pollution Caused by Solid Waste ('Solid Waste Law') adopted
1996	Environmental Protection and Natural Resource Conservation	<ul style="list-style-type: none"> • Coal Law adopted • Environmental Noise Pollution Control Law adopted • Mineral Resource Law amended • Water Pollution Prevention and Control Law amended • Regulations on the Protection of Wild Plants promulgated

Year	Focus of Initiative(s)	Description
		<ul style="list-style-type: none"> • Provisional Regulations on Environmental Management of Waste Imports promulgated • List of Wastes Subject to Importation Restrictions promulgated as Annex to Provisional Regulations on Environmental Management of Waste Imports • Circular on Adding Wastes to the List of Wastes Subject to Importation Restrictions promulgated • Regulations banning or requiring recycling of certain fast-food containers promulgated in Wuhan (Hubei Province) and Xiamen (Fujian Province)² • China Technical Supervision Bureau announces adoption of ISO Standards (14001, 14004, 14010, 14012) as national environmental management standards (entry into force in 1997) • Chinese government launches a nationwide campaign to close down major polluting township and village enterprises affecting sensitive watercourses
1997	Environmental Protection and Natural Resource Conservation	<ul style="list-style-type: none"> • Criminal Law amended (to include provisions on environmental crimes) • Energy Conservation Law adopted • Flood Prevention Law adopted • Land Administration Law amendment draft completed (amendment review underway in National People's Congress) • Marine Environmental Protection Law amendment draft completed (amendment review underway in National People's Congress) • Beijing Regulation Requiring Recycling of Certain Nonbiodegradable Fast-Food Containers promulgated • Dalian (Liaoning Province) Regulation Promoting the Use of Biodegradable, Durable Plastic Bags (to combat 'white pollution from 'flimsy food, shopping and trash bags') • Guangzhou (Guangdong Province) Regulation Banning Manufacture, Sale and Use of Certain Nonbiodegradable Fast-Food Containers promulgated
1997 - Continued	Environmental Protection and Natural Resource Conservation	<ul style="list-style-type: none"> • Qiqihar (Heilongjiang Province) Regulation Mandating Ban on Manufacture, Sale and Use or Recycling of Certain Nonbiodegradable Fast-Food Containers promulgated • Shijiazhuang (Hebei Province) Regulation Mandating Ban on Manufacture, Sale and Use or Recycling of Certain Nonbiodegradable Fast-Food Containers promulgated • ISO Standards (14001, 14004, 14010, 14012),

² These subnational regulations are included to highlight the recent growth of packaging-material controls.

Year	Focus of Initiative(s)	Description
		<p>adopted as national environmental management standards in 1996, now 'in force' (as voluntary standards) for China</p> <ul style="list-style-type: none"> • Chinese government announces that phase-out of leaded gasoline will be completed by 2000 (Beijing, Guangzhou and Shanghai announced leaded gasoline phase-out by end of 1997)
1998 -?	Environmental Protection, Natural Resource Conservation and Related Administrative Reform	<ul style="list-style-type: none"> • Amended Forestry Law adopted 29 April 1998 • In January, the National Environmental Protection Agency promulgated Dangerous ('Hazardous') Waste List stipulating wastes the import of which is restricted under the Solid Waste Law • In March, National Environmental Protection Agency (NEPA) elevated to ministry status and renamed 'State Environmental Protection Administration' (SEPA) • Also in March, China's central government initiated widespread administrative reforms, shutting down entities such as the Chemical Industry Ministry; the administrative responsibilities of the canceled ministries are to be absorbed by new or reorganized ministry-level entities • Drafts of following national legislation will likely be initiated or completed in 1998 <ul style="list-style-type: none"> - Chemicals Management Law - Clean Production Law - Desertification Prevention Law - Environmental Impact Assessment Law - Environmental Protection Law (amendment)
1998 -? - Continued	Environmental Protection, Natural Resource Conservation and Related Administrative Reform	<ul style="list-style-type: none"> - Fisheries Law (amendment) - Grassland Law (amendment) - Industrial Waste Reutilization Law - Natural Resource Conservation Law - Radioactive Pollution Prevention and Control Law - Renewable Energy Law • Drafts of the following national regulations will likely be initiated or completed in 1998: <ul style="list-style-type: none"> - Acid Rain Control Region Regulations - Regulations on the Management of Waste Transportation Manifests - Regulations on Motor Vehicle Emissions Control - additional regulations for implementation of the Solid Waste Law • In July, National People's Congress plans to complete a revised Legislative Plan comprising a list of new environmental statutes for amendment or initial drafting during the 1998-2003 period. One of these will be a Soil Pollution Law

Bibliography of Environmental Law in Asia¹

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This bibliography contains books and journal articles, on various Asian countries' environmental law, published since 1990.

Keywords: *environmental law, bibliography, Asia, China, India*

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Apart from the *Asia-Pacific Journal of Environmental Law* reviewed in this issue, the *Yearbook of International Environmental Law* has regular country reports including on a number of the countries listed here.

NOTE

- 1 The bibliography has been compiled from the resources of the University of Hong Kong Library, including the Catalogue, and electronic databases — namely the *Index to Legal Periodicals and Books*, the *Legal Journals Index* and the *Index to Foreign Legal Periodicals*. (I mention these not only to acknowledge our debt, but also to indicate to those not familiar with legal research materials that these resources exist. They are all published in paper as well as electronic format.)

Centres/Institutes of Environmental Law in the Asia-Pacific Region

Below is some information, mostly derived from the Internet, about centres or institutes with a focus on Asian environmental law, as part or all of their concerns.

PHILIPPINES: LEGAL RIGHTS AND NATURAL RESOURCES CENTER KASAMA NA KALISAN

LRC-KSK / Friends of the Earth is a legal and policy research and advocacy institution. Established in 1987, it is organized as a non-stock, non-profit, non-partisan, cultural, scientific and research foundation.

The goal of the Center is to empower the marginalized and disenfranchised peoples directly dependent on our natural resources so as to be able to effect ecologically sustainable, culturally appropriate, gender-sensitive, economically viable, equitable uses, management, conservation and development of natural resources.

Its main advocacy has been that recognition and protection of the rights of indigenous peoples and long-term occupants of the forests and of the rest of the uplands should be a main, if not the primary, component of any program on sustainable development.

Hence, the Center seeks to bridge the gap between the informal articulation of the aspirations of the peoples organizations on the one hand, and the formal, technical, bureaucratic and legal language used by the State.

The Center has already developed expertise on the subjects on indigenous peoples rights, environmental management, forestry issues, energy efficiency, community and local initiatives.

It is the official Philippine affiliate of Friends of the Earth International and its lawyers participate in Alternative Law Group (ALG) and Environmental Law Alliance Worldwide (ELAW).

Philippine Natural Resources Law Journal, a bi-annual publication of the Center, is issued to assist private and public institutions as well as community organizations in their discussions and action on vital issues of Philippine natural resource allocation and use.

The Center has five major teams:

The Direct Legal Services Team provides relevant and quality legal assistance to organized sectors and communities of the rural poor. It assists partner non-governmental and peoples organizations, coalitions, federations and alliances in analysing, reviewing, recommending or amending laws relating to the rural poor. It provides information as well as legal opinions whenever requested within specific areas within the mandate of the Center.

email: karolzki@mnl.sequel.net

The Research and Policy Development Team develops and suggests culturally appropriate, ecologically sound and sustainable legal policy options derived from the experiences of the affected sectors together with relevant scientific researches. In developing and implementing these policy options, the Center requires the community or organization be involved in the process.

email: franceb@mnl.sequel.net

The Campaign Support and Linkages Team manages and participates in task forces designed to implement national and international action plans on specific issues identified by the Center. It strives to harness the capabilities and potentials of communities, organizations as well as professionals, scientists and academe.

The team produces the various publications of the Center. It also establishes and maintains working linkages with institutions which are directly involved or related to the formulation of alternative

international and national programs and policies.
email: denfi@mnl.sequel.net

The Mindanao Branch Office provides progressive/alternative/developmental legal assistance and advocacy within Mindanao. It evaluates the implementation of official state policies on a local level. The team also provides documentary research sources to partners in Mindanao as well as established and maintains working linkages with other formations of peoples and non-governmental organizations in Mindanao.

email: lrcmbo@dv.webling.com

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Source: (with the permission of LRC-KSK)
Website: <http://sequel.net/lrcksk/>

SINGAPORE: ASIA-PACIFIC CENTRE FOR ENVIRONMENTAL LAW

The Asia-Pacific Centre for Environmental Law was established in 1996 by the Faculty of Law, National University of Singapore on the initiative of the Faculty of Law and the Commission on Environmental Law (CEL) of the World Conservation Union (IUCN), in collaboration with the United Nations Environment Programme (UNEP).

APCEL is situated in the Faculty of Law and supported by the National University of Singapore.

Asian Journal of Environmental Management

Current projects

These include: Capacity-Building in Environmental Legal Education in the Asia-Pacific Programme
Co-ordinator: Professor KL Koh
APCEL Environmental Law Database Project
Co-ordinator: Associate Professor RC Beckman
Research Project: A Study of Environmental Law in ASEAN Countries
Principal Investigator: Associate Professor RC Beckman

The Environment Forum & other Workshops
Co-ordinator: Simon SC Tay - a series of seminars on environmental law and policy jointly organised with the Institute of Policy Studies

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Further information: there was a profile of APLEC in (1996) *Asia-Pacific Journal of Environmental Law* 149 — and they have a website at: <http://sunsite.nus.sg/apcel/>

AUSTRALIA: THE AUSTRALIAN CENTRE FOR ENVIRONMENTAL LAW

ACEL is a collaborative arrangement between the Law Faculties of the University of Sydney, the University of Adelaide and the Australian National University.

ACEL promotes teaching and research in environmental law between the three Universities. It is establishing itself as a resource base in this field for Australia, Asia and the Pacific region. ACEL organised a workshop on Sustainable Development Law in China in collaboration with the Wuhan Centre and Tsinghua University Law Department — for a report see this issue of *AJEM*.

ACEL has a website via which all three sites can be contacted:

<http://www.law.usyd.edu.au/~acel/>

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'INDO-CHINA': MEKONG REGION LAW CENTER

This centre was established in 1994 with the aims of providing training in commercial and environmental law, to help strengthen the administration of justice in the region, and promote cooperation between the countries on issues affecting the achievement of sustainable development. The Center is based in Bangkok and has received support from Thai sources and from the USA, particularly the Asia Foundation. It is opening offices in Vietnam, Cambodia and Laos. The Center is organising workshops, training programmes and internships.

There is a report on the Center in 2(1) *Asia Pacific Journal of Environmental Law* (1997) p. 104.

INDONESIA: INDONESIAN CENTER FOR ENVIRONMENTAL LAW

The Lembaga Pengembangan Hukum Lingkungan Indonesia, or the Indonesian Center For Environmental Law (ICEL) was established in 1993.

ICEL provides input to the House of People's Representatives, at both central level and regional

level, and to the Government (the executive) in the form of thoughts on alternative laws and policies to cope with various environmental problems.

Advocacy

ICEL also gives legal assistance, either directly or indirectly in the form of support and consultation to groups in the community that are suffering damage or loss and to Self-reliant Community Institutions that advocate environmental cases. Advocacy is also often carried out through efforts to form public opinion and the promotion of the public's legal consciousness through press releases and holding of discussions on environmental law.

Studies and Research

ICEL is carrying out studies and research into various legal problems and environmental policies. Those that have so far been completed are studies on the implementation of Alternative Mechanisms in Settling Disputes (Mekanisme Alternatif Penyelesaian Sengketa = MAPS) in environmental cases, and Analysis of the Effectiveness of Policies, Regulations, Programs and Institutions that are related to the Control of Industrial Pollution in Indonesia (Efektifitas Kebijakan, Peraturan, Program dan Institusi yang berkaitan dengan Pengendalian Pencemaran Industri di Indonesia), and the study on Community Participation in the Management of Forests in Indonesia.

Workshop and Training

ICEL offers education and training to public environmental activists, Self-reliant Community Institutions, legal experts and practitioners, university people and students in the form of conferences, workshops, seminars, discussions, opportunities for apprenticeships at ICEL, etc.

Publications

ICEL has published and distributed in the form of books, the results of various studies and research projects as well as other information on developments in various aspects of environmental law. ICEL also publishes several publications, such as *Jurnal Hukum Lingkungan (JHL- ICEL)* (*The Journal on Environmental Law*) a quarterly journal that presents

in a thorough and critical manner certain concepts, ideas, and thoughts from environmental law experts and practitioners concerning various issues in the field of environmental law that are related to sustainable development. ICEL's bulletin of *Information, Law and Environmental Advocacy*, deals with several issues of current interest, as well as environmental cases. This Bulletin presents various short analysis of cases that have occurred in Indonesia and other countries throughout the world, which will be very useful in supporting environmental activists, the government and the public at large in carrying out their mission of protecting the environment.

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(Source: <http://www.igc.apc.org/elaw/asia/indon/icel.html>. This is a site belonging to E-Law — Environmental Law Alliance Worldwide — <http://www.igc.org/elaw/> and the information is rather dated)

OTHER CENTRES

In addition to these there is a centre for Environmental Law at Wuhan University in China.

In Malaysia the Consumers' Association of Penang is involved in Environmental Law Activities.

REVIEW

The Asia Pacific Journal of Environmental Law

Brian Baillie

Environmental law within the Asia Pacific Region is the focus of a new law journal published by Kluwer Law International (London etc), the *Asia Pacific Journal of Environmental Law*.

Now two volumes old/young, the *Journal* covers environmental law issues arising within the vast and varied Asia Pacific Basin. Generally, law and legal reform are dealt with by the *Journal's* contributors. However, refreshingly, the editorial policy appears to encourage a less legalistic treatment of the very important issues concerning the regions environment than is often the cases with environmental law journals. Volume 2, Issue 1 (1997), for example, covers a wide range of topics, including: the compatibility (or otherwise) of the Rio Forest Principles with the national agenda of Thailand and Malaysia; environmental law reform in Vanuatu; litigating environmental issues in Hong Kong; protection of marine resources in the Straits of Malacca and Singapore; and the 1996 Montreal World Conservation Congress.

The *Journal* is by no means a heavy-weight in the sphere of environmental law. Articles tend to be written by practitioners (of various disciplines) rather than academics. They are, despite or because of that,

generally brief and very readable. Generally, contributors live in the area about which they write, and may be actively involved in local or regional environmental interest groups. For example, in volume 2, Issue 1 the Legal Adviser to the *Consumers' Association of Penang*, Malaysia, has written a very interesting article on various aspects of Malaysia's environmental law and litigation, with particular reference to a recent toxic torts case (*Woon Tan Kan [deceased] & Ors. v Asian Rare Earth Sdn. Bhd.* (1992) 4 *Current Law Journal* 2299).

Yet the *Journal's* editorial team is anything but light-weight. Dr D R Rothwell (Faculty of Law, University of Sydney) is Editor in Chief, supported by an impressive Advisory Board of internationally renowned jurists and scholars. Professor Ben Boer (also of the Faculty of Law, University of Sydney and an acknowledged expert on environmental law issues relevant to the Pacific) is Book Review Editor.

Judging by its first two volumes, the *Journal* is to be highly recommended to not only those concerned with the law and the environment in the Pacific Asia Region, but also those interested in a somewhat broader coverage of regional environmental issues.

Brian Baillie is currently teaching in the Department of Professional Legal Studies at the University of Hong Kong. He has practised environmental law in Australia, and has been the general editor of the *Urban Planning and Environmental Law Quarterly*, a Newsletter produced by the law firm of Fed Kan & Co.

REPORT

Sino-Australia Environmental Law Course

Wang Zhenmin

The Tsinghua University Department of Law, in Beijing, the Environmental Law Centre of Wuhan University Law School and the Australian Environmental Law Centre at the University of Sydney jointly organised an Environmental Law Course in China from 25 November to 12 December 1997. There were 20 law students and lawyers from Australia attending the course.

Environmental issues have been a major concern all over the world. To solve different kinds of environmental problems countries have to strengthen environmental legislation and enhance the enforcement of environmental law.

Therefore in recent years China has made continuous efforts to improve its environmental legislation and its implementation. The National People's Congress (NPC) and its Standing Committee have passed many laws. The Central People's Government and local people's congresses have also enacted many administrative and local regulations to implement these laws adopted by the NPC and its Standing Committee.

This course aimed to enhance the exchange and collaboration between environmental law teachers, students and lawyers in Australia and China. It offered good opportunities for Australian environmental lawyers to get first-hand knowledge on Chinese laws and legal system, particularly environmental laws and its operation. Chinese participants also had chances to know more about Australian environmental law. Both learned a lot from each other.

There were two parts to the course. The first part was organised by Tsinghua University Law Department. Law Professors from Tsinghua University

offered an intensive Chinese law introductory course, focusing on environment-related laws such as China's administrative law, commercial law, criminal law, administrative litigation law, criminal and civil procedure laws. Study tours were organised to the State Environmental Protection Agency, the State Land Administration etc. Government officials briefed participants on their work and the operation of Chinese environmental law.

The second part was conducted in Wuhan University. This part focused on Chinese environmental law. Professors at Wuhan University Centre for Environmental Law lectured participants on Chinese environmental laws and regulations and their enforcement. Study tours organised in Wuhan included a visit to the Three Gorges Dam which is said to be the biggest environment-related project in the world.

Australian professors also briefed their Chinese colleagues on Australian environmental policy and laws. Both sides agreed to enhance their exchanges and collaboration in environmental law studies. Participants had opportunities to talk with Chinese law students and get to know about their study and daily life.

Environmental law has been one of the major courses in many law schools in the world. The Australian Environmental Law Centre under the University of Sydney is the biggest environmental law teaching and research institution in Australia. Some Chinese law schools like Wuhan University and Peking University have established similar centres. The newly re-established Tsinghua University Law Department will also soon set up an environmental research centre.

Wang Zhenmin is Deputy Head of the Law Department at Tsinghua University in Beijing.

Papers in this volume:

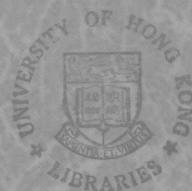
- Julia Deans* A Legal Look at Environmental Risks and Liabilities in Asia
- Antonio A. Oposa Jr* Environmental Conflict and Judicial Resolution in the Philippines
- Bryan Bachner* The Risk of Wealth: Determining a Sustainable Development Law and Policy for Hong Kong
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- Jill Cottrell and Joanna Ob* Bibliography of Environmental Law in Asia



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From the Editor

IN THIS ISSUE OF *AJEM*

This final issue of *AJEM* includes papers addressing environmental management issues in Sri Lanka, Bangladesh, Mainland China, Taiwan, Malaysia and Singapore, and Australia.

We begin with 'Water Resource Development Options of Lake Dianchi Basin, Kunming, China', by Huang Yongtai and He Bin of the Yunnan Institute of Environmental Sciences. Lake Dianchi is of fundamental importance to Kunming, for economic, social and cultural reasons. The lake is large in area but relatively shallow, making the exploitable scale of this vital resource appear larger than it really is. The lake is becoming heavily polluted causing higher costs for municipal water and raising questions about the continued uses of the lake for farming and livestock raising. Huang and He review the water resources provided by the lake and examine the development options for it in light of the growing environmental problems.

The second paper in this issue continues with the subject of water resources management, this time in Sri Lanka. Philip DeCosse, Shan Bhuvendralingam, Pradeep Liyanamana and Sanath Ranawana report on 'An Economic Analysis of Policy Options for Managing Water Pollution in the Kelani River', in Colombo, Sri Lanka. The authors estimate the cost of controlling biological oxygen demand and chromium using the World Bank's Decision Support System for Industrial Pollution Control. They note that the present approach of applying strict point source standards to all industries is inefficient compared to one of applying stricter controls to select industries.

Cherng G. Ding and Hui-Chen Chien undertake a broader topic in their search for common environmental risk factors in Taiwan. Their paper, 'Exploring Common Factors of Inter-correlated Environmental Risks in Taiwan Based on Experts' Perceptions', identifies the common factors based on factor analysis. They argue that 'in risk management, attention should be directed to these underlying dimensions so that environmental problems could be handled more effectively and economically'.

Ian Allan and James Peterson bring us back to the topic of water quality management in their paper, 'Site Selection for Post-Facto Water Quality Protection Works: Targeting the "Dirtiest Dozen"'. Allan and Peterson use spatial modelling to assess the effectiveness of mitigation measures for protecting water resources. Their work draws on experience in rural Australia with water collection systems and efforts to deal with the problems caused by inappropriately sited septic tanks.

Ataur Rahman Belal, Niaz Ahmed Khan and Syed Ahsanul Alam review 'Industrial Pollution and the Environment in Bangladesh: An Overview'. This paper summarizes the current situation with respect to industrial pollution and assesses the current institutional approaches to dealing with it. They find that institutional weaknesses are such that strengthening this institutional management capability must be a first priority.

We conclude this issue with Tony Geer's examination of 'National and International Conservation Issues within a Shared Biogeographic Unit: Malaysia-Singapore'. Here the topic is protection of bio-diversity. Economic development in these bordering nations and growing population have led to severe habitat fragmentation. Geer examines ways in which Singapore could more effectively promote the protection of viable habitats by looking to support of protection actions in its neighbour within its 'shared biogeographic unit'.

***AJEM* ENDING PUBLICATION**

It is with considerable regret that this is the final issue of the *Asian Journal of Environmental Management*. *AJEM* has been published since 1993 and since then has seen its subscription base grow. Unfortunately, the submission of manuscripts to *AJEM* proved to be highly erratic and this in the end is what led to our decision to cease publication. Without a relatively high and firm level of manuscript submissions, it becomes difficult to keep up standards. In several cases over the past few years, an issue of *AJEM* has been 'thinner' than we

would like, but that was the only way to ensure quality.

AJEM was set up at the beginning of 1993 with the aim of (1) providing a venue for high quality applied research on the Asian environment and (2) promoting the work of researchers from within the region. While both goals have been met, it has become evident that despite the rapid advances in this fast developing region, incentives to publish are not yet as strong or as widespread in the region as

they are in the older industrialized countries. Indeed, a number of our authors who were born and raised in the region in fact are now resident overseas. The recent economic downturn has made matters worse, since academics in particular now faced added pressures to undertake paid consultancies.

We wish to thank our subscribers, many of whom have been with us since the first year or so of publication. We hope that in the future, other referred journals will appear to take up where *AJEM* leaves off.*

Bill Barron
Editor

* If any subscribers have failed to receive a refund for their paid-up subscription past the end of 1998, please contact Ms Carrie Lee, Subscriptions Manager, CUPEM, The University of Hong Kong, Pokfulam Road, Hong Kong.

Water Resource Development Options of Lake Dianchi Basin, Kunming, China

Huang Yongtai and He Bin

ABSTRACT

Lake Dianchi basin in which Kunming City is located is short of water resources. The pollution of the lake adds to the shortage which has become a serious problem for the social and economic development of Kunming City. Many researches have been done and lots of water resource development options, including in-basin development options and water import scheme, have been studied. This paper will introduce the water resources and development options of the basin.

Keywords: *Lake Dianchi basin, water yield, water resource development option*

INTRODUCTION

Lake Dianchi, the cradle of Kunming City and a precious pearl of Yunnan Plateau (see Figure 1) plays an important role in the development of Kunming City and Yunnan Province (Yang 1993). Its water is used for many purposes, including domestic supply (as one of the only two water sources for Kunming City), industry, agriculture (crop irrigation and live-stock watering), water storage, flood control, shipping, aquatic products culture, recreation, etc. It is the foundation for the existence and development of the society and economy of the basin (Yang 1993). The lake, located at the lowest point in the Dianchi catchment, is also the principal receiver of wastewater from the city and other pollutant sources in the basin.

Presently, approximately 0.6 million m³/day of water is supplied to Kunming Municipal, half coming from Songhuaba Reservoir and another half from Lake Dianchi (Statistic of Kunming Municipal Water Company, KMWC 1996). However, according to the monitoring results of Kunming Environmen-

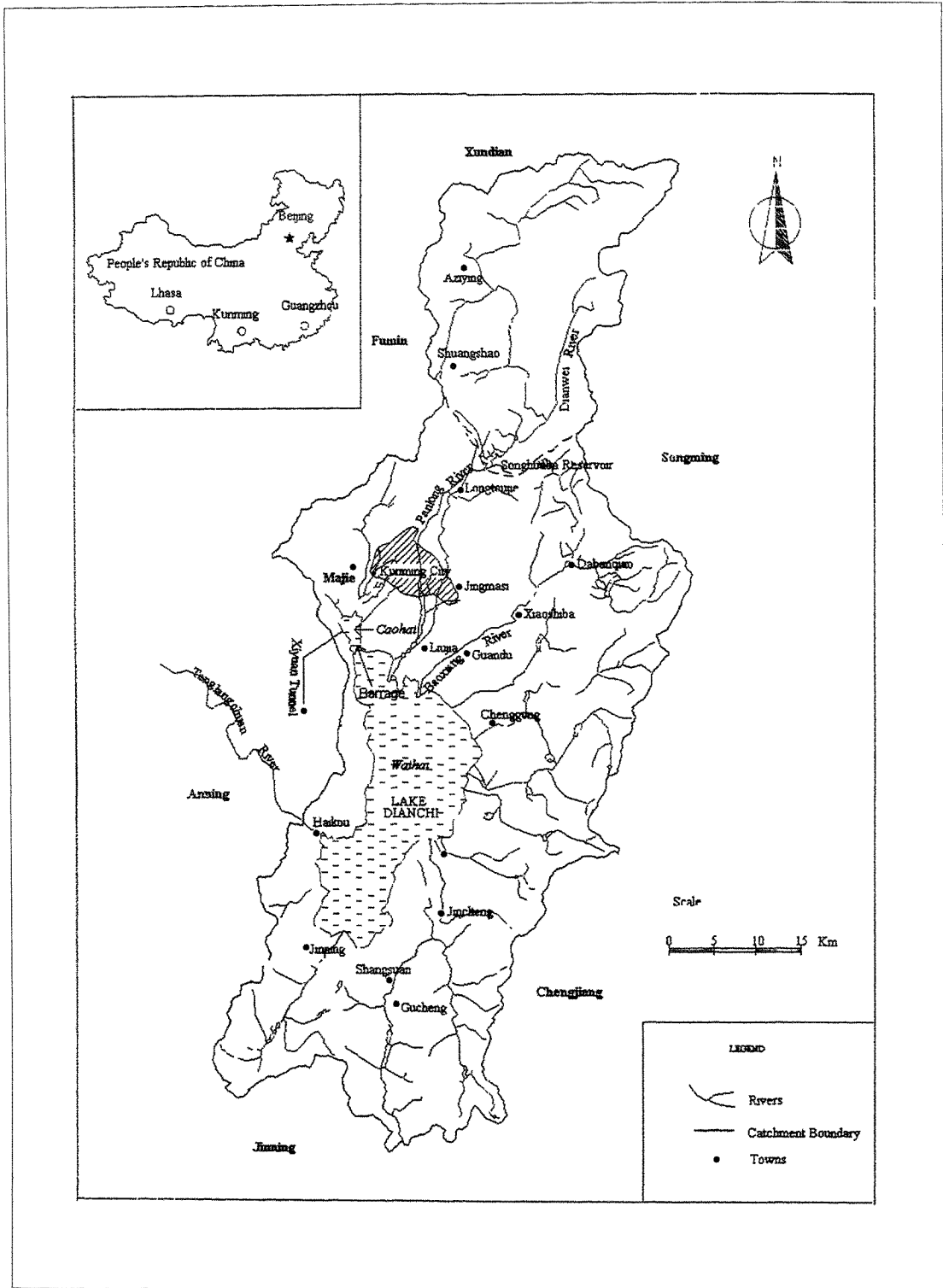
tal Monitoring Center Station, the water of the lake is not suitable as a drinking water source (Wu 1990).

GENERAL INFORMATION

General information About Lake Dianchi and Lake Dianchi Basin

Lake Dianchi catchment (2920 km²), which belongs to the Jinsha River system, upper reaches of Yangtze River system, has a population of 2.58 million and dominates the provincial economy (Huang 1997). Within the Dianchi basin there are some 21 sub-watersheds. The landforms consist of the down faulted lake basin at about 1,800 m surrounded by mountain ridges rising to 2,826 m at the highest point. The rivers draining into the lake emerge from narrow valleys in the surrounding hills and mountains and open out onto the extensive lakeshore plain. Lake Dianchi, with the surface area of 300 km² and the volume of 1290 million m³, is divided by a man-made barrage into two parts, a small inner lake, the

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Source: He 1996

Fig. 1 Lake Dianchi Basin

Caohai (8 km²) and the much larger outer lake, the Waihai. The average depth of the lake is 4.4 m with the deepest point 10.4 m (Huang 1997). The Waihai has a south-western exit through Haikou flood control structure into the Tanglangchuan River. With the completion of the Xiyuan Tunnel in the end of 1996, a second exit to the Sahe River was opened from the Caohai.

Climate and Weather

The predominantly plateau Dianchi lake basin belongs to the north sub-tropical monsoon climatic zone. Annual average temperatures are 14.7°C with an annual temperature variation of between 11.7°C to 13.3°C. Average annual rainfall varies from 1,007 to 797 mm. There is a predominantly dry period between November and April (MW 1996). Rainfall is characteristically of low intensity and of short duration, its ability to cause severe soil erosion is thus limited to exceptional storms. Evaporation from land surfaces in the basin is high ranging from 2,120 to 1,870 mm in average and dry years respectively. The main wind direction is south west with an average speed of 2.2 to 3.0 m/s.

Variations in weather conditions are one of the most serious hazards in the area and spring droughts can have important implications for agriculture. Records since the fourteenth century show that 50 such droughts have occurred. Severe floods are also an occasional hazard in the wet season with 80 major floods recorded over the last seven centuries (MW 1996).

Geography

The predominant geological strata in the basin are ancient basement rocks and more recent sedimentary strata: mainly shales, sandstone, limestone and basalt. In conjunction with tectonic uplift and mountain building these have produced a high altitude hilly terrain resistant to significant weathering. The variety of soil types depends on elevation and the period of development.

Change of Lake Size

Between 1960 and 1980, the lake, especially the Caohai, was substantially altered in size due to a major land reclamation project. The water surface area was reduced, the lake became shallower, and

its storage volume was reduced. Overall, the Caohai lost two-thirds of its water area due to land reclamation.

Many areas on the shoreline of the Waihai were also reclaimed for farmland and fish ponds especially in the vicinity of the main delta area of the Dahe River, southeast part of the lake. Dykes and walls were built around the lake to protect the adjoining land from flooding.

WATER RESOURCES SYSTEM

In considering the regional features of the basin, the system comprises three components, i.e. Songhuaba catchment (approximately 593 km²), Lake Dianchi (300 km²), and the remaining land area, termed the lakeshore catchment (approximately 2027 km²).

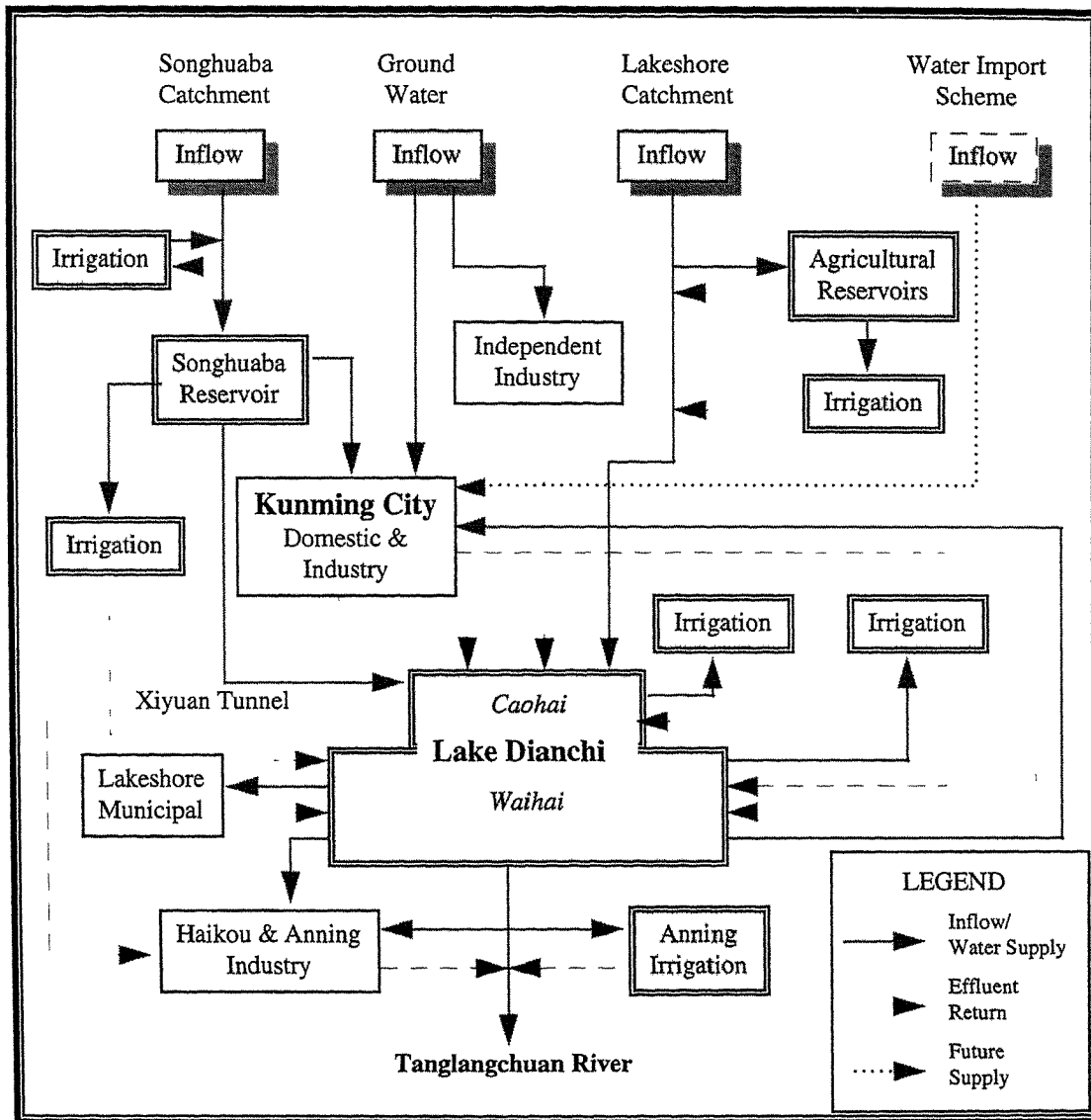
It is appropriate to consider the Songhuaba catchment as a separate component, being the largest single catchment draining to Lake Dianchi, and an important source of good quality water for Kunming. Furthermore this catchment has markedly higher rainfall than other parts of the area, and may have slightly different hydrological characteristics to the lake shore catchments.

Since evaporation over Lake Dianchi always exceeds rainfall, the lake acts as a sink rather than as a source of water. In a very dry year the volume of water lost through this sink can become quite substantial, rising from an average of 115 million cubic metres (MCM) to 202 MCM (MW 1996). Therefore any consumption of water pumped from the lake is derived from inflow within the Songhuaba catchment or lakeshore catchment, or by reducing the storage volume of the lake.

In practice the current water resource system is highly complex with many artificial and natural influences, such as surface water reservoir storage, groundwater abstraction, pumped abstraction from the lake for many different purpose, and returns the lake from each abstraction made. The simplified existing and future potential water resource system is shown in Figure 2.

WATER YIELD OF DIANCHI CATCHMENT

Necessary data and information, such as flow records, rainfall, water level records, evaporation data, water demands and consumption, of the years from 1953–



Source: Huang 1998

Fig. 2 Water Resources System of Lake Dianchi Basin

1994, were collected and reviewed at monthly intervals to estimate the yield of the basin.

Water balance models were developed by YIES to represent all inflows, outflows and usable water supply storage within both the Songhuaba catchment and Lake Dianchi. These models were operated at a monthly time step over the period 1953 to 1993, for a range of water demands, in order to estimate the 1 in 20 year yield of both catchments. The period of record analyzed contains a number of extreme drought sequences and is considered to be a reasonable basis for yield assessment (He 1996).

The estimated 1 in 20 year yield of Lake Dianchi varies between 200 – 250 million cubic metres per year (MCM/yr), depending on the extent of water resources developments within the Songhuaba catchment. This estimate excludes irrigation water consumption within the basin. net water demands within the catchment are estimated at 122 MCM/yr in 2020, assuming a minimum release of 57 MCM/yr from Lake Dianchi at Haikou, to meet essential downstream water demands in Anning County (MW 1996).

The present 1 in 20 year yield of Songhuaba

Reservoir is estimate at approximately 97 MCM/yr. By increasing the usable water supply storage within the Songhuaba catchment, the reliable yield could be increased to 146 MCM/yr. Within the lakeshore catchments, the reliable yield of the seven existing medium sized agricultural reservoirs is estimated at approximately 63 MCM/yr. At present this generally good quality water is used mainly for irrigation. Kunming independent industries are not connected to the Kunming water distribution network, and use approximately 47 MCM/yr of mainly good quality groundwater from the lower Songhuaba catchment for water supplies (MW 1996).

For Kunming, the estimated water demand for domestic and industrial purposes is expected to increase from 206 MCM/yr in 1995 to 365 MCM/yr in 2020 (He 1996). These estimates do not take into account water demands from Kunming independent industries, as it is expected that these will continue to be supplied independently from groundwater sources, or the lakeshore towns and industries which have separate supply systems using water from the lakeshore area and Lake Dianchi.

A review of in-basin water resource development options indicates that there are limited opportunities to utilize the best raw water quality for the most quality sensitive uses. These results indicate that even with further development of good quality water resources, hence Lake Dianchi is expected to remain in the future, an important source for Kunming urban water supplies (He 1996). Public perceptions regarding the proportion of Kunming's urban water demand supplied from good quality water sources may be an important factor. Without the provision of additional good quality water, abstraction from Lake Dianchi will in the future form an increasing proportion of the water supplied to Kunming.

The available information also indicates that the largest individual water demands within Dianchi catchment are the outflow from Lake Dianchi during drought and flood conditions, and agricultural irrigation within the catchment. Operation of the two outlets from Lake Dianchi at Haikou and the Xiyuan tunnel, are very important during drought years. The excessive release of water during dry periods significantly reduces the reliable yield of Lake Dianchi for water supply purpose.

During average or wet years, present results indicate that it should be possible to release most of the inflow to the Caohai and therefore reduce the

flow and pollution load reaching the Waihai from the Caohai. The impact that this policy will have on the water quality and aquatic ecology of the upper Tanglangchuan River is unknown. In dry years, it will be necessary to operate the Caohai and the Waihai in an integrated manner, and allow flow exchange between the two lakes, whilst at the same time restricting outflow from the Waihai at Haikou. This will require a detailed operating policy to be prepared to ensure existing Lake Dianchi water users are protected.

A lot of water resource development options were proposed by Yunnan Water Conservancy Design Institute (YWCDI), Kunming Municipal Water Conservancy Bureau (KMWCB) and YIES in terms of the above characters of the basin.

WATER RESOURCE DEVELOPMENT OPTIONS

In-basin Water Resource Development Options

Alternative in-basin water resource development options have been identified, and sub-divided firstly into potential core options capable of providing the largest increase in reliable yield, and secondly into supplemental options which may be used separately or in conjunction with the main options by YWCDI, KMWCB and YIES (He 1996).

The main options identified are briefly described below:

Huangshiyen Reservoir

This proposed reservoir is located in the River Xiaohe, tributary of Songhuaba catchment, adjacent to the Zhou He gauging station. The reservoir would be designed to store water mainly for water supply purpose, but could also fulfill a flood control function if required. Water stored in the reservoir would be released into the downstream channel to maintain storage within the Songhuaba Reservoir, from which water would be drawn for water supply purpose.

Studies have indicated that the potential storage at the dam site is quite large, up to approximately 100 MCM, but that a number of geotechnical difficulties remain to be solved, which may constrain the water supply storage. Recent studies have proposed a potential storage of 33–60 MCM (He

1996). The inundate area would also require the resettlement of farmers in the reservoir catchment.

Tail End Dam of Songhuaba Reservoir

The Songhuaba Reservoir was designed for a maximum operating water level of 1965.5 m, corresponding to an active storage of 101 MCM. However due to potential impact on farming activities and communities within the upstream reservoir catchment, the reservoir is normally operated at a maximum water level of 1964.0 m, corresponding to an active storage of 89.9 MCM. A tail end dam or series of small dams have been proposed to prevent reservoir water levels from flooding upstream communities. Pumping stations will also be required to transfer water into reservoir, when reservoir water levels are high. Initial studies have indicated that this scheme is technically difficult and relatively expensive (He 1996).

Raised Operating Water Level of Songhuaba Reservoir

This option achieves the same benefit as the tail end dam, but through compensation of upstream communities, no engineering works are required.

Increased Water Treatment Capacity of Songhuaba Catchment

By increasing the water treatment capacity, the utilization of good quality water from the Songhuaba Reservoir may be increased in average and wet year.

Lakeshore Agricultural Reservoirs

Preliminary water balance calculations have shown that the lakeshore catchment have surplus water resources which are presently captured by seven existing agricultural reservoirs. The concept is to change the use of these reservoirs from agricultural to domestic water supply purposes, and to transfer part of the available resource to Kunming. A replacement agricultural pumped water supply scheme would need to be developed from Lake Dianchi.

In concept the scheme is similar to the progressive change of use of the Songhuaba Reservoir, previously used to supply irrigation water, and follows the present trend of increasing use of water from the lake for agricultural supplies. Recent water quality results from the agricultural reservoirs indi-

cates that the raw water quality is significantly better than Lake Dianchi, and similar to Songhuaba Reservoir.

Lake Dianchi Flood Control

Until the Xiyuan tunnel was commissioned, the only outlet from Lake Dianchi was at Haikou, which has limited hydraulic capacity. The maximum operating water level in the lake was consequently limited by the need to store much of the flood event.

The completion of the Xiyuan Tunnel provides an opportunity to re-assess the lake operating water levels. It is understood that the lake is now operated to the normal high water level of 1887.4 m, hence there appears to be little potential benefit to be gained by raising further the elevation of flood defenses in the lowest lying margins of the lake (He 1996). Lake Dianchi now has an active storage for water supply purposes of 660 MCM, which is approximately 135% of the annual average inflow to the lake.

Songhuaba Reservoir — Lake Dianchi Conjunctive Use Scheme

The Songhuaba catchment has a mean annual runoff of approx. 193 MCM, however the reservoir storage available for water supply purposes is only 90 MCM; hence at the normal urban water supply reliability of 95% (1 in 20 years), the yield from the reservoir is limited. If the reservoir was to be operated at a lower reliability of 80% (1 in 5 years), the yield would be increased for most of the time, but during a dry year (i.e. greater than 1 in 5 years), the reservoir would fail to supply the full yield.

If the reservoir were to be used conjunctively with the Lake Dianchi, then treated water from the lake could be used to make up the supply shortfall. With this type of scheme, spill from the Songhuaba Catchment would be reduced and the yield of the reservoir would be increased. However it would be necessary to install surplus water treatment capacity at the lake, to make up for the supply deficit from the reservoir during a dry year (He 1996, He 1990).

Groundwater Conjunctive Use

This scheme in concept is similar to the Songhuaba Reservoir — Lake Dianchi conjunctive use scheme. If a suitable aquifer could be located capable of providing a large short duration yield, then this source could be operated during drought events to make up

the supply shortfall from the reservoir. The aquifer could recover naturally between drought events, or be recharged artificially using surplus water of suitable quality (He 1996).

Demand management — water conservation

Leakage from the Kunming urban water supply network is not known accurately, but expected to be substantially greater than the figure than the figure of 12% quoted in published documents (MW 1996). Although this water returns to the lake and is not a loss of water to the lake catchment, it is a loss of valuable good quality water from the Songhuaba catchment, which has limited resources.

A demand management program including leakage reduction, control of wastage, pressure control and possible use of low water consumption appliances, would enable the best quality water available in the catchment to be used for priority domestic and urban purposes. This would reduce the need to import good quality water from outside the catchment. There could be significant savings on water treatment costs, and sewage treatment costs. It is normal practice to fully explore all potential water conservation measures before considering the development of new water sources. Technical and financial information is not presently available for the accurate evaluation of this option.

Dual Water Supply System

The largest single water resource in the catchment, Dianchi Lake, contains water which is not particularly suitable for potable water supplies, but is generally suitable for industrial and agricultural supplies. Almost 40% of Kunming urban demand is from industry, which does not necessarily need to be supplied with water of potable quality (Wu 1990).

A reduced volume of potable quality water could therefore be supplied to the domestic population, using the best quality raw water from Songhuaba reservoir. If coupled with demand management to reduce pipeline leakage and conserve water, Songhuaba Reservoir may be able to provide the potable water requirements for a significant period in the future (Yang, 1993). Industrial water users

would need to be supplied from a separate supply system, using Lake Dianchi or groundwater.

Water Import Schemes

Many water import options have been studied. Among them, the option importing water from Zhangjiuhe River to Kunming is the optimal one (Huang 1997).

It is planned to import 295 million m³ of water from Zhangjiuhe River to Kunming. The inlet is more than 98 km away from Kunming. This project consists of a reservoir, a channel of 98 km long, a water works and water supply pipelines. The total estimated investment of the project is 3500 million yuan RMB. The feasible research concerning this project is being carried out and seven years is needed to completed this project (Huang 1997).

CONCLUSION AND DISCUSSION

It is an arduous task to solve the problem of the water resources in Lake Dianchi Basin.

It is estimated that with the commission of the water resource development options, the urban water requirement of Kunming City can be met by good quality water, from Songhuaba reservoir and imported water, until the year of 2010. After that, the water of Lake Dianchi need to supply Kunming City again(Huang 1998).

ACKNOWLEDGEMENTS

This paper is a summary of the previous research projects, especially the report of Annex 2 of Dianchi Environmental Action Plan, Dianchi Water Resources Master Plan, composed by Montgomery Watson, British. Yunnan Institute of Environmental Science was the counterpart in the preparation the this report. We, the authors, thank all of the persons participated in the researches of water development of Lake Dianchi basin, especially the experts from Montgomery Watson.

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An Economic Analysis of Policy Options for Managing Water Pollution in the Kelani River

Philip J. DeCosse, Shan Bhuvendralingam, Pradeep Liyanamana and Sanath Ranawana

ABSTRACT

This study assesses the costs and benefits of alternative policy options for control of water pollution in the Kelani River in Colombo, Sri Lanka. The cost of policy options for control of Biological Oxygen Demand (BOD) and chromium are estimated using the World Bank's Decision Support System for Industrial Pollution Control. Results from the analysis make it clear that costs differ significantly between the two policy options of enforcing current point source standards for all industries and just meeting ambient water standards through more socially optimal reductions by select industries. The study also demonstrates that it is technologically beyond the capacity of the industries currently located on the river to reduce their BOD loads sufficiently to bring the ambient water standard below the minimum desired level. The study's conclusions imply a shift in priorities and approach for the Central Environment Authority.

Acronyms:

BOD	Biological Oxygen Demand	GOSL	Government of Sri Lanka
CEA	Central Environment Authority	ISIC	International Standards of Industrial Classification
COD	Chemical Oxygen Demand	MCM	Million Cubic Meters
DO	Dissolved Oxygen	NWSDB	National Water Supply and Drainage Board
DSS/IPC	World Bank's Decision Support System for Industrial Pollution Control	WASP	Water quality Analysis Simulation Programme
EA1P	Environmental Bank 1 Program		
EPL	Environmental Protection License		

EXECUTIVE SUMMARY

Like many polluted water bodies in Sri Lanka's Colombo district, the Kelani River has not escaped the

impacts of a growing population and economy. Recent studies conducted by the Central Environment Authority (CEA)/ University of Moratuwa on water pollution in the Kelani River (Bhuvendralingam *et*

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al. 1995) uses the CEA's 'proposed inland water quality standards' to show that (subject to sampling and analytical uncertainties) levels of Biological Oxygen Demand (BOD), chromium, lead, and fecal coliforms exceeded acceptable ambient water quality standards.

The immediate objective is to assess the costs and benefits of alternative policy options for control of water pollution in the Kelani.

Background

The CEA is attempting to enforce compliance with established point source concentration-based standards. Because industries are the easiest identified of the point source polluters, reduction in their effluents has been identified as the primary means of bringing water pollution problems under control. It is implicitly assumed in such an approach that if each of the point source polluters could be forced to reduce their emissions, the net effect on the Kelani River would be to bring ambient water standards within acceptable norms. Yet, until the completion of the study referenced above, the CEA did not have the formal means of estimating the relationship between point source emissions and ambient water quality. Since every watershed is characterized by a different assimilative capacity, policy planning without this point-source-to-ambient-environment link includes a considerable amount of guesswork. With the CEA/Moratuwa study completed, it is now possible to model the relationship between point source emissions in the watershed and the quality of the Kelani water body at different points in the river. This modeling exercise marks a significant step forward in developing a capacity for basing environmental policy on formal and estimable models.

Approach

The approach of the study is to identify a number of different policy options for controlling water pollution in the Kelani River and then to estimate the costs and benefits of those alternative options. To simplify the analysis, we restrict our focus to two major pollutants: BOD and chromium. In each case, the pollutant levels in the Kelani significantly exceed even the 'minimum quality' CEA ambient water standards. Chromium is selected because it is generated almost exclusively by industries and thus represents a pollution problem that must be resolved

through direct interaction between the CEA and industry.

Results

Chromium

The results from the analysis make it clear that there are significant cost differences between enforcing CEA's current point source standards and ensuring only that required quality standards of ambient water are maintained. The long-run marginal costs to industries of meeting the CEA's point source effluent standards is \$88,893, while the marginal cost of reducing chromium pollution just enough to meet the ambient water quality standard is only \$1,452. Since the most strict ambient water quality for chromium is met at the relatively low marginal cost of \$1,452, any additional expenditure by industry beyond this point is fundamentally inefficient (assuming there is no designation of the river body for which the chromium levels need be lower than for "fish and aquatic life") since it cannot markedly improve the quality of the river.

Biological Oxygen Demand

The primary study area for application of the BOD economic model policy issues was the San Sebastian Canal. Policy conclusions, however, can be drawn for the Kelani River as a whole. The analysis suggest that it is technologically beyond the capacity of the industries currently located on the canal to reduce their BOD loads sufficiently to bring the ambient water standard below the minimum desired level. Even at rapidly rising marginal costs, industries can remove only 200 tons/year, yet the excess load of 357 tons/year is beyond the technical capacity of the firms. The total daily load of BOD in the San Sebastian Canal is 1,800 kg/day and the industry accounts for only 10% of this total load. Thus, even if industries were to stop producing BOD altogether, it would have a minimal impact on the total BOD in the canal.

Households, on the other hand, account for more than half of the total load in the San Sebastian Canal. A sewage treatment system has the potential for reducing loads in the San Sebastian Canal by an amount greater than the excess load and thus returning the canal's ambient water quality to an acceptable level.

Table 1
Priority Issues and Recommended Actions

<i>Priority Issue</i>	<i>Policy Implications/Recommended Action</i>
Designate use of water bodies	Water pollution control strategies for an integrated watershed management approach Use of water bodies within the watershed clearly designated before development of appropriate policies for them
Prioritize target pollutants	A shift in emphasis from surrogate pollutant measures to toxic and refractory anthropogenic chemicals
Enhance water quality monitoring and standards	A shift in emphasis from concentration-based to load-based monitoring and standards

Recommendations

Priority issues and recommended actions are shown in Table 1.

Conclusions

The conclusions to the study imply a shift in priorities and approach for the CEA. While the shift at first may appear to be a fundamental shift of priorities, implying significant upheaval and uncertainty, it is important to note that there is significant precedent for the recommendations being made in this study. Regarding the shift from concentration-based to load-based monitoring and from surrogate measures to toxics, the experiences of a number of countries in the region can be of assistance to Sri Lanka. The use of hydrological and economic models to manage pollution problems has a long history and has become increasingly accessible and low cost as technology has improved. This study clearly reflects an urgent need for much higher priority and concomitant action to move ahead as soon as possible on development of appropriate infrastructure to manage major causes of pollution in similar water bodies in Sri Lanka. We believe that the highest priority for CEA at the present, in light of the government's policy for industrial growth, is to rethink its pollution monitoring and management strategies and shift them toward the new vision elucidated here.

THE PROBLEM

Recent times have seen a proliferation of stories in

our press about pollution of well-known water bodies. Pollution of the Lunawa Lagoon near Moratuwa has all but caused it to disappear. Anecdotes abound about raw household sewage and industrial effluent being pumped into the Bolgoda Lake. And the Kandy Lake emits a noxious odor on certain days that is well-known to those who live there.

Like these other water bodies, the Kelani River has not escaped the impacts of a growing population and economy. A recent Central Environment Authority (CEA) / University of Moratuwa study on pollution and water quality in the Kelani River (Bhuvendralingam *et al.* 1995) uses the CEA's 'proposed inland water quality standards' to show that (subject to sampling and analytical uncertainties) levels of Biological Oxygen Demand (BOD), chromium, lead, and fecal coliforms exceeded acceptable ambient water quality standards.

Faced with such pollution, the institutional response of the Government of Sri Lanka (GOSL) via CEA has been to attempt to enforce compliance with established point source concentration-based standards. Because industries are the easiest identified of the point source polluters, reduction in their effluents has been identified as the primary means of bringing water pollution problems under control. It is implicitly assumed in such an approach that if each of the point source polluters could be forced to reduce their emissions, the net effect on the Kelani River would be to bring ambient water standards within acceptable norms. Yet, until the completion of the study referenced above, the CEA did not have the formal means of estimating the relationship between point source emissions and ambient water quality. Since every watershed is characterized by a

different assimilative capacity, policy planning without this point-source-to-ambient-environment link includes a considerable amount of guesswork. With the CEA/Moratuwa study completed, it is now possible to model the relationship between point source emissions in the watershed and the quality of the Kelani water body at different points in the river. This modeling exercise marks a significant step forward in developing a capacity for basing environmental policy on formal and estimable models.

OBJECTIVE OF THE STUDY

The objective of this study is to build on the hydrological modeling work of the CEA and University of Moratuwa to understand and model the economic implications of environmental policy decisions. The immediate objective is to assess the costs and benefits of alternative policy options for control of water pollution in the Kelani.

The longer-term objective of this study is to explore the potential for use of physical, chemical, and economic models for finding solutions to environmental problems. We would hope that such models also might assist in understanding the relationship between environmental policy decisions and their impact at the local level.

METHODOLOGY

General Approach

The approach of the study is to identify a number of different policy options for controlling water pollution in the Kelani River and then to estimate the costs and benefits of those alternative options. To simplify the analysis, we restrict our focus to two major pollutants: BOD and chromium. In each case, the pollutant levels in the Kelani significantly ex-

ceed even the 'minimum quality' CEA ambient water standards (see Table 2). Chromium is selected because it is generated almost exclusively by industries and thus represents a pollution problem that must be resolved through direct interaction between the CEA and industry.

BOD is selected not only because it is one of the most important determinants of environmental quality, but also because its sources are considerably more varied than chromium, being generated by households, industries, and even natural systems. The CEA's response to problems of BOD pollution thus represents a much more complex set of issues than the chromium case. The CEA/Moratuwa study found that only 8% of the BOD load in the Kelani River can be attributed to industry, with the remainder coming from household sewage and a number of non-point sources (e.g., from natural systems and farmlands).

The policy options examined for reducing levels of chromium and BOD differ slightly. The analysed policy options for reducing levels of chromium are the following:

Policy Options: Chromium

1. **Enforce Compliance with Existing CEA Point Source Effluent Standards.** Under this option, we calculate the costs to industry (additional enforcement costs of the CEA are not calculated) of reducing their pollution levels to meet the CEA point source standards.
2. **Require that Industry's Total Effluent Levels are Reduced Sufficiently to Meet Ambient Water Quality Standards for 'Fish and Aquatic Life.'** Under this policy, an institution would be identified and given the mandate to ensure that the ambient water quality in the Kelani was the guiding principle in determining the allowable amounts of pollution that can be emitted into it. No restrictions are placed on the effluents of any single firm, so long as the total effluents

Table 2
Select Proposed Inland Water Quality Standards

Parameter	Unit	Drinking Water with Simple Treatment	Fish and Aquatic Life	Minimum Quality
Total chromium (Cr)	µg/l, max.	50	2	50
BOD (5 days, 20°C)	mg/l, max.	2	-	4

entering the river do not push pollution levels above 2 mg/l, the maximum allowable level for fish and aquatic life.

3. **Require that Industry's Total Effluent Levels are Reduced Sufficiently to Meet Ambient Water Quality Standards for 'Drinking Water with Simple Treatment.'** Similarly to option 2 above, no restrictions are placed on the effluents of any single firm, so long as the total effluents entering the river do not push pollution levels above 50 mg/l, the maximum allowable level for drinking water with simple treatment.

The policy options explored for reducing levels of BOD are the following:

Policy Options: BOD

1. **Enforce Compliance with Existing CEA Point Source Effluent Standards.** Here we calculate the cost to all identified point sources of compliance with existing standards.
2. **Meet Ambient Water Quality Standards Via Reductions by Industry Only.** Under this option, the burden of reducing BOD levels is given to industry, who must reduce their BOD output sufficiently to meet the ambient water quality standard.
3. **Meet Ambient Water Quality Standards Via Installation of a Sewage Treatment Plant Only.** Under this option, installation of a sewage treatment plant is assessed as a means of reducing BOD levels to acceptable standards. Costs are estimated using data from similar sewage treatment plants along with population data from the study site.
4. **Meet Ambient Water Quality Standards Via Installation of a Sewage Treatment Plant and Initiation of a Non-point Source Pollution Program.** Although specific costs cannot be estimated with this policy option, some conclusions can be drawn about the potential for pollution management using the option.

The 'minimum quality' (4 mg/l max) ambient standard is used for all of these BOD policy options.

Modelling Framework

To model these policy options, the CEA/Moratuwa model of the Kelani River is taken as a starting point. The developers of this model measured the

ambient water quality levels of the Kelani River and estimated the pollutant loads (point source and non-point source) discharged to the river. The CEA/Moratuwa modelling team established a water quality model for the Kelani River mimicking its dose-response behaviour, where the dose was the external pollutant and the response was the resulting water quality level encountered in the water body. The fundamental relationships of the model were given by the Water quality Analysis Simulation Programme (WASP), which is generally used to help interpret and predict water quality responses to natural phenomena and man-made pollution for various pollution management decisions.¹

To examine the economic implications of alternative policy options, the World Bank's Decision Support System for Industrial Pollution Control (DSS/IPC) was used. The DSS/IPC allows the user to stipulate an ambient water quality standard and then to compute the costs that would be required for polluters to reduce their emissions sufficiently for the ambient body to meet the standard. The model uses long-run marginal cost functions for different International Standards for Industrial Classification (ISIC) codes to estimate investment costs necessary to reach reduced loads for a given firm. The costs of pollution reduction investments are derived from international market prices for known pollution reduction technologies and are linked to the physical and chemical processes typically used by different industries. Use of the DSS/IPC in combination with the CEA/Moratuwa models therefore allows the user to calculate the investment costs required by polluters to meet a variety of ambient water quality levels.²

Underlying Economics of Costs and Benefits

The investments made by polluters to reduce pollution levels represent 'deterrence costs' and therefore provide a proxy for some of the benefits of pollution reduction. Other benefits and costs not included in the DSS/IPC may also be associated with changes in pollution levels. The general categories under which economic costs and benefits can be identified as a result of changes in water (or other ambient) pollution are productivity, amenity, and human health (OECD 1995, 39–40). Amenities refer to issues such as contact and non-contact recreation, aesthetics, etc. This study does not make an attempt to formally estimate any of these categories.

When defining the 'costs' of pollution control, the DSS/IPC model places primary emphasis on long-run marginal costs as opposed to total or average costs. Long-run marginal costs are calculated using total investment costs, the interest rate, number of years for which the pollution control machinery will be functional, and effluent parameters. The emphasis is on the marginal costs that arise between choosing between one pollution management option and the next.

THE STUDY SITE

The Kelani River is the third largest river in Sri Lanka. The river originates in the central hill country of the island and flows in a mainly westerly direction until it reaches the sea at the northern limits of the city of Colombo. The river basin, which is located entirely in the wet zone of the country, has a catchment area of 2,280 km² and an annual runoff of 5,500 million cubic metres (MCM).

The Kelani River itself is formed by the confluence of two smaller rivers, Kehelgamu Oya and the Maskeliya Oya. These two rivers are dammed further upstream, forming Castlereigh and Mousakelle reservoirs, respectively, both of which are constructed and utilised for the purpose of hydro-electric power generation. Approximately 3 km upstream of Hanwela, the Kelani River is joined by a small tributary called the Wak Oya, which is dammed further upstream forming the Kalatuwawa and Labugama reservoirs, the initial water supply sources for the city of Colombo. The river loops around the northern limits of Colombo before flowing out to the sea.

The river segment between Glencorse and the sea mouth (including significant tributaries) was *selected as the broad model area*. This is presently the area with the most industrial activities and is of vital importance to the area of Greater Colombo due to the presence of Ambantale Water Intake and Treatment Plant providing potable water to its inhabitants.

For the purposes of this study, the *San Sebastian Canal* was selected as a sub-site. The canal is part of the Colombo canal system and discharges storm water, industrial effluent, and sewage collected from a large urban area into the Kelani River via the north lock situated just upstream of Victoria Bridge. The land adjoining the canal is home to a huge shanty settlement, where people live in conditions where sanitary and waste disposal facilities are non-existent.

A large number of industries are present along the canal banks, utilising the canals for liquid waste disposal. The collective result of these influences makes the San Sebastian Canal the most polluted water body in the city of Colombo.

RESULTS

Chromium

Results to the chromium analysis are shown graphically in Exhibit 1. Since the Kelani River already meets the ambient standards for 'drinking water with limited treatment,' the marginal cost to industry in meeting that standard under policy option) is \$0.

The more striking results from the chromium analysis arise from a comparison of policy options 1 and 2. Results from the analysis make it starkly clear that there are significant cost differences between enforcing CEA's current point source standards and ensuring only that high quality standards of ambient water quality are maintained. The long-run marginal costs to industries of meeting the CEA's point source effluent standards is \$88,893, while the marginal cost of reducing chromium pollution just enough to meet the ambient water quality standard is only \$1,452. Since the most strict ambient water quality for chromium is met at the relatively low marginal cost of \$1,452, any additional expenditure by industry beyond this point is fundamentally inefficient (assuming there is no designation of the river body for which the chromium levels need be lower than for 'fish and aquatic life') since it cannot markedly improve the quality of the river.

Biological Oxygen Demand

Policy Conclusions

The primary study area for application of the economic model to BOD policy issues was the San Sebastian Canal. Some policy conclusions can be drawn for the Kelani River as a whole.

The marginal costs of pollution control by industry and by sewage treatment are shown in Figure 1, as is the excess load in the canal. The excess load is the amount of the pollutant that needs to be removed before the desired ambient water standard is reached, in this case 4 mg/l. The graph, and the data underlying it, strongly suggest that it is

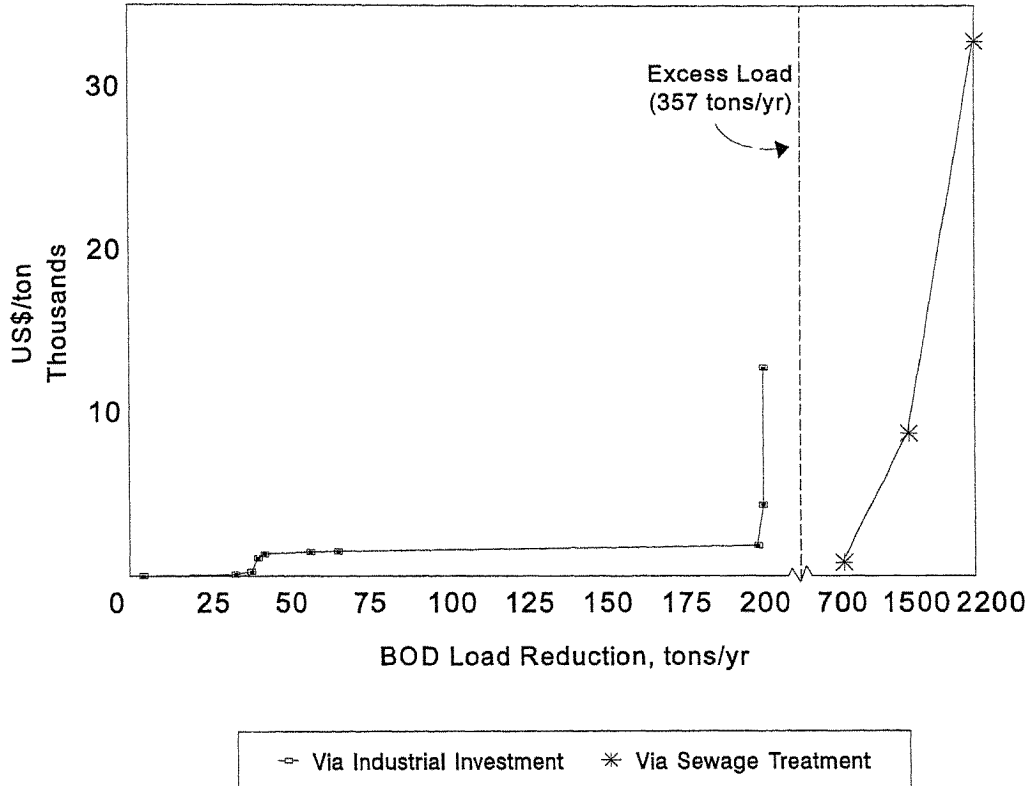


Fig. 1 Marginal Cost of Controlling Pollution in San Sebastian Canal

technologically beyond the capacity of the industries currently located on the canal to reduce their BOD loads sufficiently to bring the ambient water standard below the desired level. Even at rapidly rising marginal costs, industries can remove only 200 tons/year, yet the excess load of 357 tons/year is beyond the technical capacity of the firms.

One reason industries alone cannot resolve the San Sebastian Canal BOD problems is explained by the pie charts in Figure 2. The small pie on the left represents the total daily load of BOD in the San Sebastian Canal. As shown there, industry accounts for only 10% of this total load. Thus even if industries were to stop producing BOD altogether, it would have a minimal impact on the total BOD in the canal.

Households, on the other hand, account for more than half of the total load in the San Sebastian Canal. The marginal costs for BOD reduction via investments in sewage treatment are shown on the right-hand side of Figure 1. Clearly, investment in a sewage treatment system has the potential for reducing loads in the San Sebastian Canal by an

amount greater than the excess load and thus returning the canal's ambient water quality to an acceptable level.

It must be kept in mind that there may be an error in the calculation of land values for the sewage plant. While the land price used to calculate land values in the model is assumed to be correct, the political problems involved in clearing settlement to establish a waste treatment plant may drive up costs considerably.

Implications for the Lower Kelani River

While the DSS/IPC model was not applied for BOD to the Kelani as a whole, some implications from the San Sebastian model can be extended to the larger river. First, just as industrial effluent is relatively insignificant compared to other pollution sources in the San Sebastian Canal, so too are both industrial effluent and household effluents insignificant when compared to non-point sources in the river as a whole. The larger pie on the right-hand side of Figure 2 indicates the total BOD load in the lower

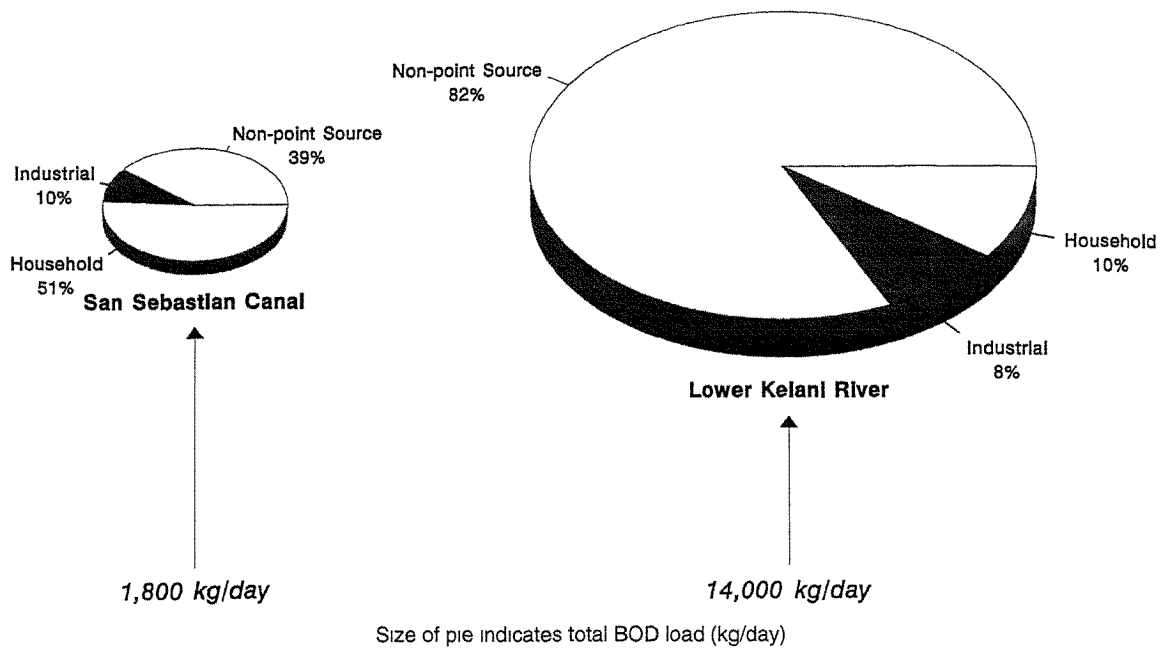


Fig. 2 Sources of BOD at Selected Points on the Kelani River

Kelani River. As shown there, non-point sources are estimated to account for 82% of the total daily load, while industrial and household sources account for only 8% and 10%, respectively. Thus, although investments in sewage control in the San Sebastian is a viable means of creating sufficient ambient water quality in that water body, they are likely to be inefficient when considered alone, as a means of bringing down BOD levels in the Kelani as a whole. Rather, some combination of non-point source

control measures and point source control measures will need to be sought if the policy decision of the government is to significantly reduce BOD in the Kelani.

A summary of the effectiveness of the four BOD policy options in reaching a common goal is shown in Table 3. Each policy is tested against whether it has the potential of reaching the ambient water quality goal stipulated at the top of the table. The information in the table demonstrates the importance of assessing

Table 3
Expected Water Pollution Policy Effectiveness

Details of Policy*	Policy has potential to achieve stated goal?	
	San Sebastian Canal	Lower Segment of Kelani River
1. Enforce industrial compliance with BOD point source effluent standards.	No	No
2. Meet ambient water quality standards via reductions by industry only	No	No
3. Meet ambient water quality standards via installation of a sewage treatment plant only	Yes	No
4. Install sewage treatment plant and initiate non-point source pollution programs.	Yes	Yes

*Goal of Policy: BOD levels in water body fall within minimum quality (4 mg/l) standards of CEA

whether a policy has the technical capacity of reaching a stated goal before embarking upon it.

As the table makes clear, resolution of BOD pollution problems in the San Sebastian Canal can only be resolved via investments in sewage treatment, perhaps in combination also with enforcement of some industrial compliance with point source standards. If the government maintains the de facto goal of reducing BOD significantly in the larger Kelani River (a goal which is called into question below), then it must begin embarking on non-point source control programs.

Technical Results Pertaining to Use of the DSS/IPC Model

A number of constraints were identified in using the DSS/IPC model. Most importantly, it was noted that the decision support system uses quite simplified water quality models for its calculations. Calculations of BOD loads also presented problems. The critical BOD load is calculated on the basis of the minimum required Dissolved Oxygen (DO) level. Target BOD level (ambient BOD standard) is not considered in calculating the critical BOD load. In fact, the system (DSS/IPC) does not calculate the maximum BOD level encountered in the river but only calculates the BOD level at the point of the river where the critical DO level (minimum DO) is encountered. Finally, the river BOD model incorporates only the upstream boundary condition and does not consider the downstream boundary condition in its calculations. This limitation inhibits the model from incorporating the background effect (due to non-point source run off) in the calculations.

Results Summary

Summary data for chromium and BOD are shown in Table 4. Results to the analysis are organized by the pollutants.

CONCLUSIONS, IMPLICATIONS, AND NEXT STEPS

Economic Modeling and Environmental Management

The current study has used the World Bank's DSS/IPC model along with the CEA/Moratuwa WASP model (see Bhuvendralingam *et al.* 1995) to show that economic and hydrological models can be effectively used to assess the cost implications of alternative water pollution policies. In spite of a number of technical constraints, the model was relatively easy to install and apply. In light of its effectiveness in assessing the costs and benefits of alternative pollution control policies, it is *strongly recommended that the further testing and application of economic models, such as DSS/IPC, be done in other watersheds*. Initial priority should be given to the Bolgoda Lake and Lunawa Lagoon water systems in the Ratmalana-Moratuwa industrial area and the Ja-ela Canal and Dandugama Oya in the Jaela-Ekala industrial area. Both are regions of industrial importance with significant actual or potential pollution impact on the local population. Other areas that might be considered for follow-up applications of the model include the Negombo Lagoon and the Kalu Ganga, although the water quality of both of these water bodies is influenced mainly by non-point sources. Since cost reduction for non-point sources with DSS/IPC cannot be estimated, however, water bodies where pollution comes predominantly from point sources should be given priority. Any follow-on applications of the model should be preceded or accompanied by parallel investment in data collection.

Potential further applications of models such as that developed here are numerous and include the following:

- Supporting the development of national, regional, and local action plans for management of industrial pollution

Table 4
Summary Pollution Load Data for BOD and Chromium

Pollutant and Water Body	Current Load (tons/yr)	Ambient Standard	Critical Load (tons/yr)	Excess Load (tons/yr)	Percent Excess Load
BOD in San Sebastian Canal	1,821	4 mg/l	1,464	357	19.6%
Chromium (Cr) in lower Kelani River	1.77	2 µg/l	1.42	0.35	19.7%

- Reorienting the development of environmental monitoring systems by identifying the pollutants and the locations that should be monitored more closely
- Giving analytical support and transparency in the design of pollution prevention strategies, such as environmental impact assessment, land use planning, and sensitive areas management
- Educating non-specialists in the potential economic impact of environmental policies on industrial activity in a given area (Sebastian and de Koning 1996, 11–12)

It may be especially effective to use the DSS/IPC model for supporting the education and engagement of non-specialists in the pollution management process. Because the model places the pollution debate in terms anyone can understand (rupees and general water quality), it can be effective in engaging broader participation in the development of environmental policy. Policy-makers can show how changing effluent levels at the household and firm add up to changes in ambient water quality and how ambient quality might be better managed. The CEA *should consider using the model, or one like it, to explain the gravity of pollution problems to other government officials or local communities*, or to justify why they are taking one approach over another.

Water Pollution and Human Health

In spite of its potential applications, the model can estimate only a narrow range of possible environmental costs and benefits.³ Egregiously missing from the model's assessment of costs and benefits is the lack of any health functions. At present in Sri Lanka, there is a virtual absence of data with which to understand the human cost of toxic water pollution. In such water bodies as the Lunawa Lagoon, where toxic pollutants are being released, *it is imperative that dose-response relationships be established via primary data collection*. It is troubling to note in Bhuvendralingam (1995) that lead levels in the Kelani River remain above proposed ambient water quality levels, even at the Ambatale water intake point.⁴ The potential impact of lead and other toxic pollutants must be estimated if models, such as the DSS/IPC, are to provide well-rounded policy-making support.

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Linking Pollution Policies to Major Pollution Sources

Bhuvendralingam *et al.* (1995) demonstrated that industrial pollution is relatively unimportant in determining the level of BOD in the Kelani River. This study has gone further to show that, at least for the highly polluted San Sebastian canal, investment in a sewage treatment system is more cost effective than industrial investments in pollution reduction equipment.⁵ The CEA must begin discriminating more carefully in its identification of priority polluters. Rather, they should recognize that *more cost effective solutions⁶ to pollution problems can often be found in efforts to control household and non-point source pollution* than in pursuit of industrial polluters.

The study also showed that even large investments in industrial and household pollution control would have a minimal effect on BOD levels in the Kelani River, where non-point source pollution accounts for the majority of the total load. If reductions in surrogate measures, such as BOD, continue to be considered as the primary goals of the CEA, then the strategy for water bodies such as the Kelani should be re-directed toward non-point source control. In the near term, it is *recommended that small-scale studies be launched to identify major non-point pollution sources*. In the case where non-point source runoff contributes significantly to the pollution load, policies leading to optimal application of agro-chemicals (such as pesticides and fertilizers) may contribute significantly toward pollution reduction.

Prioritizing Target Pollutants

At present, the CEA emphasizes the importance of reductions in *surrogate pollutant measures* — such as BOD, Chemical Oxygen Demand (COD) and suspended solids — as its strategy for reducing pollution. Since these surrogate measures are affected by both human and natural processes, however, they may not be the best priority for a pollution management strategy. This study has shown, for example, that BOD pollution levels in the Kelani River are a function primarily of non-point source processes. When the effort to control BOD is pursued with industries, the paradoxical situation has arisen in which industries introduce more toxic metals into their effluent stream because such metals may lower their BOD levels and thus their effluent concentrations.

On the basis of this study, we *argue that a shift in emphasis from surrogate pollutant measures* (which are affected by natural processes as well as human) *to toxic and refractory anthropogenic chemicals* (which result directly from human activities) *would serve the interests both of the affected populations and the CEA.* By their very definition, toxic pollutants pose a greater threat to human populations than do the biodegradable substances captured by the BOD measure. The CEA would also stand to gain from making reduction in toxic pollutants a priority. The public, after all, would have an easier time understanding the threat of toxic chemicals (the effects of which can be portrayed graphically and visually) than the effects of high BOD or COD levels (which cannot be captured in a single impact). Though the CEA should continue to monitor BOD and COD as rough checks on effluent quality, they need not tightly monitor and enforce the standards relevant to these parameters for industries discharging to large water bodies. Certainly, a shift in priorities toward monitoring of toxic chemicals would involve greater laboratory and monitoring costs, but the potential benefits to human health would very likely outweigh the costs. Furthermore, funding for laboratory and monitoring improvement under the Environmental Action 1 Program (EA1P) might be used to begin this process.

Water Bodies and Their Designated Uses

Two points are made evident from the study:

- (1) *that water pollution planning is strengthened when it focuses on integrated and discrete watersheds and*
- (2) *that the uses of the water bodies in these watersheds must be clearly designated before appropriate policies can be developed for them.*

Focusing on discrete watersheds benefits planners because it allows them to take into account the unique physical and hydrological characteristics of each watershed and the consequent applicability of models to them. The type of land use encountered in a watershed plays a major part in determining the background quality of the waterbody. While smaller water bodies are influenced primarily by point source emissions contributing either biodegradable organic matter in the case of Beira Lake or by point source emissions, which are toxic and refractory in the case of Lunawa Lagoon. Large water bodies, such as the

Kelani Ganga and Kalu Ganga, on the other hand, are dominated by watersheds that are vegetative in nature. In such watersheds, non-point source emissions generally determine the background quality of the waterbody. Hence, it would be more effective if planning occurs separately for these different types of watersheds.

Just as watersheds differ in their basic characteristics, so too do the uses of water bodies in those watersheds differ. Thus identification of appropriate policies for chromium control in the Kelani must be a function of the agreed upon use of the Kelani watershed as well as the assimilative characteristics of the waterbody itself. Chromium levels in the lower Kelani exceed the CEA's proposed ambient water quality levels for 'fish and aquatic life' but are acceptable if the river is to be used for 'drinking water with limited treatment.' *It is imperative, if ambient water quality standards are to have any relevance for planning, that the CEA and other partner institutions, perhaps under the leadership of the national Water Resources Council, begin designating uses of water bodies within select watersheds.* Methods for the engagement of the general public in these processes have been well documented at sites around the world.⁷

Concentration Versus Load Monitoring

The CEA's point source monitoring data, and indeed its point source pollution standards, are based on concentration of pollutants in the effluent stream rather than the total load of pollutants. Allowing industries' pollution levels to be measured on the basis of the concentration gives them incentive to dilute their effluent streams just enough to meet the required levels. Such dilution, being contrary to water conservation, often calls for pumping of additional groundwater at a time when, as the National Environmental Policy notes, 'ground water is being extracted without concern for the permanent lowering of the water table and the intrusion of salt water into coastal aquifers' (M/TEWA 1997, 14). Equally important for management purposes, it is the pollutant load (and not the concentration of the pollutant) that degrades the quality of the receiving water body. In light of this situation, we *recommend that the CEA switch immediately from concentration-based to load-based monitoring and standards.*

Admittedly, load data costs more to collect. Measurements are taken over a period from 5 to 30

days rather than the single visit measurements used for concentration data. Yet we would argue that the investment in improved base information is essential if the sorts of river body modeling done in Bhuvendralingam *et al.* (1995) or economic modeling done here are to be extended to other river bodies. In addition, load data at firm level is an essential prerequisite to application of economic incentive measures pertaining to effluent charges, tradeable permits, and a number other economic instruments (see discussion below).

Economic Incentives for Pollution Management

The recent National Environmental Policy makes an explicit call for the increased use of "economic instruments and incentives" for waste minimization. In particular, it calls for the use of load-based Environmental Protection License (EPL) fees. Steele and Hassan (1995) examined the potential for introduction of effluent charges. They recognized that effluent charges and trading concepts has significant potential for application but not in an institutional context in which enforcement was not taking place. Thus an essential condition to introduction of economic incentives for pollution management is *the enforcement of well thought out regulations*.

Modeling efforts of the sort attempted here can be particularly helpful in introducing economic incentives for water pollution management. The aggregate long-run marginal cost curves generated here can be used to set initial rates for load-based EPL fees. The model developed here for the Kelani sub-catchment can be used as a test basin for the introduction of these fees as well as an assessment

of the impact of fees on water quality. Were estimates of health and amenity costs at different ambient water quality levels available, they could be used to conduct a more comprehensive benefit/cost analysis of pollution policies than allowable at present.

Conclusion Summary

A summary of the study's conclusions and implications is presented in Table 5.

CONCLUSION

Conclusions to the study imply a shift in priorities and approach for the CEA. While the shift at first may appear to be a fundamental shift of priorities, implying significant upheaval and uncertainty, it is important to note that there is significant precedent for the recommendations being made in this study. There exists a significant body of literature making the case for the application of economic instruments to pollution management. Regarding the shift from load-based to concentration-based monitoring and from surrogate measures to toxics, the experiences of a number of countries in the region can be of assistance to Sri Lanka. The use of hydrological and economic models to manage pollution problems has a long history and has become increasingly accessible and low cost as technology has improved (see Bower, *et al.* in Delaware River and Tokyo bay, for example). We believe that the highest priority for CEA at the present, in light of industrial growth, is to rethink its pollution monitoring and management strategies and shift them toward the new vision elucidated here.

Table 5
Summary Matrix of Priority Issues and Recommended Actions

<i>Conclusions</i>	<i>Policy Implications/Recommended Action</i>
Designate use of water bodies	Water pollution control strategies for an integrated watershed management approach Use of water bodies within the watershed clearly designated before development of appropriate policies for them
Prioritize target pollutants	A shift in emphasis from surrogate pollutant measures to toxic and refractory anthropogenic chemicals
Enhance water quality monitoring and standards	A shift in emphasis from concentration-based to load-based monitoring and standards

NOTES

- 1 WASP is a dynamic compartment modeling program for aquatic systems. The time varying processes of advection, dispersion, point and diffuse mass loadings, and boundary exchanges are represented in the basic program. The basic principle behind the formulation of WASP is the conservation of mass and momentum. The water volume and water quality constituent masses being studied are tracked and accounted for over time and space using a series mass and momentum balance equations. Further information on the WASP model can be obtained in Ambrose, Wool, and Martin (1993).
- 2 The DSS/IPC contains a default database for emission factors, water, and solid waste associated with industrial process, the technologies applied in industrial processes or the backup technologies used to control pollution, and generalized pollution abatement cost functions for those technologies. The system also has the flexibility of allowing users to change default database parameters to suit local study conditions and monitored data. A full explanation of the processes used in the DSS/IPC can be found in Sebastian and de Koning (1996).
- 3 Avoided health cost in cleaning up the San Sebastian canal by installing a sewage collection and disposal system is estimated to be Rs 1.6 Mn per annum. In addition, amenity benefits, such as fisheries, recreation etc., should also be taken into consideration.
- 4 It is recommended that an intensive study be conducted in conjunction with the CEA and National Water Supply and Drainage Board (NWSDB) on non-point source run off bringing in contaminants (especially lead) near Ambantale water intake. The study should concentrate on a period immediately after a storm when the initial flush of storm water brings the accumulated contaminants to the water body.
- 5 The cost estimates for a sewage treatment plant included above are underestimated in that they do *not* include the human and financial costs of resettlement away from the waterbody and the proposed plant.
- 6 Installation of sewage collection and disposal system, properly designed and constructed storm water drainage system, including perhaps artificial wetlands, etc.
- 7 See, for example, Bower and Takao (1993) and Spofford *et al.* (1976).

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Exploring Common Factors of Intercorrelated Environmental Risks in Taiwan Based on Experts' Perceptions

Cherng G. Ding and Hui-Chen Chien

ABSTRACT

Analysis of risk perception data can provide an alternative and perspective for environmental decision-makers. Identifying intercorrelated environmental risks based on experts' perceptions and then discovering their common underlying factors is informative, but rarely seen in the literature. This paper attempts to explore the common factors of correlated environmental risks in Taiwan based on health-risk perceptions of environmental experts. The impacts of 21 environmental problems were evaluated through questionnaires based on an overall consideration of six health-risk evaluative criteria (concentration in the environment, carcinogenic effects, noncarcinogenic effects, probability of exposure, size of exposed population, and health-care costs). The common factors have been identified by using exploratory factor analysis with literature support. They are unsound environmental infrastructure and management, airborne issues, human-induced damage of natural ecosystem, greenhouse gases, lack of risk-avoidance sense, and lack of water resources management. In risk management, attention should be directed to these underlying dimensions so that environmental problems could be handled more effectively and economically. The approach presented in this paper and the findings of the study provide some guidelines for risk management.

Keywords: environmental problems, factor analysis, risk assessment, risk management, risk perception

INTRODUCTION

Owing to population explosion, rapid economic growth, and severe depletion of natural resources, we are confronted with fast growing environmental problems. In addition, as mentioned by Somers (1995), the forces of science and technology produce, at an ever-increasing pace, new processes and products many of which can adversely affect human health and the environment. It is imperative that our society should be able to assess in an objective fashion the benefits and risks (hazards) of these processes and products so that societal decisions on public health and environmental quality can be made equi-

tably and openly. There are many methods for risk assessment (e.g., Ding *et al.* 1996; Russell and Gruber 1987; Thompson *et al.* 1994; USEPA 1987a, 1987b, 1993). Knowledge of risks may be used as the basis for developing appropriate strategies to reduce risks (USEPA 1990). However, environmental problems are so complex that there are still many uncertainties that need to be solved (Brand and Small 1995; Johnson and Slovic 1995). In contrast to risk assessment based on objective physical environmental data, such assessment may be based on subjective perception data (Cole and Withey 1981; Slovic 1987). Analysis of risk perception data can provide an alternative and perspective for environmental de-

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cision-makers (Limoges *et al.* 1995; Slovic 1993) who must allocate the limited resources for environmental protection. Identifying intercorrelated environmental risks based on experts' perceptions and then discovering their common underlying factors is informative, but rarely seen in the literature. Some environmental risks may result from the problems regarding population structure, life pattern and resources management rather than lack of environmental protection regulations and requirements. Factor analysis (e.g., Johnson and Wichern 1992, chap. 9) of risk perception data is useful to help achieve this purpose.

The recent research on applying factor analysis to analyse risk perception focuses on constructing risk perception maps showing the relative positions of risk items in the factor space (e.g., Fife-Schaw and Rowe 1996; Jianguang 1994; Kraus and Slovic 1988; McDaniels *et al.* 1995; Ratts and Shepherd 1996; Slovic 1987; Slovic *et al.* 1987; Sparks and Shepherd 1994). Each factor is composed of a combination of risk characteristics. These works which characterize perception of hazards emphasize dimension-reduction of risk characteristics rather than discussions of underlying factors that influence risks. Moreover, these works have focused on public perception rather than the perception of environmental experts. Relatively little effort has been devoted to the perceived health risks based on a broad viewpoint. To address the above-mentioned deficiency, an empirical study has been conducted to explore the latent factors that may account for the health risk perception of environmental experts. Instead of grouping risk characteristics by using factor analysis, as is usually seen in the literature, we used the same technique to group risk items based on an overall consideration of a set of health-risk evaluative criteria. The process is to first form groups of highly correlated environmental risks according to experts' perception, and then to discover latent factors underlying the environmental risks grouped. From a management point of view, dealing with the underlying factors is effective as well as economic. The key steps in the approach proposed in the empirical study include:

1. Identifying the environmental problems to be studied;
2. Determining appropriate health-risk evaluative criteria;
3. Formulating a questionnaire used to collect the risk perception data;

4. Selecting a sample of environmental experts for the survey; and
5. Using factor analysis to group highly correlated environmental risks, and then finding common factors of the environmental risks grouped.

MATERIALS AND METHODS

Environmental Problems and Evaluative Criteria

Environmental problem identification was the first step in this study. Twenty-one environmental problems in Taiwan (Table 1), having direct and indirect impacts on human health, were determined based on literature review (Ding *et al.* 1996; ROCDH 1996; ROCEPA 1995; USEPA 1987b) as well as expert consultation. The criteria used to evaluate the health

Table 1
The Environmental Problems Under Consideration

- | |
|--|
| 1. Worker exposure to chemicals |
| 2. Consumer exposure to chemicals |
| 3. Indoor air pollution |
| 4. Criteria air pollutants ^a |
| 5. Hazardous air pollutants ^b |
| 6. Noise pollution |
| 7. Stratospheric ozone depletion |
| 8. Global warming |
| 9. Drinking water pollution |
| 10. Residual pesticides in food |
| 11. Accidental chemical release |
| 12. Habitat alteration and destruction |
| 13. Species depletion and overall loss of biological diversity |
| 14. Automotive vehicle exhaust ^c |
| 15. Industrial waste water |
| 16. Municipal waste water |
| 17. Hazardous waste |
| 18. Municipal waste |
| 19. Soil contamination |
| 20. Ground water pollution |
| 21. Soil erosion |

^a Criteria air pollutants include only the 6 air pollutants (TSP & PM10, SO₂, NO₂, CO, O₃, and Pb). Their ambient standards are under the control of Air Pollution Control Act of ROCEPA.

^b Hazardous air pollutants include the 30 air pollutants (not including criteria air pollutants) that are given priority of control by ROCEPA.

^c Automotive vehicle exhaust is isolated because of high densities of automobiles and motorcycles in Taiwan and their important effects on air pollution.

risks induced by environmental problems were determined based on the literature (Naugel and Pierison 1991; USEPA 1986, 1991, 1992). They include concentration in the environment, carcinogenic effects, noncarcinogenic effects (irreversibility effects of target organs), probability of exposure, size of exposed population, and health-care costs. Probability of exposure refers to the chance of being exposed to hazards. Size of exposed population represents the amount of population exposed to hazards. The subjects in a subsequent survey were asked to evaluate environmental risks based on an overall consideration of these criteria.

The Questionnaire

The risk perception data were collected through a questionnaire. After successful pretests were completed, the questionnaires were faxed to 100 environmental experts with a cover letter stating the purpose of the study. Follow-up phone calls were used to increase the response rate. The environmental experts are university professors and officials of environmental protection governments in Taiwan specializing in environmental engineering and public health. The subjects were instructed to evaluate impacts of all environmental problems on human health using a 7-point rating scale. Evaluation is based on an overall consideration of the above-mentioned health-risk evaluative criteria. The scale reflects the degree of impact with 7 indicating maximum severity and 1 minimum severity. Finally, 47 usable questionnaires were obtained, and were used for the analysis.

Analysis

Principal component factor analysis with correlation matrix input is used to group highly correlated perceived environmental risks. The number of factors extracted is determined by the 'root greater than one' criterion. The factor loadings are rotated by using the varimax criterion to achieve a simple structure. Common factors of the environmental risks grouped are then investigated and labeled.

RESULTS AND DISCUSSIONS

The correlation matrix (Table 2) for the environmental risks was first examined. It appears that many

pairs of environmental risks have substantial degree of correlation, indicating the usefulness of factor analysis. The results of factor analysis including rotated estimated loadings and cumulative proportions of total variance explained by the factors extracted are displayed in Table 3. Since factor loadings are correlation coefficients between environmental risks and common factors, and each environmental risk has a high loading on one factor and low loadings on the other factors, highly correlated environmental risks are easy to identify. The maximum factor loading for each environmental risk was highlighted in the table to facilitate presentation of grouping of highly correlated environmental risks. Each factor is then labeled, with literature support, according to common underlying causal elements of its corresponding intercorrelated environmental risks. In risk management, attention should be directed to these basic dimensions so that environmental problems could be handled more effectively and economically.

The common factors obtained are **unsound environmental infrastructure and management** (Factor 1), **airborne issues** (Factor 2), **human-induced damage of natural ecosystem** (Factor 3), **greenhouse gases** (Factor 4), **lack of risk-avoidance sense** (Factor 5), and **lack of water resources management** (Factor 6). These six factors account for 72.37% of the variance, and yield a satisfactory fit to the correlation matrix since the elements of the corresponding residual matrix (Table 4) are small.

Worker exposure to chemical, industrial waste water, municipal waste water, hazardous waste, municipal waste, and soil contamination, six highly correlated environmental risks, may result from **unsound environmental infrastructure and management** (Factor 1). Environmental infrastructure includes a wide variety of public services such as water and waste water treatment, air pollution control, and solid and hazardous waste treatment and disposal (Bates and Shelton 1989). A failure in the environmental infrastructure is potentially harmful to a wide segment of society. Four key interrelated components are required to yield an effective strategy for solving the infrastructure problems: prioritization of future requirements, funding, management (including program planning, financial management, needs survey, condition assessments, decision making, and the ability to present convincing arguments for maintenance and reconstruction of existing infrastructure) and education (Bates and Shelton 1989). In particular, areas of concern in pre-

Table 2
Correlation Matrix for the 21 Environmental Risks

Worker exposure to chemicals	1.00																					
Consumer exposure to chemicals	0.50	1.00																				
Indoor air pollution	0.19	0.37	1.00																			
Criteria air pollutants	0.23	0.27	0.40	1.00																		
Hazardous air pollutants	0.39	0.59	0.48	0.49	1.00																	
Noise pollution	0.13	0.20	0.27	0.47	0.35	1.00																
Stratospheric ozone depletion	0.09	0.37	0.26	0.32	0.32	0.30	1.00															
Global warming	0.04	0.39	0.30	0.33	0.30	0.32	0.74	1.00														
Drinking water pollution	0.17	0.18	0.24	0.38	0.28	0.03	-0.04	0.07	1.00													
Residual pesticides in food	0.26	0.53	0.29	0.27	0.27	0.17	0.01	0.27	0.24	1.00												
Accidental chemical release	-0.03	0.33	0.22	0.02	0.10	-0.00	-0.01	0.21	0.08	0.40	1.00											
Habitat alteration and destruction	-0.02	0.27	0.28	0.33	0.19	0.33	0.03	0.20	0.16	0.43	0.30	1.00										
Species depletion and overall loss of biological diversity	-0.14	0.25	0.19	0.27	0.05	0.24	0.13	0.25	0.16	0.40	0.31	0.87	1.00									
Automotive vehicle exhaust	0.31	0.24	0.27	0.60	0.35	0.40	0.19	0.24	0.15	0.31	-0.10	0.39	0.28	1.00								
Industrial waste water	0.38	0.18	0.20	0.37	0.27	0.33	0.05	0.05	0.31	0.29	-0.11	0.19	0.08	0.26	1.00							
Municipal waste water	0.22	0.22	-0.10	0.31	0.29	0.40	-0.21	-0.12	0.31	0.19	0.07	0.35	0.22	0.21	0.46	1.00						
Hazardous waste	0.56	0.40	0.14	0.40	0.38	0.43	0.16	0.22	0.41	0.27	0.06	0.24	0.13	0.26	0.46	0.49	1.00					
Municipal waste	0.45	0.35	0.10	0.31	0.30	0.20	0.02	0.06	0.31	0.27	-0.18	0.18	0.04	0.25	0.41	0.55	0.62	1.00				
Soil contamination	0.47	0.45	0.11	0.31	0.26	0.19	0.09	0.16	0.44	0.43	0.02	0.17	0.11	0.20	0.44	0.42	0.60	0.56	1.00			
Ground water pollution	0.34	0.43	0.36	0.50	0.38	0.28	0.32	0.35	0.49	0.27	0.19	0.37	0.24	0.28	0.38	0.38	0.56	0.45	0.71	1.00		
Soil erosion	0.22	0.33	0.34	0.22	0.17	0.17	0.23	0.30	0.38	0.19	0.12	0.46	0.39	0.23	0.35	0.15	0.39	0.33	0.48	0.68	1.00	

Table 3
Principal Component Factor Analysis for 21 Environmental Risks

Environmental risk	Varimax rotated factor loadings ^a					
	Factor 1 ^b	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Worker exposure to chemicals	0.59	0.22	- 0.38	0.04	0.34	0.06
Consumer exposure to chemicals	0.36	0.18	- 0.02	0.35	0.72	0.07
Indoor air pollution	- 0.18	0.57	- 0.03	0.16	0.37	0.46
Criteria air pollutants	0.23	0.75	0.15	0.17	0.00	0.24
Hazardous air pollutants	0.25	0.62	- 0.18	0.19	0.40	0.10
Noise pollution	0.34	0.56	0.31	0.30	- 0.09	- 0.22
Stratospheric ozone depletion	- 0.01	0.21	- 0.04	0.91	0.01	0.04
Global warming	0.01	0.17	0.15	0.84	0.19	0.08
Drinking water pollution	0.27	0.19	0.03	- 0.17	0.07	0.72
Residual pesticides in food	0.24	0.19	0.28	- 0.04	0.70	0.07
Accidental chemical release	- 0.15	- 0.15	0.31	0.03	0.72	0.08
Habitat alteration and destruction	0.12	0.25	0.85	0.02	0.23	0.15
Species depletion and overall loss of biological diversity	- 0.01	0.12	0.88	0.10	0.21	0.12
Automotive vehicle exhaust	0.19	0.72	0.21	0.08	0.01	0.01
Industrial waste water	0.57	0.34	0.05	- 0.08	- 0.06	0.23
Municipal waste water	0.72	0.19	0.32	- 0.28	0.01	- 0.07
Hazardous waste	0.78	0.18	0.05	0.17	0.12	0.17
Municipal waste	0.79	0.13	- 0.02	- 0.01	0.03	0.14
Soil contamination	0.73	- 0.03	0.02	0.12	0.19	0.41
Ground water pollution	0.51	0.14	0.17	0.32	0.13	0.61
Soil erosion	0.30	- 0.01	0.33	0.30	0.05	0.67
Cumulative proportion of total variance explained	18.61%	31.18%	42.06%	52.54%	62.81%	72.37%

^a Large loadings were highlighted to indicate the groups of highly correlated environmental risks.

^b Factor 1: unsound environmental infrastructure and management
 Factor 2: airborne issues
 Factor 3: human-induced damage of natural ecosystem
 Factor 4: greenhouse gases
 Factor 5: lack of risk-avoidance sense
 Factor 6: lack of water resources management

venting or mitigating worker exposure to chemicals include construction in fire and spill prevention control as well as temperature and ventilation control, personal protection equipments, proper storage, adequate exits and access, and safe electrical system (Howell 1996). Thoughtful and efficient design in construction, use of recycled materials, life-cycle considerations, and sustainable development should also be incorporated into infrastructure management (Houthoofd 1995).

Indoor air pollution, criteria air pollutants, haz-

ardous air pollutants, noise pollution, and automotive vehicle exhaust are **airborne issues** (Factor 2). They are currently key challenges in environmental protection problems in Taiwan (Fang and Chen 1996). A direct way to deal with these problems is to regulate air emission sources. The major efforts could be made for clean fuel, control of stationary air pollution sources, control of mobile air pollution sources, and control of pollution from construction sites (Fang and Chen 1996). The disposal of sewage sludge, municipal refuse, and hazardous waste by

Table 4
Residual Correlation Matrix Corresponding to the Six-factor Solution

	Worker exposure to chemicals	Consumer exposure to chemicals	Indoor air pollution	Criteria air pollutants	Hazardous air pollutants	Noise pollution	Stratospheric ozone depletion	Global warming	Drinking water pollution	Residual pesticides in food	Accidental chemical release	Habitat alteration and destruction	Species depletion and overall loss of biological diversity	Automotive vehicle exhaust	Industrial waste water	Municipal waste water	Hazardous waste	Municipal waste	Soil contamination	Ground water pollution	Soil erosion	
Worker exposure to chemicals	0																					
Consumer exposure to chemicals	-0.03	0																				
Indoor air pollution	-0.00	-0.01	0																			
Criteria air pollutants	-0.04	-0.02	-0.11	0																		
Hazardous air pollutants	-0.11	0.03	-0.06	-0.06	0																	
Noise pollution	-0.05	-0.03	0.11	-0.07	-0.01	0																
Stratospheric ozone depletion	-0.01	-0.01	-0.03	0.01	-0.01	-0.06	0															
Global warming	-0.05	-0.07	-0.04	0.02	-0.03	-0.04	-0.06	0														
Drinking water pollution	-0.08	0.01	-0.14	0.03	0.04	0.04	0.06	0.10	0													
Residual pesticides in food	-0.06	-0.07	-0.04	0.01	-0.13	-0.02	0.01	0.09	0.03	0												
Accidental chemical release	-0.04	-0.11	-0.02	0.10	-0.01	0.11	0.00	0.02	0.03	-0.13	0											
Habitat alteration and destruction	0.09	0.02	0.03	-0.06	0.05	-0.07	-0.00	-0.04	-0.06	-0.06	-0.09	0										
Species depletion and overall loss of biological diversity	0.08	0.05	-0.00	-0.00	0.01	-0.08	0.05	-0.04	0.02	-0.02	-0.11	0.03	0									
Automotive vehicle exhaust	0.11	0.01	-0.12	-0.04	-0.13	-0.15	-0.02	0.01	-0.04	0.07	-0.04	0.00	-0.01	0								
Industrial waste water	0.00	-0.03	0.04	-0.06	-0.06	0.00	0.05	0.04	-0.08	0.10	0.03	-0.02	-0.02	-0.10	0							
Municipal waste water	-0.11	0.03	0.01	0.02	0.11	0.02	0.03	0.04	0.07	-0.13	0.11	-0.05	-0.05	-0.11	-0.03	0						
Hazardous waste	0.02	-0.07	0.03	0.01	-0.01	0.05	-0.03	0.00	0.06	-0.06	0.09	0.00	0.01	-0.04	-0.06	-0.06	0					
Municipal waste	-0.07	0.01	0.09	-0.00	-0.01	-0.10	0.01	0.03	-0.03	0.03	-0.08	0.04	0.03	0.01	-0.11	-0.03	-0.04	0				
Soil contamination	-0.05	-0.02	-0.02	0.04	-0.04	0.03	-0.02	-0.01	-0.04	0.09	-0.05	-0.03	-0.00	0.06	-0.04	-0.05	-0.08	-0.08	0			
Ground water pollution	-0.02	-0.03	-0.01	0.05	0.02	0.03	-0.02	-0.05	-0.08	-0.05	0.08	0.00	-0.06	0.01	-0.07	0.06	-0.04	-0.05	0.03	0		
Soil erosion	0.10	0.05	0.04	-0.11	0.02	0.03	-0.06	-0.07	-0.15	-0.04	-0.04	0.03	-0.02	0.08	0.04	-0.05	-0.03	0.00	-0.07	-0.05	0	

incineration, land-filling, or land-spreading can cause significant and potentially harmful air pollution problems. The development of new disposal alternatives or the upgrading of existing facilities can control emissions of heavy metals, hydrocarbons, and other airborne pollutants to the atmosphere (Bates and Shelton 1989).

Habitat alteration and destruction, species depletion, and overall loss of biological diversity are ecological problems. Habitat alteration includes any direct physical alteration to habitats, such as draining of wetlands, conversion of grasslands or forests to agriculture, etc. Species depletion means species extirpation and extinction (Harwell *et al.* 1992). These environmental problems, having potential impacts on human health (McDaniels *et al.* 1995), may result from **human-induced damage of natural ecosystem** (Factor 3). To deal with this kind of problems, we recommend adoption of the 'sustainable development' environmental goal, which implies that economic development strategies should strive to simultaneously maximize both human welfare and environmental quality (Barnthouse, 1996).

Stratospheric ozone depletion and global warming are caused by **greenhouse gases** (CFCs, CO₂, CH₄, etc.) (Factor 4). Human activities have been substantially increasing the atmospheric concentrations of greenhouse gases. These increases enhance the natural greenhouse effect, and this will result on average in an additional warming of the earth's surface and atmosphere and may adversely affect natural ecosystem and humankind (UNEP/WMO 1992). It has been found that the CFC production could cause large rates of ozone destruction. Nothing in the atmosphere was destroying CFCs after their release. The global warming effect is the process by which heat radiating from the earth's surface is trapped by atmospheric gases such as carbon dioxide (CO₂) and methane (CH₄). The trapped heat raises global temperatures, which may significantly alter climate patterns (Kowalok 1993). The greenhouse effect can affect the introduction and dissemination of many serious infectious diseases (Patz *et al.* 1996). It becomes necessary to comply with United Nations Framework Convention on Climate Change (UNEP/WMO 1992) and the Montreal protocol (Rowlands 1993) to control emissions of greenhouse gases.

Consumer exposure to chemicals, residual pesticides in food, and accidental chemical release may affect a large amount of population. A common interpretation for their occurrence is **lack of**

risk-avoidance sense (Factor 5). Consumers daily use consumer products for their personal convenience, and they may be exposed to chemicals emerging from consumer products (van Veen 1996). Dietary exposure to chemicals in food depends both on food consumption patterns and the residue levels of a particular chemical (e.g., pesticide, food additive) on (or in) food (Driver *et al.* 1996). Major chemical accidents are associated with four key areas: technology, management systems, human factors and external events (Arendt *et al.* 1993). To help our society avoid or reduce risks, it is worth substantial effort to inform the public accurately and truthfully about risks, to communicate the essential part of protecting the public health, and to enhance risk evaluation (Arendt *et al.* 1993; Bryan, Jr. 1990; Levine 1992; Somers 1995).

Drinking water pollution, ground water pollution, and soil erosion are the outcomes of **lack of water resources management** (Factor 6). Land degradation induced by deforestation, wetland transformation, overgrazing, and careless cultivation practices has enormous direct impact on pollution of water bodies through soil erosion and transport of dissolved solids. Indirectly, the quality of water bodies is also affected by losses of soil productivity and changes of vegetation cover (Tonderski 1996). Chemical contamination of water bodies could be generated by extensive application of artificial and natural fertilizers, use of pesticides, and salinization and alkalization related to irrigating activities. Microbiological pollution usually affects surface and groundwater bodies close to animal farms and grazing areas (Tonderski 1996). Industrial/municipal sources of groundwater contamination include mining activities; tank, pipe, and sewer leakage; solid waste and hazardous waste landfills; and stormwater runoff (Brocard and Hagger 1990). We recommend conducting integrated management of water resources, which is ecologically sound, to make a significant reduction in the rate of soil erosion and ensure a safe water supply and high drinking water quality. The main themes include the applications of pollution prevention approaches to all pollution-generating activities, treatment of surface water, treatment and reuse of wastewater and stormwater, and groundwater recharge (Heinzmann and Sarfert 1995; Houthoofd 1995). In particular, an integrated, multidisciplinary and multifaceted approach for soil conservation, as well as the will to fulfill, is important (Lake and Shady 1993). Moreover, drinking

water regulations for groundwater can drive the industry to account for sources of groundwater contamination, learn the techniques used to access and monitor groundwater quality, and determine how to tailor treatments to groundwater cleanup projects (Brocard and Hagger 1990). Urgent actions of local, national, and international communities on educational, scientific, and political levels are needed to protect and preserve water resources (Tonderski 1996).

Analyzing risk perception of environmental experts, we find that the 21 environmental problems of concern may be classified into six groups. For any group of intercorrelated problems, their health risks could be simultaneously reduced by dealing with their common underlying factor.

CONCLUSION

In this paper, we have proposed an approach to explore the underlying factors of environmental risks based on perception of environmental experts. For illustration, we conducted an empirical study with respect to 21 environmental problems in Taiwan. Risk perception data based on an overall consideration of six health-risk evaluative criteria (Concentration in environment, carcinogenic effects, noncarcinogenic effects, probability of exposure, size of exposed population, and health-care costs) were

collected from environmental experts. The results show that the environmental risks may be classified into six groups. Their common factors are, respectively, unsound environmental infrastructure and management, airborne issues, human-induced damage of natural ecosystem, greenhouse gases, lack of risk-avoidance sense, and lack of water resources management. To facilitate risk management, we could direct attention to these factors. Although the study does not provide precise solutions for dealing with environmental risks, it does provide directions about how to effectively and economically conduct risk management. On the other hand, while the empirical findings are apt to fall into subjective interpretations, they do at least offer some starting points for further discussions. The approach presented in this paper and the findings of the study provide some guidelines for risk management, and may serve as a basis for more in-depth work in environmental management.

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Site Selection for Post-Facto Water Quality Protection Works: Targeting the 'Dirtiest Dozen'

Ian A Allan and James A Peterson

ABSTRACT

The legacy of settlement that pre-dates implementation of land use planning schemes and stream water-quality protection rules in rural Australia includes inappropriately sited septic tanks. For water harvesting corporations relying on runoff from private land (as opposed to closed catchments) this can be a problem. Spatial modelling using readily-available spatial data bases is shown to offer information relevant to decision makers needing to know if post-facto mitigation measures offer an effective approach to the problem of protecting water quality. In particular it indicates the scope to implement measures that are an alternative to the installation of (expensive) trunk sewerage and treatment, and/or water purification plants.

Keywords: GIS applications, water quality protection, planning scheme administration, local government, catchment management, scenario modelling, targeting, spatial modelling

INTRODUCTION

The evolution and diffusion of infrastructure for city and town water supplies in Australia reflects environmental constraints such as climatic seasonality (as reflected in the regime of surface streams; e.g., Ceplecha 1971), and the changing nature of industrial and public health needs. Where possible, closed catchments have been set aside (e.g., Dingle and Rasmussen, 1991; Griffith 1992) but this has not been possible to any significant extent in areas that were destined for settlement by farmers, horticulturalists and graziers. Here, water corporations must collect water that has come to streams from private land. Small wonder that water authorities have an interest in being part of the land use planning process.

The use of private land in Australia is now governed by local government planning schemes. These can be amended to allow closer settlement either

land parcel by land parcel, or sub-division by sub-division. Water corporations have an interest in monitoring and predicting land use changes so that catchment management expenses can be planned. Outside closed catchments they are not the prime land planning authority and so they must exert influence indirectly. In such cases, five approaches to water quality maintenance emerge:

1. achieving and/or retaining status as a planning scheme referral authority;
2. exploring and using opportunities to influence decision-making during appraisal of planning policy and practice in general and of planning scheme amendment proposals in particular;
3. directly challenging (eg through the Administrative Appeals Tribunal (AAT) or by negotiation) planning decisions that would result in land use changes detrimental to water quality maintenance;

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4. building (expensive) trunk sewerage networks and sewerage treatment/constructed wetlands works and/or water purification plants;
5. mitigating the detrimental effects of inappropriate land uses that are in place.

Implementing the last of these options is attractive in that it does not involve challenging the power of other land management agencies, nor the building and maintenance of large-scale infrastructure. Because many planning permits pre-date the implementation of planning schemes and related measures that now support water quality maintenance policies, there is some scope for improving water quality by adopting the mitigation approach. It is contingent upon identifying an effective mitigation site-selection process so that the best value for expenditure may be gained.

Site selection processes vary with the nature of the mitigation works. In this study we explore the utility of spatial modelling techniques for identifying the septic tank installations that are most at variance with the water quality protection rules. The data handling necessary was carried out using a Geographical Information System (GIS) in a study of the type known among GIS scientists as a 'search

for the dirty dozen' (e.g., Huxhold 1991, p. 99) on the assumption that often mitigation is achieved incrementally; say, a dozen at a time. It is a popular approach because the outcome identifies a few sites among very many, all of which are easily 'groundtruthed' as a routine step in the application of results. Thus any errors that accumulate grossly enough to cause misidentification of sites are uncovered easily.

THE STUDY AREA

In the Lal Lal water catchment, water quality maintenance problems mentioned above began to emerge during the 1970s. The catchment is within commuting distance of Ballarat, Melbourne and Geelong (see Figure 1). Closer settlement in such areas is typically in the form of hobby farms, and so it is septic tank rather than trunk sewerage installations that increase in number. Water quality protection measures have been part of the local planning scheme since 1988 (Shire of Buninyong 1988). Pressure to add septic tank installations to the catchment comes from:

1. farming families wanting to add extra houses to their farms,



Fig. 1 The Lal Lal Catchment is within commuting distance from the three major employment centres of Melbourne, Ballarat and Geelong. It was declared in 1973 (Victorian Government 1973) and over 220,000 people in Geelong and Ballarat rely on water harvested from it (West Moorabool Water Board 1986).

2. those planning sub-division, and
3. those perceiving a 'right' to build for owners of small land parcels that date from township surveys (e.g., Bate 1978) made under the impetus of the 1850s-60s gold rush, but now hidden within the fence-lines of farms made up of many titles.

Pressure from the first group has been steady since water quality rules were implemented. Local government approval of applications for extra installations has been consistently opposed by the water harvester (originally the West Moorabool Water Board (WMWB) now the Central Highlands Water (CHW) corporation). CHW, like the WMWB was before it, is a Referral Authority (Victorian Government 1987) which means that it must be notified of all development permit applications within the catchment (e.g., Morris 1987 [21,036]). If there is disagreement between the Shire and the referral authority, negotiation or appeal must take place.

The community has become aware that land-parcel based water quality protection provisions in the planning scheme do not satisfy the CHW's whole-of-catchment management strategies because there have been many Administrative Appeal Tribunal (AAT) hearings and hard fought negotiations (e.g., Allan and Peterson 1993) since 1987. Despite land use conflicts between LGA and water authority, there can be no doubt that, in general terms, both the LGA (now the Shire of Moorabool) and CHW can claim to be supporting official water quality protection policies.

Sub-division without trunk sewerage/with septic tank waste water disposal, is permitted in Victoria, if, as a result, no more than 500 people are to live in the township so formed or so added to (Victorian Government 1988) Thus, closely settled communities of less than 500 persons are, ostensibly, saved the expense of installing trunk sewerage. However, inappropriate septic tank siting can be a common feature of whole sub-division projects if land resources are not appraised with waste water disposal capability in mind during the planning stages. For instance, at Westland estate, near Ballarat (but outside the Lal Lal catchment), a subdivision was established (against the advice of the water authority relevant at the time) that left the local population short of the 500 persons threshold. However, the terrain chosen was such that the septic tanks needed for waste water disposal were installed in unsuitable

sites. Water quality and amenity were so affected that trunk sewerage had to be installed in 1997 by CHW at a cost of ~A\$3million (Ford R, March 1998, CHW Chief Engineer, Personal communication).

The potential for such problems to develop has been recognised for some decades. The Victorian Government has supported a number of land capability studies designed to document information upon which planners and LGA Councillors could call for decision support when amending planning schemes. The studies were carried out by officers of the (now defunct) Victorian Soil Conservation Authority. The Lal Lal catchment features in one of them (Jeffrey 1980; Jeffrey and Costello 1979; Costello and King 1979). Because what amounts to land capability had to be referred to during appraisal of applications for amendments of the Buninyong Shire Planning Scheme (now superceded during planning scheme reformulation following LGA amalgamation) Jeffrey's (1980), land system/land capability maps have been referred to often (e.g., Allan and Peterson 1993). They have also been reproduced in a spatial data base (Alan 1996) so that scenario mapping can be carried out for CHW catchment planning experiments in aid of adding to the water quality protection offered by the LGA planning scheme.

PARCEL-BASED WATER QUALITY PROTECTION

The present planning scheme imposes three simple water quality protection rules (Shire of Buninyong 1988), all of which are mappable.

These rules are:

1. A development must be more than 100 m from a watercourse.
In practice, this is defined by the streams on the 1:25 000 Victorian Survey and Mapping topographic map series.
2. A development must be on a suitable soil for disposing of septic tank effluent by soil absorption.
In practice, this is taken as being defined by Jeffrey's Soil Absorption Land Capability Map (Map 4, 1980) which comes with the recommendation that those soils imposing high to very high levels of septic tank maintenance on users be excluded from closer unsewered settlement plans.
3. One acre (0.4 ha) must be present down-slope

between the septic tank and the land parcel boundary.

This attribute cannot be mapped directly unless (as in this study) septic tanks/dwelling locations are geocoded, but surrogate locations can be generated using parcel centroids.

Clearly GIS offers scope to map, on a catchment-wide basis, the unsewered houses/land parcels that could be said to break the rules. Because development permits cannot be revoked retrospectively, some interest attaches to the results of analysis of

the 'rule-breaking population' so that the 'worst offenders' can be identified in ways that point to the best approach to mitigation.

MAPPING A 'DIRTY DOZEN'

The experiment reported here was conducted with digital mapping referring to a 56 km² north-west portion of the 228 km² catchment (calculated using digital mapping of the area). The input maps required for the mapping are described in Table 1.

Table 1
The data sets used in the study

<i>Data Set</i>	<i>Scale</i>	<i>Form</i>	<i>Layer Status</i>	<i>Comments</i>
Contours	1:25,000	Vector	Primary	Survey and Mapping Victoria. Used to create a digital elevation model (DEM) for use in orthophoto creation, and to assist in site analysis.
Watercourse and In Stream Dams	1:25,000	Grid & Vector	Primary	Survey and Mapping Victoria.
Dynamic Distance from Water Features	1:25,000	Grid	Derived	Derived from the Watercourse and In Stream Dams map, and created within the IDRISI GIS (Clark Labs for Cartographic Technology and Geographic Analysis, V.1), this was used to position the distance of a development from a water feature.
100m Stream Buffer	1:25,000	Grid	Derived	Created within the IDRISI GIS (Clark Labs for Cartographic Technology and Geographic Analysis, V.1), this was derived from the Dynamic Distance from Water Features map.
Orthophoto Mosaic	1:15,000	Grid	Primary	Fourteen photos (Qasco, October, 1993) were corrected for photogrammetric distortion, and joined to be a single photo using Orthophotogis (Salamanca Software) under Arc Info (Environmental Systems Research Institute, V.7).
Existing Development	1:15,000	Grid & Vector	Primary	One development per title was on-screen digitised within ArcView (Environmental Systems Research Institute, V.3) from the 1993 orthophoto mosaic.
Land Systems	1:15,000	Grid	Primary	Reinterpreted, scanned, vectorised using Provec vectorising software & photogrammetrically corrected using Photogis (Salamanca Software) under Arc Info (Environmental Systems Research Institute, V.7).
Effluent Disposal by Soil Absorption	1:15,000	Grid	Derived	Derived reclassifying the Land Systems map to represent the system attributes important in the disposal of septic tank effluent by soil absorption.
Titles	1:10,000	Vector	Primary	Survey and Mapping Victoria.

Land parcel status with regard to the first two water quality protection rules can be assigned by deriving a combined status map in terms of:

1. position inside or outside the 100 m stream buffer, and
2. soil absorption status.

Five classes emerged from this analysis (Table 2).

Table 2
The five class hierarchy used in this study segregates land according to the comparative amount of waste water management required by virtue of soil capability in waste water absorption.

<i>Class</i>	<i>Description</i>
Class 1 (Very Slight):	Outside 100 metre buffer and on that portion of the effluent disposal by soil absorption map ranked as having a 'High' management requirement.
Class 2 (Slight):	Outside 100 metre buffer and on that portion of the effluent disposal by soil absorption map ranked as having a 'Very High' management requirement.
Class 3 (Moderate):	Within 100 metre stream buffer and on those portions of the effluent disposal by soil absorption map ranked as having a 'Very Low', 'Low' and 'Moderate' management requirement.
Class 4 (High):	Within 100 metre stream buffer and on that portion of the effluent disposal by soil absorption map ranked as having a 'High' management requirement.
Class 5 (Very High):	Within 100 metre stream buffer and on that portion of the effluent disposal by soil absorption map ranked as having a 'Very High' management requirement.

The analysis involved modeling using grid/raster-based techniques and linking to the land parcel information for site identification and display. The sequence of tasks is summarised in Figure 2.

RESULTS

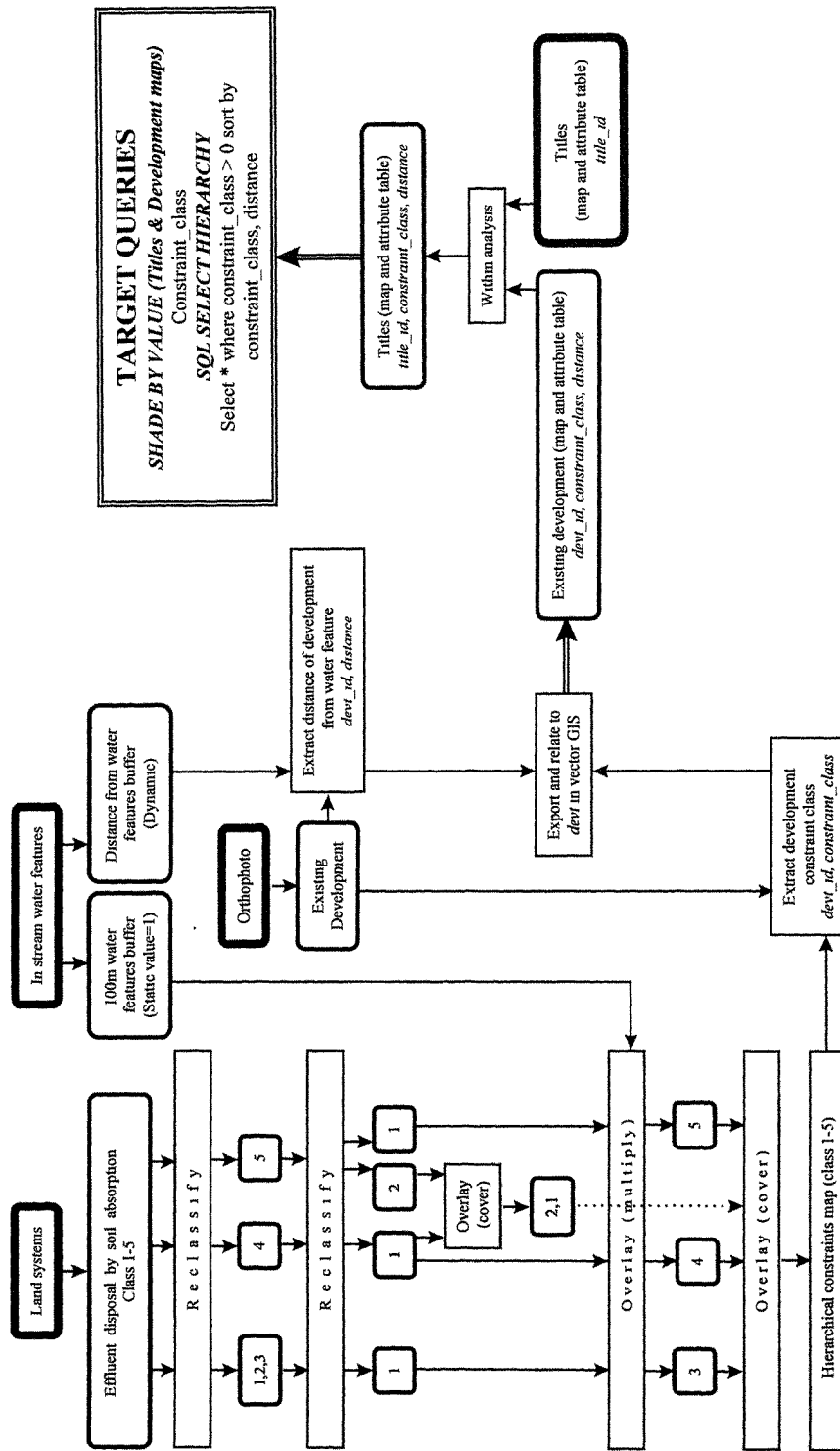
There are 213 dwellings in the study area, ninety of which can be said to be on 'constrained land'. Selection of the first 'dirty dozen' yields the twelve listed in Table 3 as the twelve probably contributing the most to water pollution. Thus, by application of a modern version of a time-honoured method (e.g., McHarg 1969) of spatial analysis the target land parcels among many have been identified. As Berry (1993, p. 24) has pointed out;

...in the absence of spatial guidance, there is a tendency to assume that every square inch [...] is in conflict.....

The distribution of the 'dirty dozen' (see Figure 3) constrains choice of mitigation measure. Clusters of problem parcels might be such that investment in a small sewerage treatment plant is warranted. In other cases the mitigation measure will be best chosen from further analysis as illustrated in Figure 4.

Table 3
Constraint hierarchy of the dirtiest dozen sorted by constraint class and then distance from a water feature. Note that within the constraint hierarchy, only four developments are very highly constrained and six developments are highly constrained. The table allows for the prioritisation of remedial works within the constraint hierarchy. The distribution of the 'dirtiest dozen' is depicted in map 2 and the 'dirtiest' parcel (ID 141) is depicted in some detail in map 3.

<i>Parcel ID</i>	<i>Dirty Dozen Rank</i>	<i>Constraint Class</i>	<i>Constraint Description</i>	<i>Distance from Water (metres)</i>
141	1	5	Very High	30
180	2	5	Very High	42
147	3	5	Very High	60
203	4	5	Very High	67
185	5	4	High	30
197	6	4	High	30
208	7	4	High	42
188	8	4	High	60
207	9	4	High	84
186	10	4	High	90
139	11	3	Moderate	30
199	12	3	Moderate	30



Vector Analysis

Grid Analysis

Fig. 2 The processing steps undertaken. The land system map was reclassified into five classes to represent the capability of the soil to dispose of septic tank effluent by soil absorption. The five class risk hierarchy was then created by overlaying effluent disposal by soil absorption management requirement classes 5 (very high), 4 (high) and 1, 2, 3 (very low, low, and moderate) onto the stream buffer to create risk classes 5 (very high), 4 (high) and 3 (moderate) respectively. Management requirement for disposing of septic effluent by soil absorption classes 5 (very high) and 4 (high) that are outside the stream buffer were reclassified into constraint classes 2 (slight) and 1 (very slight) respectively. Grid cells representing houses were then overlaid onto the dynamic distance from water features map to add a further dimension to the prioritisation. Finally a tabular file was passed to the vector GIS with fields representing the Development Identifier, Constraint Class and the Distance from a Water Feature. Each title was given a constraint status that corresponded to the constraint class that the development was situated upon. This was then related to the titles so that the 'dirtiest dozen' could be identified.

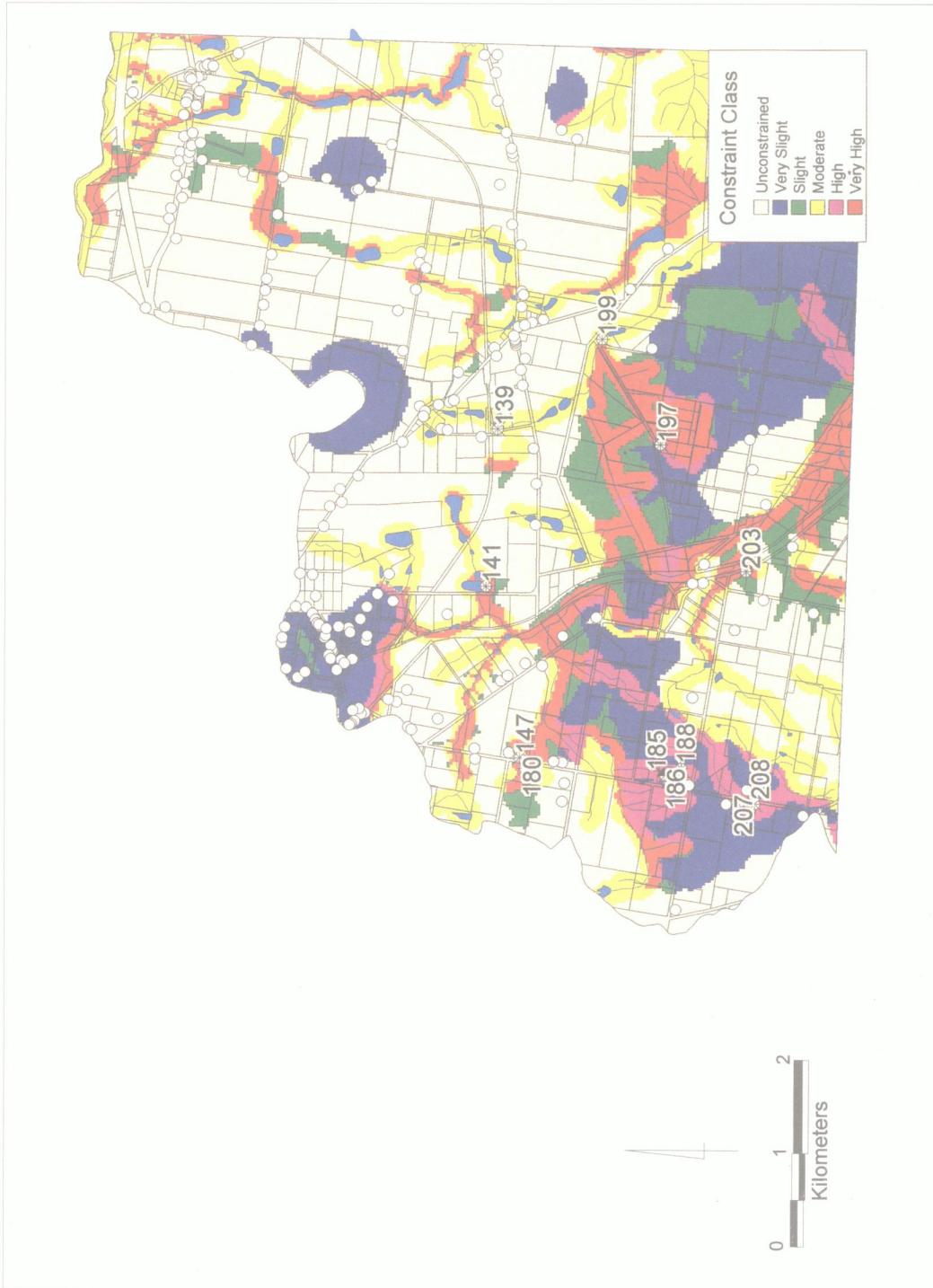


Fig. 3 Distribution of the constraint hierarchy for the study area. The dots represent existing developments (as at October 1993). Identifiers of the 'dirtiest dozen' (Table 3) are also shown.

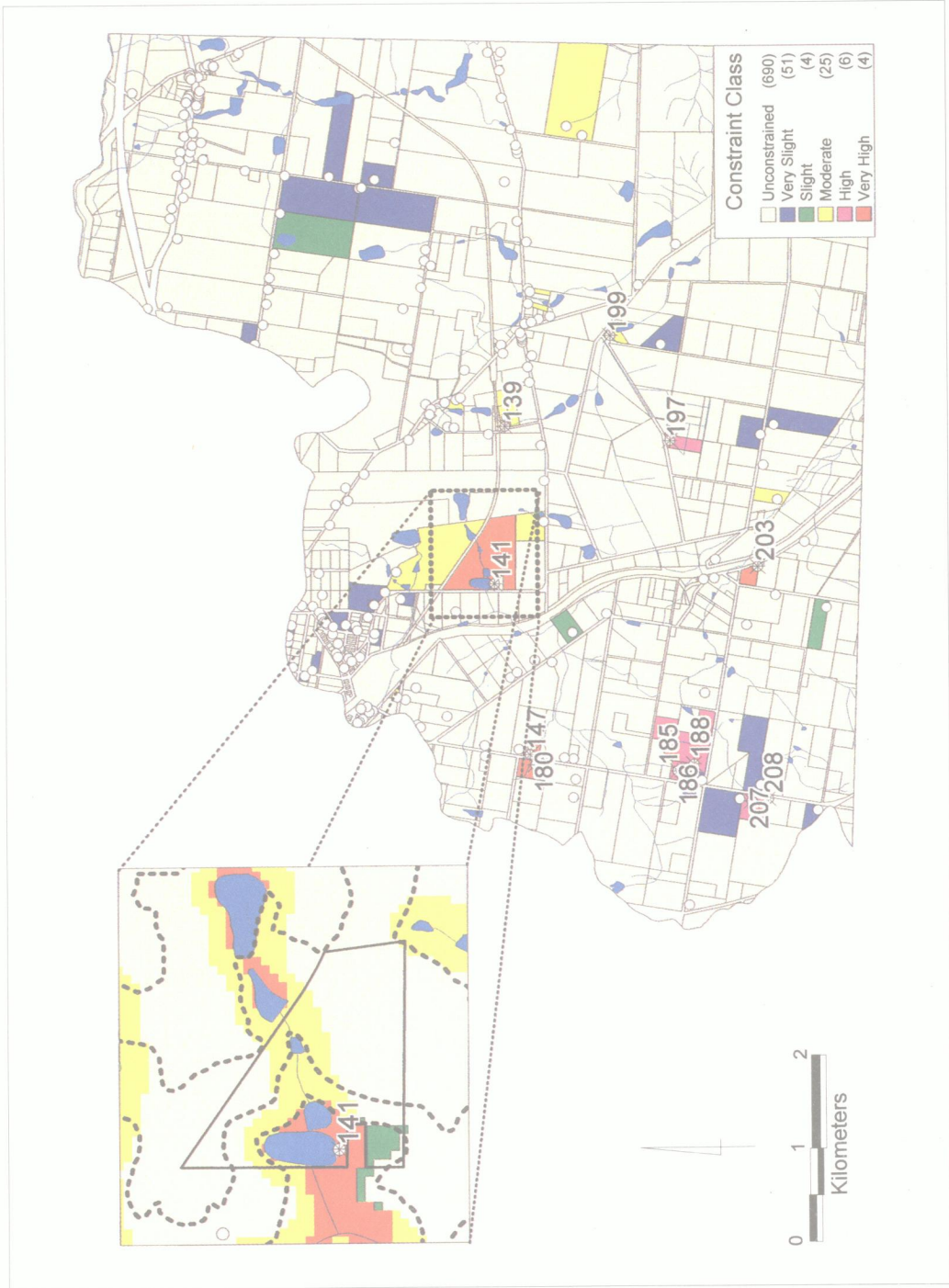


Fig. 4 The land titles are shaded to represent the value of the 'constraint class' of the development within it. Clearly, any monies to be spent on remedial works would be most effectively used if targeted to the greatest offenders. The map insert shows the grid version of the hierarchical constraint map surrounding the dirtiest of the 'dirtiest dozen'. The spatial data base can now be deployed immediately in aid of mitigation method selection. This development is situated on the 'Very High' constraint class and is surrounded by the 'Moderate' and 'Slight' constraint classes. Perusal at the contours suggests that unless effluent can be pumped to an absorption field in an unconstrained area of the title, alternative methods for septic effluent disposal will need to be investigated. Clearly, parcel ID 141 is one that deserves priority in deployment of water quality protection funds.

CONCLUSIONS AND FUTURE WORK

Our experiment indicates that a hierarchy of degree of post-facto non-conformity to water quality protection regulations can be derived through digital spatial data handling. Application to this study area revealed a 'terrible ten' or a 'dirty dozen', depend-

ing upon how much mitigation might be contemplated. In that the assembly of high quality data for digital spatial data handling allows spatial modelling, it is clear that there is scope to experiment with any distribution patterns available and relevant to a site selection task.

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Industrial Pollution and the Environment in Bangladesh: An Overview

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ABSTRACT

Of late, Bangladesh has experienced an increased concern about environmental degradation in general and industrial pollution in particular. Research and information on these issues, however, are strikingly scarce. This article focuses on the problem of industrial pollution in relation to the general status of environment in Bangladesh. It reviews the existing information on the issue, in order to shed light on the magnitude of the problem and the strategies for handling the crisis including their limitations. It contains a summary of the country's major environmental problems, a compilation of varied information on industrial pollution, an analysis of the current institutional approaches to combat industrial pollution, and a description of some heartening recent developments to face environmental problems. The article ends with an exhortation for more research into and a reassessment of the weaknesses of institutional arrangements for environmental management.

Keywords: *Bangladesh, environment, industrial pollution, institutional arrangements*

INTRODUCTION

In line with the global experience, there has been an unprecedented enthusiasm about environment in Bangladesh in recent times. Among a host of alarming environmental problems, pollution by industries has been identified to be one of the most notorious and serious environmental hazards for Bangladesh (see, e.g., DoE 1995, no date, Hussain 1994). Some analysts have gone as far as to argue that if the rate and magnitude of industrial pollution cannot be contained, Bangladesh faces the imminent risk of an 'environmental catastrophe' (e.g., Inam 1995).

Although there seems to be a consensus among concerned governmental quarters, international aid agencies and research organisations about the seri-

ousness of industrial pollution as an environmental problem, research and literature on this issue are remarkably scarce. Hussain (1995) rightly notes that:

There is a great scarcity of information on environmental problems. . . . In Bangladesh the most neglected area of productivity and . . . research is in the industrial sector. There is no organisation, [for example,] involved with research on the [environmental impact] of imported technology, . . . engineering design, technology adaptation, experiment in plant etc.. It is in this light [that] we should address the issues of development and environmental problems of Bangladesh.

The existing literature varies substantially in quality and quantity of information, and is found mostly in the form of media reports (e.g., *The*

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Bangladesh Observer 24.4.1995, *The Morning Sun* 25.1.1995, *The Bangladesh Times* 6.2.1995), back-to-desk reports by contracted experts, public circulars and leaflets issued by government agencies (e.g., DoE 1995), official representation by staff from environmental/research organisations (e.g., MOEF 1991, Huq 1995, Huq 1996) etc. The report of the Task Forces on Bangladesh Development Strategies (Task Force 1991) and the recent National Environmental Management Action Plan (for a summary of NEMAP, see Huq 1996 and BCAS 1995) remain two of the very few relatively organised and comprehensive volumes on the state-of-the-art concerning the Bangladesh environment.

In view of the above, this article focuses on the problem of industrial pollution in relation to the general status of environment in Bangladesh. It reviews the existing information on the issue in order to shed light on the magnitude of the problem and strategies for handling the crisis including their limitations. The discussion is opened by presenting

a summary of the country's major environmental problems. The next section concentrates on industrial pollution by pulling together existing information. Subsequently, the current institutional approaches to combat industrial pollution in Bangladesh are briefly analysed. Finally, we look at some heartening recent strategies to encounter environmental problems, especially industrial pollution, and furnish some suggestions.

ENVIRONMENTAL PROBLEMS IN BANGLADESH: A SUMMARY

Bangladesh's environmental problems are legion and remarkably varied to allow generalisation or accommodation under a single framework of discussion. However, it is possible (and imperative for the purpose of this paper) to present a summary-profile of the major environmental problems, as presented in Table 1.

Table 1
A simplified presentation of the major environmental problems in Bangladesh

Environmental problems related to the country's wider socio-economy	Over population (total population 123.1 million, 750 persons per sq. km., population growth rate 2.2%); abject poverty (per capita income 260US dollars; 49% of the households are functionally land-less, land-man ratio: 0.29 acre); mass illiteracy and unawareness about environmental issues (literacy rate 32.4%);
Problems related to unplanned and over exploitation (or misuse) of resources	Industrial pollution; rapid deforestation (currently forest is depleting at a rate of 8000 hectares per year; land area under forest cover 8%); unplanned irrigation and embankments projects; land and soil erosion; degradation of wet lands; adverse impact of coastal shrimp culture; unplanned urbanisation; alarming growth of city slums; unplanned mining; pollution from imperfect vehicles; uncontrolled siltation in river systems; arsenic poisoning in irrigated areas; lack of safe drinking water; inadequate drainage and sanitation; widespread misuse of pesticides.
Problems related to natural calamities	Prolonged draughts, frequent floods, erratic and abruptly fluctuating climatic conditions.
Regional problems	Consequences of rapid deforestation in upstream neighbouring countries; water borne pollution from neighbouring countries; unilateral withdrawal of water resources of major rivers by upstream state of India; pollution of the Bay of Bengal within and beyond the territory.
Global problems (which Bangladesh shares)	Greenhouse gas emission; climatic change; sea-level rise; ozone layer depletion.

Data sources: Ahmed 1993, BBS 1996, DoE 1995, no date, Huq 1995, Khan 1998, Landell-Mills no date, Schroll 1995, Task Force 1991.

The above table, which is far from exhaustive, shows the magnitude, variety and complexity of environmental concerns in Bangladesh. From the above, the Department of Environment (DoE) has selected seven 'primary causes for environmental degradation in Bangladesh', viz. industrial pollution, overpopulation, poverty, geographical location and natural calamities, indiscriminate deforestation, lack of fuel and illiteracy (DoE no date). Some selected environmental indicators are shown in Table 2.

INDUSTRIAL POLLUTION IN BANGLADESH

Although Bangladesh is primarily considered as an agrarian economy, the industrial sector now makes a significant contribution (11%) towards the Gross Domestic Product (GDP) of the country. The country's recent policy emphasis is to move towards an industrial development. Various fiscal incentives are being offered for investments (particularly for foreign investments) in the industrial sector. Table 3 presents some indicators of the industrial sector.

With the increasing emphasis on industrialisation, industrial pollution is 'becoming a matter of great concern' (Task Force 1991:6). There are three main industrial zones in the country, pivoting around principal urban centres of Dhaka, Chittagong and Khulna. Besides, various small and medium scale industries are scattered all over the country. At present, there is a total of 30,000 industries, of which 6,000 are large and 24,000 are small and medium scale industries. The number of public sector units is 142 (DoE no date).

Research on the number and nature of polluting industries is scarce and the information varies considerably. The Department of Environment (DoE) conducted a survey to identify types of polluting industries in 1986 and published a list of 903 'most polluting industries' which is summarised in Table 4.

Table 4 presents a general picture of the major polluting industries. In recent years, the list has been expanded to a total of 1317 industries (*The Daily Ittefaq* 24.9.1995; *The Bangladesh Observer* 22.4.1997). Tanneries, textile mills, pharmaceutical

Table 2
Selected Environmental Indicators

Carbon dioxide emissions per capita: in kilograms	142 (1990)
Water quality of major rivers and dissolved oxygen: in milligrams per litre:	
Jamuna	6.5-7.5 (1995)
Buriganga	3.6-6.5
Sitalakhya	6.0-7.0
Meghna	6.1-7.1
Padma	7.4-8.3
Urban concentrations of suspended particulate matter (Dhaka, Farmgate Police Station): in micrograms per cubic metre	727.8-1773.24 (1995-96)
Urban concentrations of sulphur dioxide (Dhaka, Farmgate Police Station): in micrograms per cubic metre	46.45-540.98 (1995-96)

Data sources: BBS 1996, Ahmed et al. 1996.

Table 3
Selected Industrial Indicators

Contribution to GDP	9.6% (1994-95) ^a
Index of Industrial Production (1988-89=100)	163 (1994-95)
Industrial production (annual percentage change)	3.6 (1997) ^b

Source: BBS 1996; *Financial Times* 1998. ^a A more recent estimate suggests the figure at 11%, see, *Financial Times* 1998. ^b Provisional official estimate.

Table 4
Summary of the 'most polluting industries' (as identified by the DoE)

Rank	Classification of industries	Numbers (%)
1.	Textile mills	298 (33.0)
2.	Tanneries and leather processing industries	176 (19.5)
3.	Pharmaceutical industries	166 (18.4)
4.	Jute mills	92 (10.2)
5.	Steel and iron industries	57 (6.3)
6.	Rubber and plastic industries	34 (3.8)
7.	Pesticide industries	25 (2.8)
8.	Chemical industries	23 (2.5)
9.	Sugar mills	16 (1.8)
10.	Pulp and paper mills	5 (0.5)
11.	Fertiliser factories	5 (0.5)
12.	Cement industries	3 (0.3)
13.	Distillery factories	3 (0.3)
		903 (100)

Data sources: DoE official data, personal communication (4.3.1995), *The Daily Ittefaq*, 10.1.1995. Figures in parenthesis indicate percentage.

industries, pulp and paper and jute mills remain the 'most polluters'.

The most obvious forms of industrial pollution in Bangladesh include air pollution by releasing carbon, dust, smog and various gaseous substances; noise pollution; pollution of river systems by releasing solid wastes and hazardous chemicals. There is little systematic country-wide data on the exact quantity and extent of the various forms of industrial pollution. There have been, however, surveys and research on a piecemeal or regional basis. In what follows, we pull together selected information (which we consider reliable) from such research with an end to present a relatively fuller picture of the country's industrial pollution.

A recent survey conducted by the DoE notes that more than 1,200 industries of the country discharge about 35,000 cubic metres (m³) of wastes in river water every day. In the capital city of Dhaka (including its suburbs) alone, 14,000 tonnes of solid waste and 16,000 m³ of chemical waste are discharged by industries every year into local rivers (DoE personal communication; for a summary of the survey findings, see *The Bangladesh Observer* 22.4.1997). It has been found that the rivers, adjacent to industries, contain high concentration of suspended and dissolved solids with high Biological Oxygen Demand (BOD) loading of 2000–3000 milligram per litre (mg/L).

The country's 502 textile industries discharge waste water of 40,000 m³ per day. The pollution

load of these industries is estimated to be 26,000 kg per day (DoE personal communication). The back-up industries of the textile sector, such as dyeing, printing and finishing plants, are also causing pollution and are adversely affecting public life. One press report shows that in the Thamai village of Belkuchi Thana (sub-district), Sirajgonj, local people appealed to the public administration and health department to close down eighteen processing and dyeing industries in the area. These were found to discharge toxic effluents causing skin disease, hepatitis, kidney problems and various intestinal disorders (*The Bangladesh Observer* 28.2.1995).

The tanneries and leather industries are another major source of industrial pollution in Bangladesh. Most of the leather industries are concentrated in Dhaka and Chittagong. A major portion of the leather products are processed in the Hazaribagh area of Dhaka. The area has already become polluted. One of the example of harmful effects of the leather plants is that people in Hazaribagh (including its adjacent areas) suffer from the foul smell of hydrogen sulphide. Cumulative waste water from the leather industries is 4,000 m³ per day (Task Force 1991).

In the case of pulp and paper industries, pollutants mainly flow from chipper houses, washing and bleaching units. The country's five pulp and paper industries release waste water of about 228,000 m³/day and the pollution load is 40,000 kg/day (*The Daily Observer* 22.4.1997). The Karnaphully Paper Mills (KPM) is reported to pollute the nearby river

Karnaphully by dumping solid wastes, wood particles, inorganic compounds, used bleaching chemicals, spent cooking liquors etc. The authors' personal visit (6.6.1995) to the plant reveals that there is no waste treatment plant in the KPM. Most of the industries in Bangladesh, it may be noted, do not have any system for treating wastes, and they are generally reluctant to take any responsibility for discharging hazardous wastes into the public domain (DoE no date, 1995, Hossain 1994, Hussain 1995, Task Force 1991).

Fertiliser factories are responsible for releasing metallic and liquid catalysts (e.g., ammoniated and acidulated water). All the urea fertiliser factories are situated on the banks of major river systems in the country. To cite one example of pollution caused by urea factories, ammonia concentration in the Sitalakhya river about half a kilometre down stream from the Urea Fertiliser Factory, Ghorashal was found to range between 1 and 3 mg/L; and scientists from the Bangladesh University of Engineering and Technology predicted that this value might rise to as high as 30 mg/L (Task Force 1991:145). It may be noted that a concentration between 1.2 and 3 mg/L ammonia has been proven to be toxic to aquatic life. The Chittagong Urea Fertiliser Factory is also found to be polluting the river Karnaphully. The sample collected by DoE shows 3 mg/L of ammonia at the discharge point of the factory whereas according to Bangladesh water quality standard it should be within 0.025 mg/L (DoE personal communication, *The Daily Azadi* 13.3.1995).

In the western part of Bangladesh, where natural gas supply is scarce or absent, power industries using sulphur based fuels are a major source of pollution. Sugar plants are also causing considerable pollution in the form of liquid waste water discharge and reckless disposal of solid and gaseous waste.

THE INSTITUTIONAL ARRANGEMENTS FOR INDUSTRIAL POLLUTION CONTROL

As may be seen from Table 5, in response to the environmental challenges posed to Bangladesh, the Government of Bangladesh (GoB) established a separate Ministry of Environment and Forest (MoEF) in 1989. This reflects the importance attached by GoB to environmental issues. Until 1989, DoE was operating as a low-profile project with a small work force and limited responsibilities. It gained

momentum after 1989 when the separate MoEF was established. In 1992, the National Environmental Policy (NEP) was framed for the protection of the environment. Almost at the same time, the National Conservation Strategy (NCS) was formulated to deal with the country's natural resources emphasising the issue of 'sustainability'. In order to implement these policies and strategies, the Environmental Protection Act, 1995 was enacted by the Parliament of Bangladesh giving wide powers to DoE. Besides, a detailed action plan was proposed in NEMAP which is now ready for implementation. It may be noted that NEMAP is considered a comprehensive environmental document for Bangladesh and it took several years for completion with the financial assistance from the United Nations Development Programme (UNDP). It aims to provide a broad framework for environmental management activities. In the process of its development, a nation-wide consultation process was carried out involving different environmental stakeholders, such as, non-governmental organisations (NGOs), public and private sector representatives, professionals, media and people from various walks of life. The NEMAP records consist of five volumes. The first volume gives the vision. The second volume contains the main report and the third volume outlines some specific projects for environmental protection. The fourth volume describes the methodology adopted for its preparation, while volume five is a technical document. The types of activities for NEMAP have been classified into three groups: policy level, advocacy and specific projects. All the proposed actions in NEMAP have been broadly categorised under four heads: Institutional aspects, sectoral, location specific, and long term issues. It is expected that the benefits of implementing this plan will be visible in the next two or three years.

Although the institutional arrangements for environmental protection in Bangladesh seem to be reasonably comprehensive, their performance and efficacy have been constrained by a number of problems. Although the DoE, as the country's premier environmental agency, has been strengthened with the enactment of the Environmental Protection Act, 1995, the powers given to the DoE by this Act are yet to be exercised fruitfully. This is evidenced by the non-compliance of and non-response to DoE's notices issued to the 903 industries (as shown in Table 4). By June 1995, only 196 industries had responded (*The Daily Ittefaq* 24.7.1995). This ex-

Table 5
Institutional arrangements for the control of industrial pollution in Bangladesh

Relevant Laws, Policies and Offices	Summary Provisions and Functions
The Factories Act, 1965	Provides for the adoption and approval of layout plans and designs of buildings in which industrial/manufacturing units can be located. Also includes requirements for treatment of industrial effluents before discharging into water, and purification of dust and fumes before emission into air.
Ministry of Environment and Forest (MoEF)	The apex body responsible for the protection of environment in Bangladesh. It co-ordinates the environmental management activities between itself, DoE (which is its subsidiary department) and other relevant sectoral ministries and government agencies, such as, ministries of industries, energy and mineral resources, water resources, agriculture, fisheries and livestock, land etc.
Department of Environment (DoE)	The functions include liaising with related environmental authorities or associations; giving 'environmental clearance' to the newly established industries; conducting enquiry into environmental problems or allegations of industrial pollution; advising and, where necessary, directing any person engaged in the import/export of hazardous materials on "environment-friendly use" of such materials; undertaking any other measures necessary for conservation and improvement of the environment and for the prevention of pollution.
National Environmental Policy (NEP), 1992	The main emphasis of the policy is to ensure the protection of the environment and to undertake development activities on a sustainable basis. It includes provisions to update relevant laws for the purpose of implementation of this policy. It serves as a basis for chalking out detailed action plans for the protection of the environment.
National Conservation Strategy (NCS)	Primarily deals with natural resource management and outlines the key themes and initiatives (e.g., 'sustainability' and 'participatory planning') which subsequently found expression in NEMAP.
Environmental Protection Act, 1995	For the first time, it includes the mandatory requirements for environmental clearance for any new industry to be set up. It empowers the Director General of DoE to visit and examine any place, premises, plant, equipment, process, ingredient and material with the end to protect the environment and direct the appropriate authority or person to take appropriate measures to stop and control pollution. Also includes detailed punitive provisions for non-compliance.
National Environmental Management Action Plan (NEMAP)	Includes a 'menu' for a large number of actions and alternative strategies for environmental management. Identifies the actors from public and voluntary organisations to carry out suggested actions. The proposed actions include strengthening of DoE, capacity building for NEMAP Secretariat in MoEF, strengthening environmental expertise in other line ministries and agencies, assisting environmental activities of NGOs, environmental awareness programmes etc.
Income Tax Ordinance, 1984 (as amended in 1996)	Recently amended, allowing tax incentives in the form of accelerated depreciation for investment in plant and machinery used in the treatment of and disposal of toxic and environmentally hazardous wastes.

ample shows clearly the weakness of the DoE in particular and of the whole institutional arrangements in general. Section 15 of the Environmental Protection Act, 1995 includes punitive measures for non-compliance with the Act. But to-date no industry has been actually punished for contributing to environmental degradation. In some areas (e.g. Sirajgonj, Joypurhat and Natore), local people have approached the relevant authorities concerning the polluting industries, but public agencies remained ineffective and unresponsive (e.g., *The Bangladesh Observer* 29.3.1995, *The Financial Express* 28.8.1995). Thus, there is little or no effective implementation of the rules, regulations and institutional provisions, despite the existence of a separate MoEF, a more strengthened DoE and relevant legal framework. Several reasons may be attributed to this dismal scenario. First, proper implementation of the Environmental Protection Act, 1995 depends largely on the detailed operational rules and regulations which are yet to be specified. Secondly, in order to make the above institutional arrangements effective, proper motivation and political commitment are required but which are still lacking. Many polluters are still found to be more strong, both socially and politically, than the authorities responsible for controlling industrial pollution (Hussain 1995). Thirdly, there is a lack of co-ordination between DoEF and other line ministries/agencies. Effective inter-agency co-ordination has been repeatedly argued to be crucial for effective environmental management in Bangladesh (Hasan and Mulamoottil 1994, Khan 1998). Finally, DoE is suffering from the shortage of funds, necessary manpower and proper scientific and technical knowledge.

RECENT DEVELOPMENTS

Recently, GoB has taken a number of decisions to combat environmental pollution. These include re-activation of the high profile National Environmental Committee (NEC). In a recent meeting of the NEC, with Prime Minister Sheikh Hasina as the chair, some important steps have been taken, such as, the establishment of an 'Environmental Court' to control pollution, and the decision to promulgate comprehensive rules to facilitate the execution of the Environmental Protection Act, 1995. The government has also decided to provide working capital to industries for developing an integrated Environmen-

tal Management System (EMS). In addition, plans are underway to work out detailed rules and regulations for Environmental Impact Assessment (EIA) of different industrial projects under section 20 of the Environmental Protection Act, 1995 (*The Financial Express* 5.5.97).

Another important development in this regard is the governmental approval of the draft NEMAP which is now ready for implementation. As noted earlier, this remains one of the very few relatively comprehensive documents on the state-of-the-art concerning the Bangladesh environment which has been prepared in the light of NEP and NCS.

Because of the low literacy level, mass awareness about environmental issues is considerably low in Bangladesh (Schroll 1995, DoE no date, Khan 1998). Most people are generally unaware or passive about the hazardous effects of industrial pollution. However, it is heartening to note that the situation, albeit on a limited scale, appears to be changing slowly. As noted earlier, villagers of Sirajgonj district, for example, lodged an united appeal to the concerned authorities to close down eighteen processing and dyeing industrial plants for (allegedly) causing pollution. Another public response was noted in the Natore district where local people urged the authorities to take measures against two sugar mills and one distillery responsible for the contamination of the River Narad (*The Daily Observer* 29.3.1995). Similar public protest was also seen in Joypurhat against the local Sugar Mills (*The Financial Express* 28.8.1995).

Moreover, different professional groups have come forward in recent years to collectively campaign for environmental protection. The Bangladesh Environmental Lawyers Association (BELA) and Bangladesh Environmental Journalists Association (BEJA), for example, regularly arrange seminars and symposia to increase public awareness about environmental issues.

Of late, increased interest has also been noted in the academic and research community on environmental matters. Within the last few years, selected universities have started offering specialised courses and training on a range of environmental topics. The North South University (NSU), for example, has introduced undergraduate and postgraduate modules on environmental studies. In the mid-1990s, the University of Chittagong expanded its Institute of Forestry and Environmental Sciences to widen its teaching and research activities on the environment.

Moreover, a number of research NGOs are attaching top priority to environmental issues on their research agenda. The Bangladesh Centre for Advanced Studies (BCAS) has achieved a reputation for its pioneering work on environmental matters. It played an important role in the NEMAP exercise and other environmental management activities in Bangladesh. This trend of increased interest on environmental research and education is likely to continue in future.

CONCLUSION

From a compilation of selected comparative evidence, this article has attempted to proffer an overview of the problem of industrial pollution. The findings allude to the seriousness of industrial pol-

lution as a major environmental hazard for the country.

In conclusion, two issues can be identified which call for immediate attention. First, we feel that although the institutional arrangements are reasonably comprehensive, their effectiveness and performance have been reduced to a minimal degree owing to such constraints as lack of resources, absence of inter-agency co-ordination, lack of supportive/follow-up regulations, socio-political affluence and power of the polluters etc. These constraints need to be addressed urgently in order to maximise the potential of the institutions charged with curbing pollution. Secondly, as repeatedly mentioned before, reliable environmental information and studies are conspicuous by their absence or inadequate presence. Bangladesh requires a great deal of research in this field, as at present our ignorance is profound.

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National and International Conservation Issues within a Shared Biogeographic Unit: Malaysia – Singapore

Tony Greer

ABSTRACT

The aim of this paper is to examine some of the broader conservation issues that have arisen between two countries within a common biogeographic unit. Peninsular Malaysia and Singapore are endowed with similar flora and fauna, although Singapore being smaller shows less diversity. In a global comparison the two countries maintain a rich biodiversity and as such the potential conservation responsibilities placed on these countries is high.

The contribution of the timber resource to the unit is acknowledged, as it is within the lowland forests that most of the terrestrial biodiversity is housed. Resource development has led to economic gains within both Malaysia and Singapore but not without external costs including the gradual loss of fauna and flora as a consequence of habitat destruction.

An understanding of the consequences of habitat fragmentation is a prerequisite to an investigation into these issues as it bears relevance on the importance of different size protected areas in the unit. Peninsular Malaysia, by virtue of its larger land area, has larger protected areas and contributes significantly to biodiversity conservation in the unit. Singapore also maintains the potential to contribute through the securing of small reserves in an increasingly changing landscape and also by means of continuing the development of ex-situ conservation efforts. The conclusions are that if a global conservation responsibility is placed upon the biounit, much of the responsibility is to be met by Malaysia. The imbalance is largely the result of Singapore being a small city state. However, being devoid of a hinterland, Singapore has an ever-increasing stake in the conservation of local and regional biodiversity. With this in mind potential participatory mechanisms between the two countries and within the region are discussed.

Keywords: *biodiversity, biogeography, conservation, tropical forests, forest fragmentation, Singapore, Malaysia*

INTRODUCTORY NOTE

Within the paper, conservation efforts are assessed by reporting the numbers and status of vertebrate species. Biological diversity extends well beyond vertebrates and they are referred to here as general

biological indicators able to illustrate the changes in ecological processes, mainly as a result of habitat loss. It is hazardous to equate the conservation of biodiversity with particular vertebrate species and their specific habitats (Ng 1993) as this over represents some habitats at the expense of others. Similarly

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lowland rain forests are by no means the only habitat under pressure due to land conversion and resource development but the following discussion will refer mainly to these forests. An extensive literature on the biodiversity and ecology of both Malaysia and Singapore already exists and details of particular species and habitats are to be found within the referenced texts.

The objectives are to examine the status of biodiversity conservation within and between two countries, Malaysia and Singapore. The two countries lie within a distinct biounit and the conservation potential should be assessed as such rather than specific national achievements. Both countries share a long tradition of cooperation and collaboration even though each has distinct economic and social development policies. Being a small city state, without a hinterland to meet the broad range of resource needs of society, places Singapore in a difficult and unusual position. Even with the best of intentions the state is limited in how it can best participate in future conservation efforts, even though there will be a continued and increasing demand for the resource services. However, this should not necessarily exclude Singapore from participating in pertinent *in-situ* conservation programmes, nor should the state necessarily be absolved from conservation responsibilities. This is a call for a renewed look at conservation efforts in and between the two countries. Many of the current issues and debate, if resolved, could well be extended to other bioregional management issues.

Parts of Thailand and Myanmar also share the biounit; however, they are not discussed here although any international cooperation would necessarily apply to them.

A GLOBAL BIODIVERSITY STRATEGY?

Conserving biodiversity goes beyond protecting wildlife in nature reserves to safeguarding the natural systems of the earth. The loss of biodiversity represents a loss to all people today and in the future. (WRI, IUCN, UNEP, 1992). Ultimately biodiversity is lost or conserved at the local level. Government policies create the incentives that facilitate or constrain local action and the interconnections of the world's environment mean that biodiversity loss in one area is liable to be felt widely (WRI, IUCN, UNEP, 1992).

Within the proposed Global Biodiversity Strategy framework (WRI, IUCN, UNEP, 1992: 56) nations are urged to develop a principle and policy of 'national ecological security' to ensure that international trade policies do not intensify biodiversity loss. Although within the spirit of the proposed strategy it is difficult to account for the actions of individuals, government should ensure that their actions do not knowingly impact the ecological security of other nations (WRI, IUCN, UNEP, 1992: 56).

Managing conservation issues within a national development framework is fraught with difficulties. Moving beyond national boundaries multiplies and compounds issues further. However, just as issues related to economic development are prioritised and imperative in the short term, biodiversity management must be factored into longer term planning.

Conservation issues are further complicated by the uneven distribution of biological diversity. Does this mean that the burden on conservation is also unevenly distributed? This paper starts with the premise that governments do accept the need to manage biodiversity and examines the present status of conservation in Malaysia and Singapore. Possible options for bioregional management between the two countries are then examined followed by a concluding discussion centred on theoretical scenarios. However, if the survival of a broad range of species in the future is to stand any chance, the reality and theory need to converge.

THE TIMBER RESOURCE AND DEVELOPMENT: MALAYSIA – SINGAPORE

Southeast Asia is presently undergoing a rapid transformation of landscape — a process initiated during the colonial period, continuing unabated until today. Although land development on such a scale is not unique to this region, the rate of environmental change and the potential impact on biodiversity both locally and globally is probably significant. The region includes some of the fastest growing economies in the world and the medium to long term economic forecasts suggest that such growth will be sustained.

The biogeographical setting of this economic development is one of tremendous diversity. Floristically the Southeast Asian rain forests are acknowledged as among the most species-rich terrestrial ecosystems in the world (Whitmore 1984, Soepadmo 1996) and Peninsular Malaysia alone con-

tains nearly 8,000 plant species from 1,500 genera (Whitmore 1973). Associated with such complex ecosystems is a high diversity of vertebrate species and a vast number of invertebrate species. Within nearby Indonesia, part of which extends into the seasonal tropics, there is an estimated 10% of all plant species, 12% of mammals, 16% of reptiles and amphibians and 17% of birds; many of which are endemic (Collins *et al.* 1991:154). Malaysia, which is contained entirely within the humid tropics, has an equally impressive diversity per unit area of land (Dinnerstein *et al.* 1996:149) as indeed does Singapore (Turner 1994:48).

Inextricably linked to the forest systems of the region is the contribution of industrial timber production to the local economies. During the 1980s, a period of peak logging activity, timber revenues contributed about 5% to the GDP of Malaysia (Kumar 1986) and about 7% in Indonesia (Repetto *et al.* 1989). As both economies move towards full industrialisation, the contribution of the forestry sector will decline but with a continued input from long term production forests. Singapore, without any significant natural resource base of its own, participated in the development of the timber industry of the region by establishing itself as a processing centre for whole logs. Processed imported timber, largely from Malaysia, contributed on average 1.7% to the total export earnings of Singapore during the 1980s (United Nations 1994). This role declined as neighbouring Malaysia and Indonesia adjusted their whole log export policies following the economic slump of the late 1970s (Collins *et al.* 1991). Increasingly, logs were retained in the country of origin for processing locally. Singapore, however, continued to play a significant role in the timber industry by becoming a major importer of processed wood for domestic furniture production (Johnson 1988).

Although the importance of industrial timber production will eventually decline with shifts in emphasis in economic development, some of the previously unaccounted for forest values will increase in importance. Environmental and social amenity functions will cause the remaining forest to increase in value to society and a broader range of goals may be incorporated into forest policy. Such policy is inherently biased towards the needs of remote beneficiaries of the forest and often equates with national development interests. It should also not be forgotten that forest dwelling and nearby people also have their own value system for forest goods and utilise

numerous products from the forest, both commercial and non-commercial.

THE BIOGEOGRAPHICAL SETTING OF MALAYSIA AND SINGAPORE

In order to properly manage and maintain the biodiversity of a region, the geographical distribution and numbers of species needs to be broadly understood. Species distribution can then be matched with the remaining habitat and an initial assessment made of the conservation potential of an area. A number of issues may arise from such an inventory as national boundaries and subsequent conservation efforts rarely coincide with species range.

In a review of the protected area systems in the Indo-Malayan Realm, Singapore, Peninsular Malaysia, southern Thailand and the southern tip of Myanmar, are grouped into one of four 'biounits' in the Sundaic sub-region, within the Indo-Malayan Realm (IUCN/UNEP 1986) (Figure 1). Each of these subunits would have a characteristic fauna and flora that developed in isolation from its neighbours. However, a subunit does not possess the major truncation of species types that occur at the boundary of a sub-region (IUCN/UNEP 1986). For a fuller account of the biogeographical evolution of the Malay archipelago see Whitmore (1981; 1987). Much of the following discussion will focus on the Malay Peninsula biunit, emphasising Malaysia and Singapore, with some reference to the neighbouring Sumatra/Nicobar biunit (Figure 2). The relationship of Thailand within the unit is equally important.

The Sundaic sub-region is characterised by high species diversity and low endemism with much of the terrestrial diversity being concentrated in the lowland rain forests. For this reason many species often coexist in relatively small areas (Aiken & Leigh 1992:36–7) with a low density distribution. This has necessitated a number of different time, space and resource partitioning mechanisms to explain the successful coexistence of so many species (Aiken & Leigh 1992: 36–8). Consequently any form of disturbance will affect individuals of many species but as long as the disturbance is not widespread, the species as a whole will be largely unaffected.

Deforestation has resulted in a much depleted forest cover within the region, placing an increased importance on the remaining areas. The present and future role of the remaining forests in Southeast Asia

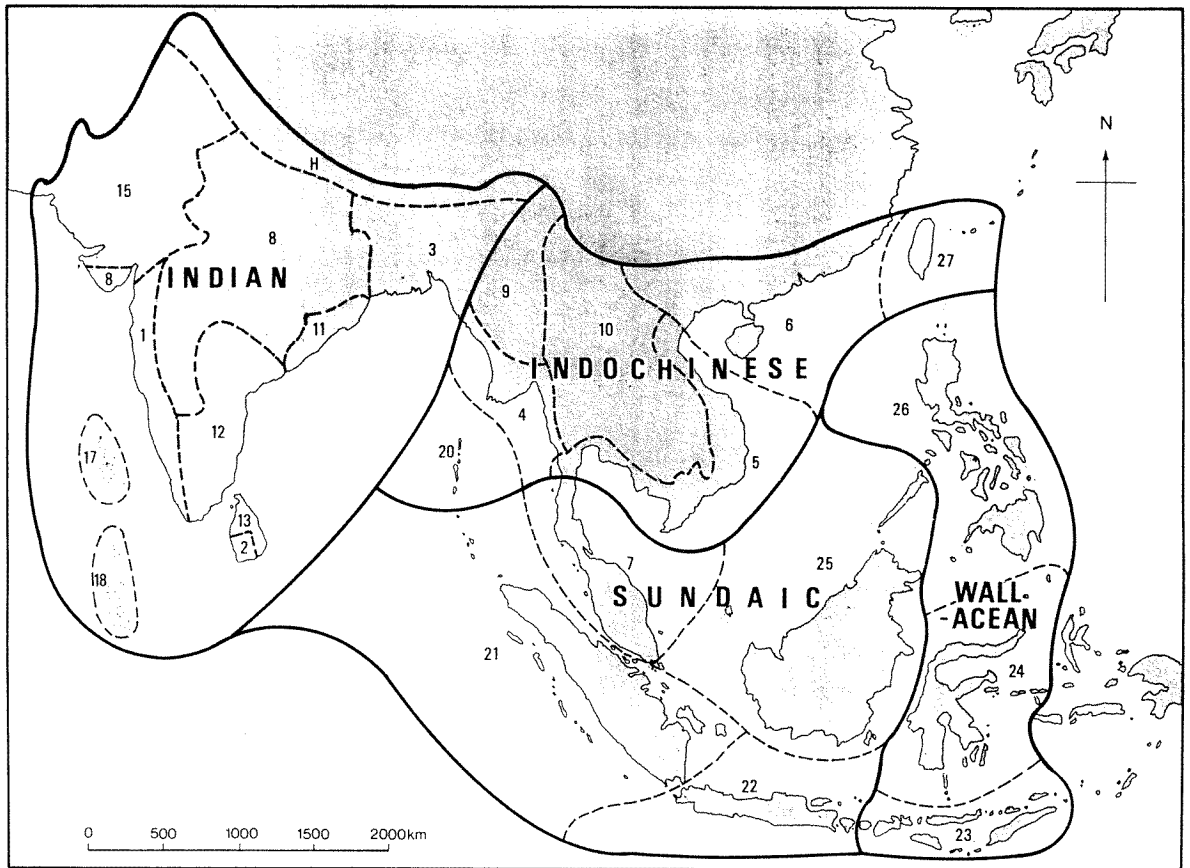


Fig. 1 The Indo-Malayan Biogeographic Realm (after IUCN/UNEP 1986).

Unit Name

Indian Sub-region

- 1 Western Ghats
- 2 Sri Lankan Wet Zone
- 3 Bengal
- 8 North India
- 11 Eastern Ghats
- 12 Coromandel
- 13 Sri Lankan Dry Zone
- 15 That/Indus
- 17 Laccadives
- 18 Maldives
- H South Himalayas

Indo-Chinese Sub-region

- 4 Myanmar Coast
- 5 S. Indochina

Unit Name

- 6 S. China
- 9 Irrawaddy
- 10 Indochina
- 20 Andamans
- 27 Taiwan

Sundaic Sub-region

- 7 Malay Peninsula
- 21 Sumatra/Nicobars
- 22 Java/Bali
- 25 Borneo/Palawan

Wallacean Sub-region

- 23 Lesser Sundas
- 24 Sulawesi/Sula
- 26 Philippines

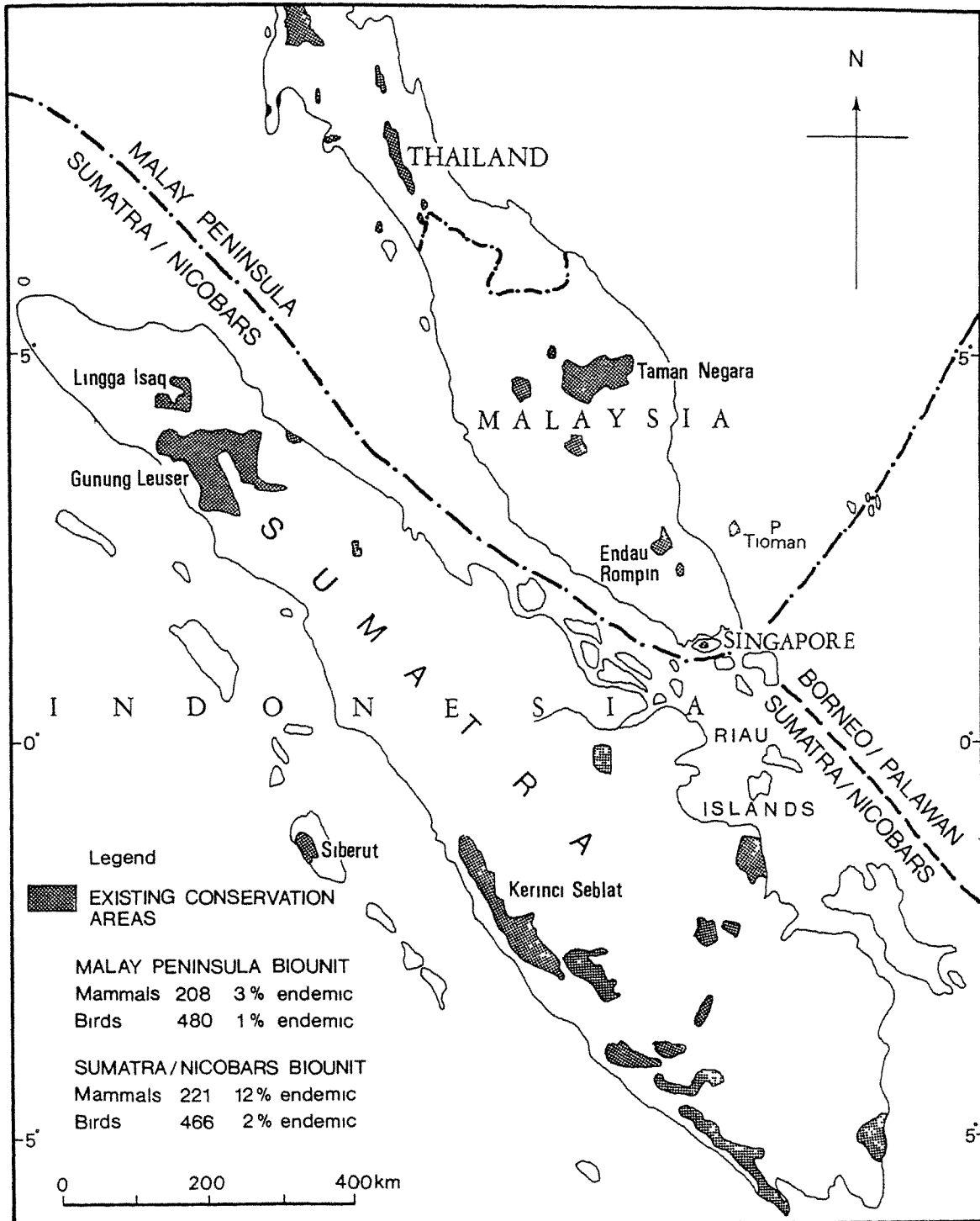


Fig. 2 Map of existing conservations areas greater than 50 km² Species numbers refers to residents only (After Collins *et al*, 1991 and IUCN/UNEP, 1986)

and their importance to conservation is discussed by Dinnerstein *et al.* (1996). It is suggested that if the present protected areas in the Malaysian and Sumatran biounits remain secure, the units will retain the potential to maintain important regional reservoirs of tropical forests and diversity.

As regions of 'megadiversity' the responsibility placed upon these countries is enormous. For example, of the 121 species of small mammals in Peninsular Malaysia 38 are threatened with extinction (Fitter & Fitter 1987). A number of the larger mammals which are particularly hard to conserve are also listed as threatened in the IUCN Mammal Red Data Book (IUCN/UNEP 1986). These include the two horned (Sumatran) rhino (*Dicerorhinus sumatrensis*), tiger (*Panthera tigris*), clouded leopard (*Neofelis nebulosa*), seladang (*Bos gaurus*) and Malay tapir (*Tapirus indicus*) (IUCN/UNEP 1986). Within the Malaysian biounit the conservation responsibility for some of these species such as the tiger (*Panthera tigris*), now remains solely with Malaysia as they are locally extinct in Singapore.

Biogeographically, Singapore is not unique although it remains interesting. This is largely because as an island at the southern limit of the biounit there has been a tendency towards speciation. Only one true endemic vertebrate species has been recorded, the Singapore whiskered bat (*Myotis oreias*) and is known only from a single specimen caught in 1840 (Ng & Wee 1984). There are, however, a number of endemic subspecies including those of the red spiny rat (*Maxomys surifer*), the lesser mouse deer (*Tragulus javanicus fulviventer*), the cream coloured giant squirrel (*Ratufa affinis affinis*), the shrew faced ground squirrel (*Rhinosciurus laticaudatus leo*) and possibly the banded leaf monkey (*Presbytis femoralis femoralis*) (Ng & Wee 1994). Extinctions of these mammals would mean the total extinction of the subspecies but not the species. Most extinctions in Singapore are local as most of the species range extends either through the rest of the Malaysian biounit or into other neighbouring units. Some mammals presently recorded in Singapore, such as the oriental small clawed otter (*Amblonyx cinerea*), may consist entirely of individuals wandering from Malaysia (Ng & Wee 1994). Of the 63 species of birds in Singapore that are presently rare or at risk (Lim 1992), 45 of these are still classified as common or abundant in Malaysia. Nineteen of the 39 species that have gone locally extinct since 1940 remain common in Malaysia.

Tigers were regularly reported from Singapore and probably ranged freely from the Peninsula by way of Pulau Tekong and Pulau Ubin (Harrison, 1966:5). Under ideal conditions, tigers may range within 100 km²; however, this may be extended as far as 4,500 km² (Lekagul & McNeely 1988). The number of sightings and reported attacks upon residents (Harrison 1966:5) would suggest that some individuals were at one time resident on the island. Clouded leopard, tapir, rhino and seladang have never been recorded in Singapore (Harrison 1966:6)

To the south and west lies the Sumatran/Nicobar biounit (Figure 2) which has a flora and fauna with many similarities mainly due to the land bridges that existed during the recent glacial periods (Whitten *et al.* 1987). The fauna of Sumatra has more similarities with the Malaysian biounit than other parts of Indonesia as when sea level rose Sumatra was isolated first from Java, Borneo and lastly Peninsular Malaysia (Whitten *et al.* 1987). Although there is a great richness of mammal and bird species, only nine species of mammal and fourteen birds are endemic (Whitten *et al.* 1987). Islands within the Riau/Lingga archipelago have no endemic mammals although they may have some endemic subspecies (Whitten *et al.* 1987:57) and as such are the Sumatran biounit equivalents of Singapore.

The low level of endemism between the Malaysian and Sumatran biounit theoretically allows for a species to become extinct in one unit and survive in the other. However, both countries are undergoing similar developmental pressures and it can be expected that extinction processes within the Sumatran biounit would follow the same general pattern. Extinctions on islands such as Singapore have further implications as they are geographically isolated from the species source area and therefore the immigration of new stock becomes difficult.

PROTECTED AREA SIZE AND SHAPE

It is unrealistic to expect large areas of pristine habitat to be maintained in areas of expanding population, particularly in face of the changing needs of society. As land and vegetation is converted, forests become fragmented until the remaining undisturbed habitats are isolated as patches. The isolation process within tropical forests may take many years, undergoing several stages of development, particularly if the forest is part of a rotational production stand. Rates of

species survival will depend upon the size of the remaining habitat and the proximity to other undisturbed areas. The fate of the remaining habitat islands and the changes that result from the isolation, both biotic and abiotic, have received much attention (Saunders *et al.* 1991; Laurance & Bierregaard 1997). Within the current debate on the function of existing reserves it is generally acknowledged that larger reserves minimise edge effects and are able to accommodate the wide ranging species (Primack 1993). However, it is also argued that small well-placed reserves play an important role as a number of small reserves may be better able to conserve a greater variety of habitat types and more populations of rare species than a large block of the same area (Simberloff & Gotelli 1984; in Primack 1993).

As a fragmented area diminishes in size it will eventually reach a stage when it is no longer able to support the critical minimum population size for more and more species (Simberloff 1990). The time frame for the gradual loss of species or 'species relaxation' may vary. A species within a patch may become locally extinct only to be recolonised later (Fahrig & Merriam 1994). This will depend upon the species and the proximity of the next nearest fragment containing the species. In tropical forests, Simberloff (1990) suggests that extinction losses will be exacerbated as tropical species (many of them as yet undescribed) will have smaller ranges and local extinction will occur once the range is removed. Simberloff (1990) distinguishes between local extinctions related to habitat loss and that of the more gradual loss of species that survive in fragments. Within Singapore, most extinctions have resulted from the loss of habitat (Turner *et al.* 1994); however, the low population numbers of many remaining species would suggest that the more gradual extinction process is now taking effect.

It has been argued that, by conserving corridors of land between similar habitats, recolonisation may be aided and the overwhelming problem of habitat fragmentation may in part be addressed (e.g., Noss, 1987). Carefully planned protected areas would also allow options for expansion or contraction of habitat and species, given the many impending global climate change scenarios. Connecting corridors may also have a role to play in complementing larger multiple reserves in real life landscapes (Noss 1987). This is disputed by Simberloff *et al.* (1992), who claim that if the land is worth conserving in its own right then it should be conserved but otherwise the

negative aspects of corridors (Simberloff & Cox 1987) are detrimental to the larger conservation area. After the debate, however, often there is no other choice than to manage the remaining fragments as best possible (Primack 1993).

Corridors that facilitate the natural patterns of migration will probably be most successful at protecting species (Primack 1993). The equatorial humid tropics, with limited seasonality, experiences little or no migrations of terrestrial land vertebrates although there may be irregular grouping and movements of some species such as pigs and elephants in Malaysia (Payne *et al.* 1985). Corridors facilitating the movement of wildlife have to be well thought out with a priority of joining areas of like habitats. Given the urban environment of Singapore and the large distance between reserves in Peninsular Malaysia, there are only limited options for expanding the protected area network with corridors.

On an altogether larger scale, the region is on the eastern path of the Palaearctic migration system of birds and is a wintering ground for some species. The final destination for many birds is further south in Sumatra and not all species would follow the Malay Peninsula or require areas of suitable habitat for resting or feeding on route (Nisbet 1976). However, it is clear that the full importance of habitat availability on route is not fully understood and therefore it would be prudent to acknowledge that for some species some habitat is required.

In the neotropics it has been recorded that populations of migrant land birds have experienced significant declines in recent years primarily as a result of fragmentation of their North American breeding grounds but also due to loss of wintering habitat (Maurer & Heywood 1993).

CONSEQUENCES OF FRAGMENTATION

From observations on a 700 hectare patch of fragmented cloud forest in the western Andes of Colombia, it was reported that bird surveys in 1911 recorded 129 species present. Twenty-four had gone locally extinct by 1959 and 16 more species by 1991 (Kattan *et al.* 1994). This is with no further deforestation in the previous 20 years but extinctions continue to occur. However, the region is particularly vulnerable to local extinction as it is at the limit of the altitudinal and geographic distribution for some of the species.

How does this compare with data in the Malaysian biounit? Observations in Singapore have recorded 35 bird extinctions from the list of residents recorded pre-1940; nearly all from mangrove and rain forest habitats (Lim 1992). Since 1940 a further 39 bird species have become locally extinct, with an additional 52 species at risk of extinction, most of them forest birds (Lim 1992). Although not directly comparable with the small patch of forest in Colombia there are some similarities. Twenty years has past since the last period of active deforestation in the Colombian example, yet species continue to become extinct. Changes in the biota of the much smaller Bukit Timah Nature Reserve (71 hectares) record a similar trend (Corlett 1988, 1992). While Bukit Timah has remained much the same size over the last forty years it has become increasingly more isolated. This bears a second point of comparison as the reserve, located at the southern limit of the biounit, is more than 30 km away from the already fragmented forests of Johor, West Malaysia, which effectively prevents immigration by most rain forest birds and almost certainly all mammals (Corlett 1992). This has resulted in the loss of more than half of the reserve's bird fauna and many of the mammals (Hails 1985; Corlett 1988). However, the comparison is complicated as not all the extinctions are due to isolation and fragmentation but some result from the direct effects of hunting and trapping (Corlett 1988). A similar sized reserve at Lima Belas, Perak, Malaysia (70 hectares) still contains many of the mammalian species 60 years after isolation (Bennet & Caldecott 1981; in Corlett 1988).

Important questions regarding the minimum number of individuals that constitute a viable population remain unanswered. Small populations result in the loss of genetic variation and inbreeding depression. Viable population estimates of between 500 and 10,000 individuals are often used with 5,000 being a medium figure. The number of individuals is then multiplied by the range of the species to give an estimate of the size of protected area needed to ensure a viable population of animals (IUCN/UNEP 1986). Clearly the application of this form of minimum population size theory would require large land areas for the low density, wide ranging species such as the top carnivores of a system. Nevertheless there is some evidence that small populations subjected to environmental stress remain valuable to conservation, particularly small plant populations (Leisca & Allendorf 1992).

In Singapore at present there is a remnant group of between seven to twenty banded leaf monkeys in the 1,800 hectares central catchment reserve. For a related species of leaf monkey in Sarawak, in an area that is lightly hunted, it has been estimated that 14,600 hectares are needed to support an effective breeding population of 1,000 (Elizabeth Bennett, personal communication in Abang Haji Kassim & Gummal, 1996). Such a comparison must surely leave the future of the Singapore population in doubt unless there is some form of active management (Wee & Corlett 1994).

PROTECTED AREAS

In order to maintain ecologically representative examples of an environment, some form of protected status needs to be given to that environment. Protected areas are usually blocks of land gazetted by law from the existing national land resource inventories and are excluded from the usual array of developmental pressures. National Park status and other categories of protected area, although universally accepted as a means of managing land for conservation, do not necessarily mean that the objectives of conservation are met, as most areas remain under pressure, particularly from the adjacent land users (Collins *et al.* 1991). In addition to such pressures acting upon the viability of the reserve, consideration has to be given to how representative the protected area is of the environment that is being conserved.

There is a broad range of different protected area categories with each affording different levels of protection and potential usage, depending upon the primary conservation objectives. The legal status of each category may also vary from state to state and internationally (Mackinnon *et al.* 1986; Collins *et al.* 1991). In the Malaysia - Singapore context the categories of importance may be summarised as follows:

- (i) National Park — To protect outstanding natural and scenic areas of national or international significance for scientific, educational and recreational use (Mackinnon *et al.* 1986). To date Peninsular Malaysia has only one park within this category, Taman Negara (434,351 hectares). In respect to the amount of protection that can be afforded to an ecosystem this can only be superseded by a Strict Nature Reserve/

Scientific Reserve category which usually does not allow any access except under special circumstances.

- (ii) Wildlife Reserve/Sanctuary — This category offers the same social objectives and the same protection to wildlife as a national park but is retained and administered within the state land inventory. Within Malaysia, land gazetted under the National Parks Act cannot be revoked except with the concurrence of the federal minister whereas state parks and reserves have and may be wholly or partially revoked (Aiken & Leigh 1992: 123). There were 18 wildlife reserves and bird sanctuaries in Peninsular Malaysia circa 1990 amounting to 310,368 hectares (Aiken & Leigh 1992).

In addition to the above categories there remain extensive areas of forest reserve, some of which are intended to remain under some sort of forest cover as part of the long term timber production industry of Malaysia. There also exists a network of 81 Virgin Jungle Reserves amounting to 910 km² (Collins *et al.* 1991:189) with the purpose of preserving representative patches of forest type in commercial production forest areas. Forest reserves, including Virgin Jungle Reserves, play an important role in maintaining current biodiversity (Johns 1992). However, the management of such areas is not designed for the long term conservation of natural forest communities and as they degrade with continued resource development so will the forests' potential to maintain intact ecosystems (Collins *et al.* 1991).

THE PROTECTED AREA SYSTEM IN PENINSULAR MALAYSIA

An important question recently asked by the Malaysian Nature Society was, whether the protected area system is sufficient to include the total biodiversity of the country (Leong *et al.* 1990). This question when addressed nationally will of course include the East Malaysian states of Sabah and Sarawak and will necessarily consider biodiversity issues in the adjacent Borneo/Palawan biunit. Although Malaysia, particularly within the region, has a history of success in park management the forest cover within the protected area system continues to remain under pressure (Collins *et al.* 1991). The suggested population of 70 million people fairly early next century

can only add to this (Kiew 1984). The protected area network will continue to move towards resembling isolated islands in an extensive sea of development (Aiken & Leigh 1992) and Malaysia would eventually be in a state worse than Java today from the viewpoint of land use and conservation (Kiew 1984). Continued pressures on the protected area system would include the flooding of forests for hydroelectric development, continued concession demands by the timber industry and further land conversion pressures.

The existing forest conservation areas in Peninsular Malaysia amount to 9.6% of total land area. However, this relies heavily on Taman Negara which at 434,351 hectares is also one of the largest in South-east Asia (Collins *et al.* 1991:64). Habitats not represented in the park remain particularly vulnerable. Protected areas are often over-representative in habitats which are considered to have marginal land value for any other type of utilisation (Primack 1993). In tropical forest regions this translates to an over representation of montane forests which are difficult to access or are gazetted for environmental protection purposes. Endau-Rompin in the states of Johor and Pahang retains the largest remaining intact fragments of lowland rain forest (930 km²) (Collins *et al.* 1991). In Thailand, where existing and planned protected areas amount to a respectable 11% and 13% of total land area (Collins *et al.* 1991: 230) extinctions are still taking place. This is largely a result of a bias in the habitat types being conserved. The species rich lowland forest areas are under-represented in the forest types conserved (Legagul & Round 1991).

Aside from the diminishing physical options available for conservation in Malaysia, land is said to be strictly a state matter even though the federal constitution of Malaysia does take the conservation of natural resources as an item in the National Development Plan (Kiew 1984). Since the gazetting in 1938 of Taman Negara, a tri-state park, attempts to secure national park status for Endau-Rompin, shared between the states of Johor and Pahang, have met with considerable resistance. However, since 1988 the area has been granted the status of state park with each section of the park being administered by the relevant state (Collins *et al.* 1991). In part as a solution to the resistance of states to give up land to federal administration it has been suggested that the federal government can compensate the state for land allocated to conservation (Leong *et al.* 1990). How-

ever, the intricacies of long term resource compensation should not be understated. Given the problems of protected area land management at a national level, the realities of international conservation deals are apparent.

BIODIVERSITY CONSERVATION IN SINGAPORE

For Singapore, the status of nature conservation and some of the major constraints are well documented (Wee & Corlett 1986; Corlett 1988; Corlett 1992; Turner *et al.* 1994; Wee & Ng 1994; Corlett & Turner 1997). It is sufficient to say that the reserves suffer from all the pressures of a small, fragmented forest systems and are further constrained by the continued development of a burgeoning tropical city. The 72 hectare patch of coastal-hill dipterocarp forest at Bukit Timah was recently separated from the 1,800 hectares of mainly secondary forest of the central catchment by the construction of the Bukit Timah Expressway. The remaining reserve system stays under continued pressure from development and provides an extreme example of the longer term effects of patch isolation. Nowhere is the dramatic decline of so many species as well documented as Singapore. This translates to the extinction of virtually all the large mammals, 26% loss of vascular plants, 28% of resident birds and 44% of freshwater fish (Turner 1994). The number of extinctions is still considerably lower than would be predicted by ecological theory, probably indicating that more species are going to be lost (Turner 1994, Turner *et al.* 1994).

The entire Republic of Singapore is a protectorate for wild animals and birds with the exception of a few abundant pest species (Lye 1991). There are enough laws to protect the wildlife of Singapore, with the greatest protection within the nature reserves while elsewhere all wild animals are protected except invertebrates. However, as with most protected areas, there are management problems and enforcement of the laws is difficult. Even with increased patrols by the National Parks rangers, there remains a persistent poaching problem, but this has to be considered separately to the land use pressure.

The long term viability of the conservation status of the reserves as functioning habitats is still in doubt. Although the reserves are not able to maintain a range of species comparable to undisturbed

forest they remain important for conservation of some species within the urban setting of Singapore. To increase the viability of the reserves Wee and Corlett (1994) suggest a number of measures which include a more active management role with better protection of the reserve margins. They also state that without active intervention, biodiversity will continue to decline but this does not mean that biological conservation should be looked at as a lost cause in Singapore.

The Singapore Zoological Gardens, in conjunction with the National Parks Board, Singapore, have recently embarked upon a local mammal reintroduction programme (*Straits Times* 29/10/97). Starting with suitably acclimatized mouse deer and small clawed otter (*Aonyx cinerea*), the Zoo plans to breed and when appropriate, release selected species. Part of the rationale stems from the fact that the remaining forests are now more secure due to reforestation programmes, better policing and decreased poaching pressure. The reintroduction programme is essentially an *ex-situ* conservation effort and, given the current level of expertise and resources available, is an area where Singapore can make a significant contribution towards biodiversity conservation within the biounit.

POSSIBLE INTERNATIONAL PARTICIPATORY MECHANISMS

For real progress to be made with biodiversity conservation a mechanism needs to exist that allows the dissemination and implementation of objectives both nationally and when appropriate, internationally. Such information would include details on domestic biodiversity and distribution, the legal and financial aspects of implementation and feasible conservation strategies given the political will of the country. Each country, depending upon a unique set of national circumstances, will have differing wants, means and ability to contribute to conservation programmes.

Many pertinent bilateral conservation issues between Malaysia and Singapore may globally be construed as unusual but answers, if found, could address issues relevant to other international conservation efforts. If biodiversity management is to succeed, the resource needs to be conserved in the first instance at a reduced scale of individual biounits. With this in mind, a largely theoretical management question to be asked of Singapore is; how can a

densely populated, land scarce country contribute more fully towards biodiversity conservation — if indeed at all? Obvious limitations on space and the already advanced state of urban development leaves Singapore with limited options for contributing further towards regional *in-situ* biodiversity programmes. Should it therefore remain that all efforts concentrate on *ex-situ* programmes alone or can Singapore further participate by means of extension and direct involvement with other conservation programmes within the biounit? To move towards providing a relevant answer, the structure of existing international cooperation needs to be examined.

MECHANISMS FOR COOPERATION — THE REGIONAL SETTING

Malaysia and Singapore are two of now nine countries which together form ASEAN (Association of South East Asian Nations). The geographic coverage of ASEAN broadly coincides with the important Indochinese and Sundaic biogeographic subregions and therefore potentially provides a convenient political framework for significant conservation cooperation. The association aims to work towards further and closer cooperation and mutual assistance on matters of common interest, not only among member states but also with existing international and regional organizations. However, the level of socio-economic development in the various ASEAN states differs and this may affect the level of participation and capability to respond to environmental protection needs. The resulting *laissez-faire* nature of the association places only a limited responsibility on individual countries, allowing considerable leeway for flexibility in the implementation agreements (Koh 1997: 8).

Although the ASEAN Working Group on Nature Conservation meets regularly on environmental matters (the most recent of which, Jakarta in September 1997, coincided with a regional haze), to date there is only one framework treaty for the South-east Asian region. In 1985, the then six member states, Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore and Thailand signed the ASEAN agreement on the Conservation on Nature and Natural Resources. Some signatories have since taken steps to implement the agreement (Thailand, Indonesia and the Philippines), but it has not yet entered

into force (de Klemm *et al.* 1995). The Contracting Parties undertake to adopt individually or through concerted action the measures necessary to maintain essential ecological processes and life support systems, to preserve genetic diversity, and to ensure the sustainable utilization of harvested natural resources. Parties are required to develop national conservation strategies which should be coordinated within the framework of a regional conservation strategy (de Klemm *et al.* 1995). The 1994 ASEAN Ministerial Meeting on the Environment agreed that the entire ASEAN sub-region was to be regarded as one ecosystem, particularly in the fields of transboundary pollution and the management of natural resources. This was in part prompted by the critical issue of extensive forest fires at that time in Kalimantan, Indonesia, which severely affected the air quality in Singapore and Malaysia (Lye 1995). However, as witnessed by the 1997 forest fires and resulting smoke pollution, responsibilities remain unclear as do effective channels of communication.

The 1985 agreement provides *inter alia*, guidelines for the conservation of species and ecosystems, the maintenance of genetic diversity and outlines the appropriate measures that need to be taken including the recognition of endangered and endemic species. Article 5 (2) of the agreement states that each contracting party shall, wherever possible, apply protective and management measures to species endangered at national level. Article 5(3) states that the contracting parties should recognise their special responsibility in respect of species that are endemic to areas under their jurisdiction and shall undertake, wherever possible, all the necessary measures to maintain the population of such species at the highest possible level (Koh 1997).

MECHANISMS FOR FUNDING

If the responsibility of conservation is to be focussed in regions of high biodiversity, then it has been suggested that funds generated at the national level need to be supplemented by funds from international sources. A number of mechanisms are currently available for transferring funds from industrialised nations to the tropics; the most important of which are the Global Environment Fund (GEF) and the Biodiversity Convention (McNeely *et al.* 1990:123; Newcombe 1995; Weatherly 1995).

It has also been suggested that when possible

conservation should be supported to the maximum extent possible through the market place through appropriate policies from the central government or in association with return of profits from the exploitation of biological resources (McNeely *et al.* 1990). The reservation for conservation of 9.7% of a 973,000 ha forest concession in the Malaysian state of Sabah by a statutory body, the Sabah Foundation, has proven to be an innovative management step which in part sees the resource user subsidising conservation (Marsh & Greer 1992). However, such efforts leave little room for international participation other than at a research level.

EXISTING COOPERATION

There is a considerable legal framework already in

place for the potential sustained conservation of a significant portion of the region's biodiversity. Malaysia and Singapore cooperate at a number of different levels within an international forum as signatories to a number of global conventions (Table 1). Both countries have yet to ratify a number of important conventions. For Singapore this may in part be explained by the perception that due to its comparatively small size there are limits to how the state may effectively contribute; however, it has been pointed out that it remains important that they do so as this may encourage momentum within the region (Koh 1997:8). It might also be added that being a signatory to a convention does not necessarily mean that the objectives of the convention can or are implemented. Some parties may delay ratification until they feel that they are able to implement the requirements of the convention.

Table 1

Multilateral treaties of significance to Malaysia and Singapore. The ASEAN Agreement on the Conservation of Nature and Natural Resources has to date only been ratified by Thailand, Indonesia and the Philippines. The Convention on the Conservation of Migratory Species of Wild Animals has entered into force in the Philippines only (1 February 1994). The two agreements are included as it may be considered that the above package of conventions, if enforced, would provide an appropriate framework for international conservation between Malaysia and Singapore and indeed ASEAN.

<i>Name of Convention & Date Entered into Force</i>	<i>Malaysia</i>	<i>Singapore</i>
International Plant Protection Convention - 03 Apr 1952	17 May 1991	
Plant Protection in Southeast Asia and the Pacific Region - 02 Jul 1956	20 Nov 1957	
Convention on Fishing and Conservation of the Living Resources of the High Seas - 20 Mar 1966	20 Mar 1966	
Convention of the High Seas - 30 Sep 1962	30 Sep 1962	
Convention Concerning the Protection of the World Culture and Natural Heritage - 17 Dec 1975	07 Mar 1989	
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)- 01 Jul 1975	18 Jan 1978	28 Feb 1987
Global Convention on Wetlands (RAMSAR) - 21 Dec 1975	10 Mar 1995	
Convention on the Conservation of Migratory Species of Wild Animals - 01 Nov 1983		
United Nations Convention on the Law of the Sea (UNCLOS) - 16 Nov 1994	14 Jan 1997	17 Nov 1994
ASEAN Agreement on the Conservation of Nature and Natural Resources		
Convention on Biological Diversity - 29 Dec 1993	22 Sep 1994	20 Mar 1996

Sources: World Conservation Monitoring Centre (1992); (Koh 1997); Consortium for International Earth Science Information Network (1998).

BIOREGIONAL MANAGEMENT

Increasingly there is recognition that the future for cooperation on species and habitat conservation within a multinational biogeographic framework must lie with regional management and cooperation. When cooperation is extended to an international level there is also the potential to benefit further as a broader range of skills and contributing institutions may be drawn upon (Miller 1996). The resulting emergence of *bioregional* management programmes has led to a general shift in focus from the more traditional protectionists policies towards more integrated conservation programmes which include broader social and development needs. The adjustment is one from having to meet national conservation objectives, towards one that encompasses ecosystem based projects. However, the basis of bioregional management programmes is often a conciliatory, bottom up approach with a focus on the conservation of contiguous ecosystems which may or may not be within the same country. Such an approach is often part of a more integrated development programme, drawing upon a strong ethic of place and stewardship and the framework appears to be suitably applied to North America and Australia (Miller 1996:8).

Many bioregional programmes are within a single country, e.g. Great Barrier Reef Marine Park Authority, Australia or the Greater Yellowstone Ecosystem, USA, where different public agencies manage a region (Miller 1996). Malaysia and Singapore are separated by the heavily utilised and trafficked Straits of Johore; consequently the shared boundary has no obvious localities and systems for cooperative conservation candidature. However, the littoral states of the Malacca Straits — Malaysia, Indonesia and Singapore — are able to cooperate on general environmental management issues such as dealing with oil pollution (Chia 1995). Bilateral cooperation is greatly simplified when the protected areas straddle terrestrial boundaries. Within the region Malaysia and Indonesia have had some success cooperating on transfrontier protected areas at Samunsam and Tanjung Datu, Sarawak and Hutan Sambas, Kalimantan on the island of Borneo (Thorswell 1990:20).

The agenda and initiative for bioregional management programmes has largely been driven by examples with more obvious needs for international cooperation. For example, the Greater Serengeti Eco-

system encompassing parts of Kenya and Tanzania. However, the direct linkage and geographic setting prevent reasonable comparison with the fragmented forest systems of Malaysia and Singapore. More appropriate for comparison is the tri-country cooperation between Denmark, Germany and the Netherlands and the management of their respective portions of a shared ecosystem — the coastal zone of the Wadden Sea. The case is reviewed by Miller (1996) and the essential points are reproduced below. Of particular interest is the balance between the political and legal concerns within the programme alongside issues related to the national sovereignty of three countries. Each country has distinct and differing conservation priorities; however, all are committed to the central goal of conservation. From the example several points were highlighted as being important lessons learnt (Miller 1996:31).

- i. The need for inter-governmental mechanisms can be minimal if local and national land and conservation institutions and practices are well established. It was considered more practical to harmonize the very different conservation and management practices within existing national legal and administrative systems.
- ii. As the trilateral programme evolved a common secretariat was installed to facilitate political activities and implement agreed measures, collect and disseminate information in conservation measures and study and publicise activities.
- iii. States were able to retain full sovereignty over the relative management programmes and issues whilst still being able to meet the international conservation objectives.
- iv. The Wadden Sea programme provides an example of an international management plan that can address issues as distinct as marine pollution and wildlife and habitat conservation. Detailed conservation objectives can be integrated into country programs, once agreed upon and specified through dialogue backed by research and analysis (Miller 1996).

The Wadden Sea programme has worked well using political commitment rather than depending upon legal means. While legal agreements are binding in theory, their implementation in practice may be no more certain than political commitments (Miller 1996). Such a management framework is reliant upon serious political commitment and requires the institutional capacity to implement

objectives. However, in the Asia-Pacific region the government agencies responsible for protected area management are often limited by lack of resources and political influence (Braatz 1992). It may also be taken from the Wadden Sea example that the initial cooperation should focus on no more than two or three common concerns and interests.

Some of the lessons and basic concepts of bioregionalism must be examined for possible adoption within ASEAN. Malaysian conservationists are faced with problems of fragmenting and diminishing habitat; while neighbouring Singapore is left with severely depleted habitats and with few options for participation. While the wider framework of ASEAN and other multinational treaties provide guidance as to the general objectives of international conservation concerns, it would appear that the forum is not suitable for determining specifics applicable to national and bilateral programmes. Only at a reduced level of prioritised habitats within biounits in Southeast Asia may specific issues be targeted. Decisions on what to conserve and where, would be made by utilising biogeographical criteria alongside national and international needs and ability to pay. If a comprehensive bioregional plan were to be developed it could be envisaged that, at one level, all the countries within a subunit would regularly assess the status of conservation within national domains and the results would be coordinated by appropriate biounit secretariats. Such a management approach could be extended progressively through ascending orders of biogeographic units. Although theoretically the ASEAN agreement already provides for such an agreement, the implementation of any serious integrated conservation programmes has yet to take place.

DISCUSSION

Outlined above is a general assessment of conservation status of terrestrial conservation areas within the Malaysian biounit. Malaysia having a much larger land area is currently the major contributor towards biodiversity conservation within the unit. Singapore, being much smaller and an island at the edge of the biounit, has a more marginal role to play in terms of *in-situ* conservation efforts.

It would appear, that if maintained, the existing protected area coverage in Peninsular Malaysia is adequate (Dinnerstein *et al.* 1996). Whether or not

these areas will continue to remain ecologically viable, however, is still uncertain. If fragmentation of habitats in Peninsular Malaysia was to continue to the extent that they reach the diminished and isolated form of the remaining habitat in Singapore then the future for the biodiversity of the unit looks bleak. Logistically it is no longer possible for Singapore to continue to fully participate in biodiversity conservation by setting aside larger or more conservation areas. However, Singapore could participate further in *in-situ* conservation efforts within the biounit if a suitable participatory mechanism for doing so were enabled.

If a purely pragmatic approach to conservation issues within the biounit was to take place, it is entirely possible that Singapore could be relieved of any specific responsibilities that required the setting aside of actual conservation areas. Differentiation at a subspecies level does occur on the island as it is near the extremes of some species range. However, all but one species and a handful of subspecies are found elsewhere within the unit. This lack of endemism and the small size of the island compared with other conservation areas in the biounit would preclude the island from being singled out for any particular conservation potential (Figure 2). An important exception to this would be in ensuring that sites for passage migrants remain accessible, facilitating inter and intra-unit conservation. However, as a Nation State a broad spectrum of conservation issues demand attention at a local level and for a small land area many issues, including conservation, are disproportionately elevated. This is particularly so when compared to the conservation status of the similar sized nearby islands of Malaysia and Indonesia. For example, Islands within the Riau group, which as part of a large national land area, generally have a low conservation status, with representatives of the fauna and flora being conserved elsewhere.

Located within a region of such high biodiversity Singapore suffers some harsh per unit area extinction comparisons with other countries. Singapore remains one of the few cities that has retained some original (forested) habitat within its suburbs. In most urban areas the original habitat is quickly lost and at best is substituted by parks, partly in response to aesthetic and functional demands and partly because conservation can be excluded to rural hinterland regions. In a more realistic city by city comparison Singapore would probably score highly.

This should not, however, absolve Singapore

from its conservation responsibilities although they are complicated by its status as a small island state. For example, the phenomena of species, particularly birds, being rare or at risk in Singapore but still common or abundant in Malaysia raises a number of important issues. This provides a possible dilemma for conservation efforts, extending beyond purely biological conservation criteria and into areas of social cognizance and national identity. Should resources be made available for the safeguarding of locally threatened species when they are abundant elsewhere? Presently there are no areas within Singapore or Malaysia specifically designated for the protection of specific species.

In Singapore the dilemma may be illustrated by the example of the Crested Serpent Eagle (*Spilornis cheela*) the present population of which is thought to consist of only two resident individuals. Across the nearby causeway in Peninsular Malaysia the bird is common (Lim 1992; Strange & Jeyarajasingam 1993). There could be a case nationally for trying to secure the viability of the species by a controlled re-introduction programme. However, it could equally be argued that, as the species remains viable elsewhere, specific conservation efforts be abandoned. Such action, however, would impose upon aspects of national decision making and it is unlikely that the people of either nation would welcome such utilitarian interference. Such intervention would also undermine an important aspect of conservation: the inclusion of local peoples. Of crucial importance in most national conservation efforts is the contribution of participatory conservation groups ranging from NGOs, committed activists and the casual natural historian.

The management emphasis for the national park system in Singapore is on providing a well managed public utility. In much the same way that integrated park management is essential to accommodate the needs of local people in larger protected area systems, the same principles apply in Singapore. As with other protected areas there will be competing demands for the land and/or the resources within the park. If the general public in Singapore were not interested stake holders, the viability of the park would be compromised particularly if the parks were seen as exclusive. As such, an integral part of the conservation effort at Bukit Timah is that public access is ensured (*Straits Times* 17/5/1995). In this way the protected area provides value to all interest groups.

With an increasing awareness of nature amongst Singaporeans the demands placed upon the park system will continue to increase. This is also evident domestically by the popularity of housing near the Bukit Timah Nature Reserve (*Straits Times* 27/9/1996) and internationally by the number of Singaporeans visiting the National Park (Taman Negara) in Peninsular Malaysia. The bulk of the visitors entering Taman Negara are Malaysians, while Singaporeans made up the largest foreign tourist group (Laporan Tahunan 1995) Ideally, tourism revenue should in part contribute to the upkeep of park systems and also provide an alternative demand for the park, other than conservation, thus helping ensure its future. This issue hinges on accepting tourism revenue as an equitable form of compensation.

Although highlighted here by the case of neighbouring countries within the same biounit the issues extend well beyond the local and regional scales to an international level. The reliance of one country upon others to provide wilderness areas for recreation, or for biodiversity conservation purposes, is often taken for granted and assumes that the costs of not developing the resource in a more traditional fashion are being met by the tourism activities, or it is a cost that is subsidised by the nation concerned (Pearce & Moran 1994). More often than not the bulk of that cost is borne locally and thus the conflict between protected area management and the needs of local people (Pearce & Moran 1994). The biodiversity issues within such a debate are still not clear and will only become apparent if or when biodiversity can be truly accounted for economically. Such values will become more apparent with time as external costs of biodiversity loss increase (Miller 1996).

A moral standpoint on conservation of biodiversity could be that economic values should not play a role in determining what should and should not be saved and biodiversity should be worthy of conservation in its own right (Pearce & Moran 1994). Some proponents of conservation would rather have it that a region or locality is not developed. However, this does assume that if economic development does not take place or fails locally then there will be no further loss of biodiversity.

As societies develop economically there is an increased willingness by individuals to participate in conservation and at an international level, some countries, if not fully reimbursed, end up subsidising a global good. It has been suggested by Pearce

and Moran (1994) that this can be remedied by either making sure there are sufficient benefits at a local level or a system of international compensation is formulated. Such global environmental markets (GEMs) where compensation occurs through the development of a market of the conservation goods, are beginning to emerge under the Global Environment Facility (Pearce & Moran 1994).

It can be seen that on a global scale biounits, particularly within regions of high biodiversity, are lumbered with a considerable responsibility to maintain what they have. At a local level, the development of Singapore shifts part of this responsibility to Malaysia in two ways: (i), as species become locally extinct the conservation responsibility is shifted to Malaysia; (ii), as Singapore continues to develop its own limited land areas, increasingly the outdoor recreational demands of the population will switch to other countries.

CONCLUSION

In trying to achieve the objective of maintaining regional biodiversity it is unrealistic to envisage that large areas of land can be further gazetted as protected areas although the existing network may be supplemented by smaller state parks, in the case of Malaysia and small nature reserves, within Singapore. Given the vulnerability of the existing areas it remains important to ensure that the existing reserves, no matter how small, remain fully and properly protected if a continued collapse of biodiversity is to be halted.

As fragmented patches of habitat increasingly

dominate the contemporary landscapes, there is an increasing need to incorporate them within mainstream conservation frameworks. The suggested bioregional management approach and the pooling of resources does provide a mechanism for nations sharing biounits to contribute to biodiversity maintenance beyond national boundaries.

Within ASEAN there is no shortage of resolution to make progress with good conservation management; the difficulties arise at a local and national level in the first instance. The implementation of effective domestic conservation policy is constrained not necessarily by funds or lack of commitment per se, but the legal and political difficulties associated with changing land ownership. Additional acquisition of land, if indeed an option, requires altered legal status of forest lands and the transfer of land titles — issues which are particularly difficult to resolve. If this process is extended to a level requiring international participation, then surely all aspects of management increase in difficulty, particularly as national sovereignty may be open to compromise. The commitment of funds to Malaysia by Singapore cannot realistically be used to extend existing protected area networks due to such constraints. However, funds could potentially be earmarked to supplement ongoing projects. Existing international conservation policy remains constrained by the norms of international relations which essentially excludes the *in-situ* participation of one country in another. With this in mind it is likely that Singapore will continue to play a relatively minor, although increasingly important supplementary role, through the provision of *ex-situ* conservation support.

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