

Chapter 2. Status of Biodiversity in Asia

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The status of biodiversity

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SUMMARY

This chapter presents a broad overview of the richness, importance and status of biodiversity in Asia. Asia, one of the richest biological regions of the world, is facing an ecological crisis due to population pressure. The region has an average human density eight times higher than the rest of the world; this puts enormous pressure on land and biodiversity resources. A collapse of major ecosystems and species populations is not only eroding livelihoods for billions of the earth's poorest citizens but is causing major environmental disasters in the form of floods, landslides, droughts, desertification and smoke haze. These problems are crippling the development of Asia's agricultural and industrial sectors.

In addition to loss of habitat due to logging and agricultural expansion, wildlife trade (both legal and illegal), pollution, alien invasive species, climate change and the threats posed by genetically modified organisms (GMOs) are growing problems in the region. The most important issue is to recognize the huge benefits being derived from biodiversity and ecological services and develop ways of taxing the main beneficiaries to reward those regions and communities whose actions either enhance or refrain from destroying such services

Key issues

- Asia has hugely valuable biodiversity resources, upon which the livelihoods of billions of people depend.
- Biodiversity is being lost on all fronts at unprecedented rates.
- New threats are emerging, which biologists are poorly prepared to deal with.
- The current rate of increase in protected areas and associated improvements in management of biodiversity resources is failing to achieve conservation objectives.

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- Major changes in transparency and accountability is needed in resource allocation and land-use planning.
- Greater emphasis must be placed on the economic issues at stake.
- Planners must consider all the costs of the indirect damages that their developments may cause to the environment.
- Improvements must be made in monitoring and reporting on the state of biodiversity.
- A greater share of the real and potential benefits from biodiversity must be given to those stakeholders who will otherwise destroy their holdings in search of a better living.

The state of biodiversity conservation in Asia

Biodiversity is the living part of our environment, the total richness of living forms and life processes of our planet. It includes the full range of ecosystems, their component species and the genetic varieties of those species. Biodiversity includes not only natural life forms but those forms which have been selected and shaped by human domestication, breeding and even genetic engineering: agriculture, fisheries, forestry, horticulture, wildlife management, nature conservation and human resources.

The countries of Asia have great biodiversity importance and richness, ranking with South America as the richest place on earth for variety of living forms. Of the world's 25 recognised biodiversity hot spots, seven are in Asia (Mittermeier et al. 2000). These hot spots cover the entire ASEAN region plus the Western Ghats of India, Sri Lanka, southwest China and the eastern Himalayan countries of Nepal, Bhutan and India. The Hengduan Mountain area of China is the richest temperate ecosystem in the world.

Although Asia covers only 14 per cent of the globe, it is home to over three billion people, about half of the world's population. Human density is eight times higher than the world average. The population grows very fast and many of the countries are very poor. The pressure on biodiversity is great and urgent; humans annually mobilize approximately 40 per cent of the total primary production on land. These figures emphasise the huge dependency on biodiversity resources and the need to manage them wisely.

Biodiversity loss is unlike loss in other sectors because it is essentially irreversible. A species lost is lost forever and the ecosystems it lived in are degraded a little bit more. The constant dilemma is trying to meet ever-growing demand with ever-shrinking resources.

Why is biodiversity so important?

There are four kinds of benefits derived from biodiversity:

1. Direct harvesting, including plants or animals for food, fodder, medicine, fibre, dyes, fuel, construction materials and other uses.
2. Social values, including aesthetic, cultural, recreational, education and research benefits.
3. Environmental services of ecosystems, such as climate regulation, flood and drought control, consistent water supply, nutrient recycling, natural pest control, pollution cleansing and soil generation.
4. Development potential, through domestication, development and improvement of genetic resources and biotechnology. Huge numbers of microorganisms have their own antibiotics and scientists have hardly begun to identify potential uses. Biotechnicians can now isolate useful genes and transfer them to different species to create new varieties with new properties.

The total value of these products and services is enormous. The value for China alone has been estimated at \$257-421 billion per annum (Wang and MacKinnon 1997); a total calculated value is \$5000 billion (SEPA 1998). It has also been estimated that more than 40 per cent of the world's economy and 80 per cent of the needs of the world's poor are derived from biodiversity.

But despite these benefits, and despite the fact that most countries are clearly trying hard to conserve biodiversity, have signed international conventions for this purpose, have developed national legislative frameworks and established system of protected areas, the situation remains desperate.

Status of Asia's biodiversity

Feedback concerning the status of Asian biodiversity is not promising, either in terms of major habitat types or individual species. The WWF's Living Planet Index, for example, which measures components for forest, freshwater and marine ecosystems, shows continuous decline, with a total loss of 30 per cent since 1970 (WWF 1999). Asian countries score among the lowest in the world.

Forests

Asia has lost two thirds of its original forests. The remaining forests are disturbed and fragmented to varying degrees, and are located mostly in less biologically rich montane zones (montane forests do have a high proportion of local endemics). Forests continue to be destroyed (Appendix 1); forest fires in Borneo and Sumatra have destroyed more than five million ha in four years. The smoke from these fires creates the haze that has become the topic of

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concern for a special ASEAN task force. Of 112 deforestation hot spots identified globally in the humid tropics by the TREES program, 41 are in Asia. As that study concludes: "The picture, which emerged at the end of the analysis conducted during the "hot spot" meeting, is a relatively bleak one. The information presented on these maps is cause for concern because it seems to indicate that the processes are steamrolling over large areas and may be irreversible" (Archard et al. 1998). Between 1960 and 1980 Asia lost almost a third of its tropical forest cover, the highest rate in the world (Bryant, Nielsen and Tanglely 1997).

Wetlands

The AWB report on wetlands concludes: "Undoubtedly the most important fact to emerge from the Asian Wetlands inventory is that the great majority of natural wetland ecosystems in southern and eastern Asia are under threat... Most of the threats to wetlands in Asia are a direct consequence of the need to feed and house this massive and ever-increasing number of human beings" (Scott and Poole 1989). The Asian Wetland Symposium of 1992 concluded that: "...wetlands are being lost and degraded rapidly in Asia, as well as in other regions, and many people are paying the cost, some with increased cost of living, and some with their lives."

Marine

The WRI report on coral reefs states: "Fifty-eight percent of the world's reefs are potentially threatened by human activity — ranging from coastal development and destructive fishing practices to overexploitation of resources, marine pollution, and runoff from inland deforestation and farming. Coral reefs of Southeast Asia, the most species-rich on earth, are the most threatened of any region. More than 80 per cent are at risk." (Bryant et al. 1998).

Rises in temperature associated with El Nino and global warming have caused 180 coral bleaching episodes in the past nine years; this compares to 100 events in the preceding decade and only three recorded events in the previous century. These episodes have killed 95 per cent of all shallow-water corals in the Indian Ocean.

Species

The news on all fronts is bad — there is barely a single success story on the Asian horizon. The last decade has seen continuing drops in populations of big mammals such as elephants, tigers, bears, antelopes and wild cattle. Populations of marine turtles, freshwater fish and amphibians continue to

slide, and many primate populations are in serious decline. Rijkssen and Meijaard (1999) estimate that 97 per cent of the Bornean orang-utans have been eradicated during the last century and that 33 per cent of the survivors have been lost in the last four years. BirdLife International's 1994 review of globally threatened species showed that four of the world's top five countries in terms of numbers of threatened species were in Asia (Collar, Crosby and Stattersfield 1994). A total of 323 species are included in the new Bird Red Data Book for Asia (Collar et al. 2001). The Philippines holds the dubious distinction of having more endangered species per unit area than any other country on earth. Each time a country reviews conservation status, the numbers of recorded threatened species rise. In a recent brainstorming meeting in Thailand, 554 vertebrate species were identified as nationally threatened (OEPP 2000) compared with the 88 listed as globally threatened by WCMC (1994). The Vietnamese Red Data Book (MOSTE 1992) lists 290 threatened vertebrates in Vietnam compared with 81 in Appendix 2. Globally threatened lists will likely be greatly expanded when the majority of countries have completed their own national listings. The rate of change is huge: "The wild bird trade has been estimated to involve somewhere between two and five million specimens per year and the largely undocumented trade in Chinese songbirds, mainly to east and Southeast Asian destinations, may add another one to three million birds to the total" (Nash 1993).

Protected areas

There has been satisfactory growth in the numbers and size of protected areas throughout Asia for the past two decades (Appendix 1 presents figures for most countries). Several countries have crossed the ten per cent coverage threshold advocated by the 1992 Caracas Action Plan. This growth, however, has to be seen in the context of shrinking natural habitats, standards of management of the protected areas, criteria of the various protected areas and the actual amount of "natural" habitat inside the protected areas. Official figures can be misleading; for instance, while categories of protected areas included under the Philippine National Integrated Protection Areas System constitute a healthy sounding 12.8 per cent of the country, only 3.2 per cent actually comprise "remaining natural" habitat inside protected areas of IUCN categories I to IV. The remainder is degraded or converted habitats or in protected areas of categories V and VI which are not primarily for the protection of biodiversity conservation.

MacKinnon (1997) provides a detailed analysis of the protected area system of the region. "There is an overwhelming sense among reserve managers and conservation planners that the current level of effort is insufficient to stabi-

lize rates of habitat loss, which continues at an unacceptable rate. Indeed, despite apparent success in getting large areas of natural habitat included in protected area systems, the overall situation for biodiversity conservation looks worse than it did ten years ago”.

Major threats to Asia's biodiversity

The long-recognized trends in habitat loss and unsustainable harvesting of nature remain the most serious threats to biodiversity in Asia, but there are changes in the pattern and new threats emerging.

For example, the loss of the lowland forests of Borneo remains a top concern in the region but the cause is fire and conversion to plantations rather than just logging. New terms like “global warming” and “genetically modified organisms” define major threats. These terms were hardly known ten years ago. More attention is now being paid to marine issues. The sea still looks blue and beautiful but under the surface is a tragedy of damaged reefs, poison or dynamite residue and dolphins rotting in trawl nets.

Most marine fishery stocks are now reduced to between one and ten per cent of levels at the turn of the last century. Some important component fishery species are extinct. It is possible to think that the situation is in hand; more fish are caught than ever before, but at about 50 times less return per fishing effort and by accepting as edible many species that were formerly discarded. The same is true of the forestry sector — wildlife, tropical forests and wetland systems are heavily degraded and destroyed.

We suffer from the trap of the shifting paradigm of sustainable use. Each generation strives to maintain its own level of productivity, but every time the status quo fails to be preserved the production system degrades a little further and the targets of sustainability slip ever lower. Natural biological systems could be far more productive but to reverse the slide substantial investments are needed in ecosystem restoration and restocking. A higher standard is required than just maintaining a certain level of productivity; there should be an active program to restore production levels of natural ecosystems to what they were a generation ago. There are exciting and rewarding challenges to restore forest cover, restore the health of wetlands and seas, regenerate coral reefs and restore lost species of plants and animals.

The Western Great Development program of China is an example, with plans to restore forest cover over 18 million ha of degraded lands. This is expected to improve ecological services to relieve the flood and drought problems that now afflict that country each year.

The “tragedy of the commons” remains a constant problem. How can we control levels of harvesting and use of biological resources so that the resource stocks can recover and give us maximum sustainable yield? Asia will have another 1.5 billion mouths to feed by the year 2030.

New problems are arising: the spread of alien species, facilitated by the globalisation of trade; and the special risks posed by release of GMOs resulting from the work of biotechnicians. Methods must be found to ensure adequate risk assessment and safe field testing of these organisms — once released into the environment, these organisms cannot be recalled. GMO technology is the most powerful tool invented since nuclear fission.

Tinkering with genetics could result in the release of rogue weeds or animals, or rogue diseases hazardous to human life and welfare. Irresponsible countries may even resort to sabotaging a rival’s productivity by the deliberate releases of such organisms. The potential abuses for human cloning are too awful to contemplate. There is also a danger of biological domination, where certain companies or countries obtain monopolies of the supply of superior varieties of foods, a practice totally incompatible with the concept of “fair and equitable sharing of benefits from use of genetic resources” advocated in the Convention on Biological Diversity (CBD).

The most immediate concern in introducing a GMO is the risk to the host environment. Will the organism spread uncontrolled as a weed, out-competing, destroying or crossbreeding with valuable local forms? Is it free of any infectious viruses or diseases that could spread to other organisms? Is the organism safe to eat, with no long-term health risks?

These questions are not new. The same concerns accompany any introduction of a new life form into a native environment either deliberately or by accident. The world is already full of disastrous examples. Charles Darwin described the spread of European *Cynara cardunculus* in South America: “I doubt whether any case is on record of an invasion of so grand a scale of one plant over the aborigines” (Darwin 1839).

The countries of the ASEAN region already suffer from the spread of many pan-tropical pests: *Lantana camara*, *Eupatorium odorata*, *Eichhornia crassipes*, European rats and African and European diseases. Native species of fish have been lost as a result of release of African cichlids. The move towards globalization of trade has greatly increased the speed of unwelcome invasions.

More than 100 marine species have spread from the Red Sea into the Mediterranean as a result of the Suez Canal. Millions of tons of seeds and micro-

organisms are transported around the world in ship ballast (Sandlund, Schei and Viken 1999). Every grain ship docking in China brings in about 120 tons of unwelcome weed seeds; 200 species of such weeds have been intercepted at Shanghai.

Article 8 of the CBD calls on member countries to “prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats and species.” Some countries, such as Australia and New Zealand, have applied stern quarantine regulations for many years.

Accidents happen because countries have been lax in tackling these problems. Perhaps it takes the irrational fears of new genetic monsters resulting from GMO technology to finally get people to think more seriously about the types of safeguards and controls needed to take to protect the earth’s precious biodiversity and our own health and welfare.

Deliberate introductions can be as bad as accidents. After Florida beekeepers introduced *Melaleuca* trees they claimed to have gained benefits of \$15 million yearly as a result, but recent studies calculate that the introduction is inflicting annual losses of \$169 million yearly in Florida because of the cost of controlling infection into tourism areas (Sandlund, Schei and Viken 1999). In ASEAN, widespread planting of Australian Acacia trees is seen as beneficial for fixing nitrogen into poor soils and for providing fast-growing species for pulp, but these species are spreading feral through evergreen forests, making them more fire prone and adding to the region’s haze problems.

Underlying causes of the threats

The threats outlined in Appendix 3 have underlying causes related to population growth, demographics, trade pressures, political instability, perverse incentives, economic performance, poverty, corruption, lack of law enforcement, poor protection standards, lack of awareness and lack of information.

One of its effects of population growth has been the repeated splitting of farms to pass on to descendants. This means that the average farm gets smaller and smaller. Most family farms in Asia are less than one hectare — so small that they cannot support a family’s needs. Large numbers of people are leaving the land to seek new jobs in the towns or become migrant workers overseas. Others go hungry or squat and clear state forests. The “green revolution” has only had a major impact in large, flat deltas and valleys; there, conversely, the average farm is getting larger as farms combine for greater efficiency. Rich farmers get richer and poor farmers get poorer.

Conversion of natural habitat to short-term marginal agriculture or plantations, and damage from fire and oil spills are threats that often stem from planners' failure to understand the true values of natural biodiversity. A hill of scrub may appear to be unproductive but in fact serve a valuable function in catchment protection. Studies in China's Hubei province showed that degraded forests generated 40 times more benefit from enhancing downstream hydro power production than they did from timber and fuelwood. Such findings empowered leaders to ban logging. By increasing hydro production, the government could afford to subsidise farmers with free electricity; to pay them to protect forests, rather than cutting them. This has brought another positive result, since the forests have improved and now support the generation of even more electricity.

The pressures on biodiversity are not always obvious, and economic incentives, subsidies and policies sometimes fail to recognize marginal costs. For instance, timber licences are granted on the basis of earnings figures that do not include either the loss of biodiversity capital (wood biomass), the effect on climate or the downstream damage through erosion or hydrological change. Similarly, the removal of a government subsidy on paraffin in Myanmar made the sale of charcoal much more profitable and half the mangroves of the Irrawady delta were quickly lost.

In addition, countries are often unable to apply the policies to their own resource use because of international macro-economic relationships and adherence to rules of the World Trade Organisation (WTO).

Tools to counter the threats to biodiversity

Establishment of protected areas (PAs)

PA systems vary greatly in extent and effectiveness. Bhutan has 25 per cent territorial coverage, with all ecosystems represented, a system of genetic corridors linking all PAs and little pressure from local people on the protected lands. Myanmar still has less than 1 per cent PA coverage; while China has about 10 per cent, other than one or two giant reserves they comprise over 1000 very small areas, most of which face enormous human pressures.

PA systems have been greatly strengthened over the past decade. Indonesia, Malaysia, India, Sri Lanka, Brunei and Nepal already had significant PA systems by the 1980s. Bhutan, China, Cambodia, Lao PDR, Vietnam and Thailand have made notable advances in setting up protected areas during the 1990s. Myanmar is slowly setting up reserves but still has a long way to go. It is

heartening to see North Korea at last taking an interest in biodiversity conservation and emerging from a long isolation to take its place in international fora on biodiversity issues.

Standards of management of protected areas in Asia remain generally low. Protected areas often have inadequate budgets and poorly trained and badly equipped staff. Most PAs are already highly damaged and contain human settlements within their boundaries.

Efforts to solve these problems have included evicting local settlements and integrated development projects or buffer zones, as well as allowing local people inside reserves and zoning a few core areas in a mosaic of land-use with varying degrees of conservation as the management objective. None of these approaches has been very successful. Finding solutions to the conflicts of interests between local people and biodiversity conservation remains one of the great challenges for the next decade.

Despite all these problems, a recent analysis of the effectiveness of protected areas in protecting tropical biodiversity (Bruner et al. 2001) concludes that, by and large, protected areas are successful, but require marked boundaries and a guard force on the ground.

Controls of harvesting and trade

Most Asian countries have embraced the concept of sustainable use in their policies and strategy. The International Timber Trade Organisation (ITTO) is developing mechanisms of certification to promote products harvested on a sustainable basis. CITES reporting and watchdog work by such agencies as TRAFFIC are helping to reduce unsustainable trade in wildlife products. International fisheries agreements are also helping. Despite all these mechanisms, however, forests are still being destroyed and degraded, wildlife trade is growing and clearly not sustainable and fisheries stocks fall ever lower.

A major factor in trade and harvest pressure is the emergence of China as an economic giant with insatiable demands for all kinds of products. The country is now a large importer of timber, grain and wildlife. Growing wealth in China fuels a growing demand for exotic wildlife foods and rare species considered to have medicinal properties. This puts enormous pressure on wildlife resources in Russia, Mongolia and along China's southern borders with Vietnam, Lao PDR and Myanmar. Trading and smuggling routes for reptiles extend throughout Southeast Asia; monitors at one trade point on the Vietnam border recorded 12 tons of reptiles crossing into China in one day.

China's demand for timber and pulp is also being felt in neighbouring countries. Deals with Malaysia involve the transformation of large areas of tropical rainforests in Borneo into Acacia plantations for pulp. This is causing a great loss of biodiversity and increasing the threat of fire, but the large sums of money involved override these concerns.

Demand in South China for large exotic fish, both food and ornamental species, is creating wide trade routes throughout the South China Sea and into the Southeast Pacific. Such trade endangers large groupers, sharks, sea horses and Napoleon Wrasse.

Chinese authorities are aware of these problems and are keen to maintain a good environmental image. In 1994 the government hosted the Beijing Declaration meeting, where China agreed with its neighbours to work harder in implementing CITES. Use of tiger and rhino products in traditional Chinese medicines has been banned. Law enforcement on the selling and eating of protected species in South China has been tightened, and efforts are being made to close some of the wildlife trade points on the Vietnam border.

In West China, trade works the other way round; China's wildlife is being threatened by outside demand. Thousands of rare falcons are smuggled through Pakistan to Arab countries every year as well as rare Chiru antelope (*Panthalops hodgsoni*) for the shahtoosh wool that commands such high prices.

In other parts of Asia, unsustainable harvesting of crocodilians, snakes, sea horses (Vincent 1996), parrots, songbirds (Nash 1993) and other wildlife is still a big problem.

Laws and law enforcement

Almost all countries have adequate laws for the establishment of protected areas and the protection of species, and most have suitable laws to prohibit or control trade and to require EIAs. Most countries have weak enforcement of these laws, partly because the law enforcement agencies and courts see biodiversity offences as trivial and pay little attention to strict enforcement. At the other extreme China has executed more than 30 people for wildlife offences involving killing or trading in giant pandas and elephants.

International programs

Almost all Asian countries are party to the CBD and most are also party to other conventions such as RAMSAR and CITES, as well as such international initiatives as UNESCO's Man and Biosphere (MAB) program and World Heritage

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Sites. It is clear that the officers of each country enjoy participating in the meetings of these conventions, but the contribution of these international programs is not easy to measure. While there is a lot of positive activity, it can distract from urgent domestic needs.

Ex situ/captive breeding

Many projects across Asia are devoted to experiments in ex-situ captive breeding or reintroduction of species. Some are probably undertaken out of commercial motives. A review of such projects by MacKinnon and MacKinnon (1991) shows that most of these ventures have been conservation failures (cases examined included rhinoceroses, oryx primates, carnivores and birds). There is really no alternative to preserving natural habitats.

Education and awareness

There is little awareness of the importance of biodiversity in almost all elements of society, even professional biologists and conservationists. Awareness must be generated through economic studies, education and special awareness programs.

Governments can do a lot through formal education programs and by adding more environmental content into other forms of learning materials. Government agencies are usually not effective in creating awareness services, and although NGOs have a commitment to promoting awareness they have limited resources and specific targets.

There is great potential to dramatically increase the quality and impact of educational and awareness materials by making better use of the new tools available. Computers and the internet are spreading into every corner of Asia. The audience is enormous but products must be competitive.

Awareness must be fostered through the use of computer games, sports, fashion and other distractions available on television or computers. Designing awareness campaigns should involve more communications professionals from the private sector.

Community participation

While it is clearly a mistake to alienate the local community from the management of forests, protected areas and other natural areas, the participatory approach currently fashionable has almost as many pitfalls as the old-fashioned ways of trying to move people out of protected areas. Too much of a participatory approach leads to a lowering of conservation ideals to meet local

people's demands for economic gain and access to land and resources. In many cases effective management will be unpopular. According to one analysis, the degree of local participation in management of protected areas was among several factors that seemed to have no impact on the effectiveness of biodiversity protection (Bruner et al. 2001).

Government has a responsibility to decide on the prescription needed, work with local communities to make the medicine more palatable and allow maximum local involvement in deciding the details of the treatment. Much of the success will depend on ensuring that a fair share of benefits — such as ecotourism revenues or bio-prospecting royalties — goes to the local community and is not taken away by external investors.

Much more dialogue is needed between land managers and the community. In many cases land-use decisions may have been not exactly what the local people want, but they are a far better option than the alternative, such as having their forests completely logged by an external agency. Compromises are needed.

Information systems

There has been a great deal of development of computerized database systems for biodiversity information. Many of these are sophisticated, high-technology initiatives such as geographical information systems (GIS), and a number of them can be viewed on the web. There has also been significant progress in data sharing and connecting data bases with networks. While some countries of Asia have only recently become connected to the web and access to some of the available data is still slow and frustrating, this is a short-term problem; web services are improving very quickly.

Bigger problems occur because agencies prefer to develop their own database system rather than use standard products. Many database developers are more interested in the sophistication and attractiveness of their system than in the data itself. Generally very little data is provided from the field to these databases. There is too much reliance on remote sensing rather than on ground investigation, and the vast majority of species records in major museums and collections remain undigitised.

There are still no accepted standards for reporting or descriptions for habitat types or other important parameters. Synonyms and incorrect scientific names add to the confusion.

Data on web-sites is often locked in an inflexible format such as a web page, from which the items of information cannot be easily extracted or even

updated by the data manager. Web pages are also extremely slow to download compared to raw data in text, tables or picture formats. There is huge potential for information storage analysis and access, but procedures for data recording, standardization and sharing protocols still need to be developed.

Environmental Impact Assessment (EIA)

EIA can be valuable in ensuring that marginal costs, such as indirect or long-term environmental damage, are taken into account when major developments are planned. In most cases, however, the EIA is paid for by the developer and consists of a consultant's whitewash.

The situation would be far healthier if governments insisted on higher levels of government, NGO and local academic involvement in the EIA process, greater transparency of the results of EIAs, and more rights of appeal for those whose lives may be directly or indirectly affected by a proposed development.

Ecotourism

Ecotourism is already a major economic factor in Asia. Tourism is the world's largest industry, generating \$3.4 trillion per year and providing 200 million jobs. Nature tourism is a large component of this industry, accounting for seven per cent of the total and growing between 10 and 30 per cent per year (compared to an overall growth of 4.5 per cent for all tourism). It is estimated that six million tourist visits to east Asia per year are nature based; this earns countries a total of \$5.5 billion (Lindberg et al. 1997).

This income is reflected in the development of airlines, hotels, food outlets, souvenir industries and other benefits, although the bulk of profits are made in or near capital cities and do not reach the nature destinations that lures the tourists to Asia. Entrance fees to most protected areas are minimal.

There is a huge potential to make money from tourism, but the market is competitive, fickle and specialized. Most protected areas would benefit from professional advice on how to capitalize on their potential.

Government leaders should be more aware of the economic benefits of nature-based tourism, should see it as a further justification for the establishment of protected areas and should design ways in which a more equitable share of profits can reach the poor rural areas that are the true destinations of such visitors.

Protected areas also need to greatly improve their interpretation of the scenery, vegetation and wild species for visitors. A primary role of ecotourism

must be to win support for the policy of nature protection. Too many protected areas opt out and offer easier entertainment such as a mini zoo or amusement park.

The role of planning

Although there are many underlying causes to the threats to biodiversity or weaknesses in the array of tools available to combat the problem, a lack of plans is not one of them. Indeed, in most country there is a plethora of plans of every kind. The plans may not be widely read or effectively implemented, however.

The willingness of external aid agencies to pay for such plans — including national studies and site-specific management plans — is evident, but the lack of implementation is worrying and underlines a basic problem. Much of the planning in the past resulted from external organizations trying to feed plans to national authorities. It was not truly collaborative and didn't arising from needs identified by a national organization. Some plans and studies are externally commissioned as a way for international organizations to have better information on the situation in a recipient country; many are the products of visiting consultants with very little national input. The number of plans produced has often exceeded government agencies' capacity to provide representatives for them.

A plan may be brilliant but if it is not implemented it is worthless; less than worthless, since it constitutes a waste of effort and resources. The lessons of the past 20 years show that governments must want plans, must put major efforts into them and have a feeling of ownership over them if they are to be followed and implemented.

Governments seem to be calling the shots now more than ever before. That is good news. It should be noted, however, that many protected areas in India, Sri Lanka and Thailand have been well managed for decades without any written management plan having ever being produced.

The role of research in biodiversity conservation

Research is needed to discover and develop new uses of biodiversity, enhance the benefits from those uses, make them more sustainable and share them more equitably. More effective ways to protect valuable biodiversity are needed. Research is also required to guarantee greater biosafety.

Research can be directed at reducing waste and damage in harvesting systems, including reduced-impact logging, secondary forest enrichment, less damaging

fishing methods, and agro-systems that maintain high biodiversity. Studies can take place in the areas between natural and artificial ecosystems; they are ideal for the buffer zones adjacent to protected areas.

It is also important to continue to document the value of biodiversity through its direct products and indirect services, as this information is needed to convince planners and leaders to develop conservation policies and make the necessary investments in conservation action.

Priorities for action

Generating greater public transparency

Some of the worst abuses of power could be avoided if countries adopted procedures that guarantee a greater degree of transparency in decisions relating to the disposal of, access to or developments that threaten valuable resources. CBD signatories have committed themselves to ensuring that the benefits derived from the sustainable use of renewable resources are shared in an equitable way and that the intellectual property rights of local peoples will also be respected. It is easy to sign the convention but real changes do need to be made in local laws and procedures to back up these commitments.

Empowering public opinion

Transparency alone will not prevent the misuse or unfair allocation of resources. The affected people must have a voice and a constituency. In some countries (e.g. Indonesia, Thailand, India and the Philippines) people have become vocal through the development of a powerful NGO network. In other countries (such as Vietnam, Lao PDR and China) the local people have little input; NGOs are rare and need more support and encouragement. The academics of each country have a responsibility to act as an independent voice, watching and commenting on the actions of government.

Creating greater access to information

Both the public and private sectors need better access to pertinent information so that correct decisions can be made, and wrong decisions identified and challenged. Biodiversity databases are multiplying across Asia; some are linked with networks and accessible over the web. Data is getting easier to obtain and agencies are more willing to share information. There is still room for improvement in this area. Key data holders would probably be less reluctant to share their data if better mechanisms were in place to prevent the misuse of data for commercial or exploitative purposes.

It is not enough to assemble data, however. Most of the people who need information are not even aware that they need it. Better analysis and presentation of data is also required.

Improving data reporting

PA reserve staff can be the eyes and ears of management and planners. They patrol in the field and can report on the condition of wildlife resources and habitat and on human activities. Simple reporting forms exist and have been field-tested but are very seldom used on a regular basis. Information from the field is rarely sent to the central databases used by decision-makers and biodiversity monitors. Reporting ability would be vastly improved if good local-language field guides were available which ensured more accurate field identification of species.

Improvements can be made to the flow of data, at the same time reducing the level of hard-copy report writing, by making greater use of the web. National reporting to international conventions (RAMSAR, CBD) or to the World Conservation Monitoring Centre (WCMC) is arduous and ties up too much staff time. It would be better for data to be kept on accessible web sites, where all requests for information can be redirected. The reports themselves are currently rather superficial and give a glossy overview, failing to reflect the true ground situation. Each country shows off a long list of protected areas but seldom mentions that these are poorly managed and contain settlements and degraded habitat.

There is also a tendency to fill reports with erroneous or misleading statements about biodiversity richness. Species recorded long ago but almost certainly no longer present are still listed in an attempt to justify continued investments.

Another misleading figure is species richness in relation to unit area. In fact the relationship between the numbers of species present in a given area and the size of the area are not an arithmetic but a logarithmic relationship. An area ten times the size of another would be expected to have only twice and not ten times the number of species present. The smaller an area the richer it will appear when that richness is expressed per unit area. Thus Singapore can claim to be much richer than other countries of the region although this is not biologically the case. The Philippines is made out to be the hottest of the hot spots on the basis of numbers of species and numbers of endemics per unit area but this is not a valid measure of biodiversity richness. The Philippines is biologically much less rich than many other areas in Asia when area is calculated correctly.

Another common error in reports is to provide lists of species for different places with a total of the sum of the parts. In fact there would be high levels of overlap between the respective species and the real totals would be much lower than those given. The ability to compare reports across the board would be much facilitated if countries would adopt some common terminology, classifiers and reporting standards; for instance, the term “per cent forest cover” can mean very different things in different countries. It may indicate all lands under forestry department control irrespective of tree cover, and it may or may not include secondary scrub, plantations, mangroves, water bodies, bamboo or all grades of tree cover.

Strengthening the forums for transfrontier dialogue and monitoring

Species do not respect human borders and often such artificial barriers to management hinder protection. There have been positive moves over the past few years to increase transfrontier dialogue, plan transfrontier reserves, agree to data-sharing protocols and hold technical meetings with neighbouring countries. Transfrontier programs have been mounted for monitoring migrating species, Asian waterfowl, trade and other issues. Subjects such as access to genetic resources and biosafety need to be given greater emphasis at regional levels. One idea pursued by UNESCO is the establishment of Peace Parks in transfrontier areas as a way to save biodiversity and reduce frontier tensions at the same time.

Generating and sharing of benefits from biodiversity

The great biological riches of the world are generally found in the poorest and least developed areas and the custodians of such wealth remain unrewarded for protecting these riches for so many generations or for the indigenous knowledge of this biodiversity. It is imperative that better mechanisms be developed to make it worthwhile to take care of biodiversity. The current system of allowing rich companies to profit from information and genes and patent both is clearly not the answer.

The ASEAN countries have reviewed a draft framework for controlling access to genetic resources which specifically rejects the concept of patenting the variants of life. This runs counter to aspects of WTO agreements. Revisions to existing agreements may be needed to ensure more fairness in benefit sharing while maintaining incentive to promote exploration and development of new products.

Another promising line is being explored in China. Certain types of taxes are being restructured to ensure that the beneficiaries of good water conservation — the agricultural, industrial and hydro power sectors — pay realistic fees. These taxes can be used in catchment areas in compensatory programs to reward poor communities whose development options are limited by the need to retain dense vegetation cover.

Strengthening and extending protected area systems

New ways must be found to help local people feel a greater sense of ownership of protected areas. Ecotourism usually involves external companies, who set up expensive hotels and bring in tourists, effectively taking the profits from travel, accommodation and food. This may bring money into national economies but it provides very few benefits for the nature destinations and almost none for local communities. The low salaries paid to guides are hardly a fair share for the community that has preserved intact wildlife or scenic attractions for hundreds of years.

The type of lower-level ecotourism set up by local people around reserves in Thailand is much more likely to gain local support for nature protection. Efforts are needed by national authorities, local communities and potential tourists to support this kind of tourism.

New ways need to be found to ensure that small isolated protected areas do not act as islands but are linked through intervening mosaics of land-use patterns that can act as corridors for many of the component species. The creation of genetic corridors (as in Bhutan) or biodiversity regions (as in China) are examples of new initiatives that should be further explored.

Governments should be urged to put greater investments into protected areas. It is a pity, when they have invested billions of dollars in terms of foreclosed land-use options, that they are unwilling to put down the few millions of dollars needed to ensure that these areas are managed properly.

Economic studies of protected areas would show that most of them make a huge contribution to national economies in indirect services and give very high rates of economic return for investment. Maintenance of protected areas is a legitimate target for loans from international donors.

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Appendix 1. Basic physical data

Country	Area ¹	Popn. ²	%human growth	%forest cover	%forest loss	%PA
Bangladesh	144	118	2.5	6	4.9	0.7
Bhutan	47	0.7	2.1	60	0.1	21.0
Brunei	5.8	0.3	2.5	75	0.4	21.0
Myanmar	677	45	2.0	43	1.4	1.0
Cambodia	182	8.5	2.2	60	1.4	18.0
China	9,597	1,300	1.4	20	0.6	7.1
India	3,288	1,000	2.1	16	0.7	4.6
Indonesia	1,905	190	1.8	50	1.1	18.0
Japan	370	124	0.6	20	0.2	6.9
Lao PDR	237	4.7	2.9	47	1.0	11.6
Malaysia	330	19.7	2.3	50	2.3	4.6
Mongolia	1,565	2.1	2.8	c.20	—	10.3
Nepal	141	21	2.5	35	1.1	9.0
Pakistan	796	129	3.0	2	4.1	10.4
S. Korea	98	43	1.6	c.15	—	7.0
N. Korea	122	22	1.2	c.12	—	2.6
Philippines	300	67	2.3	26	1.5	7.8
Singapore	0.6	2.9	1.1	7	-0.5	4.7
Sri Lanka	66	18	1.5	26	1.5	13.2
Taiwan	37	37	1.5	29	0.6	10.7
Thailand	513	58	1.4	25	4.0	13.8
Vietnam	332	72	2.1	25	1.6	4.0

Sources: WCMC web data (as of 1997) and ARCBC data holdings.

1. In thousands of sq. km 2. In millions

Appendix 2. Basic biological data of selected taxa

Country	Mammals			Birds			Plants		
	Total	End. ¹	Thr. ²	Total	End.	Thr.	Total	End.	Thr.
Bangladesh	109	0	16	684	0	28	5,000	0	24
Bhutan	99	0	18	543	0	12	5,446	—	20
Brunei	157	0	9	438	0	14	3,500	7	27
Myanmar	251	6	31	999	0	44	7,000	1,071	32
Cambodia	123	0	23	429	0	18	5,000	—	7
China	394	77	42	1244	67	86	30,000	17,500	343
India	316	44	40	1219	55	71	15,000	5,000	1,256
Indonesia	436	201	128	1531	397	104	29,375	17,500	264
Japan	132	38	17	583	21	31	4,700	2,000	704
Lao PDR	172	0	30	651	1	27	6,000	—	2
Malaysia	286	27	42	736	11	34	15,500	3,600	490
Mongolia	134	6	8	390	2	11	2,272	229	1
Nepal	167	1	23	824	0	23	6,500	315	21
Pakistan	151	3	10	671	0	22	4,929	372	12
S. Korea	49	0	6	390	0	19	2,500	224	69
N. Korea	c.55	0	7	371	0	16	2,500	107	7
Philippines	153	97	49	576	192	86	8,931	3,500	360
Singapore	45	1	6	295	0	9	2,168	2	29
Sri Lanka	88	13	4	428	23	11	3,000	890	436
Taiwan	63	10	6	445	14	12	2,983	—	95
Thailand	265	7	34	915	3	45	11,625	—	385
Vietnam	276	7	38	800	12	47	10,500	1,260	341

Source: WCMC 1994 updated from ARCBC data holdings.

1. Number of national endemics
2. Number of threatened species

Appendix 3. Summary of major threats to Asian biodiversity

Threat category	Sub-category	Affected regions	Comments
Habitat loss	Forest logging	All forested regions	Most accessible forests already logged; logging usually followed by agricultural expansion and/or fire; sustainable logging an elusive goal
	Agricultural clearing	Forests, grasslands, marshes	Countries with fast population growth and lack of employment
	Forest fires	All forested regions	Intensified by El Nino cycles and conversion of non-commercial forests to plantations
	Drainage of wetlands	Land hungry regions	Impounding of lakes, creation of fish ponds, extension of paddy
	Flooding by reservoirs of giant dams	China, Thailand, Lao PDR, India	Some critical areas threatened, added importance of watershed protection can have positive effects
	Coral blasting/mining	Most coral reefs, especially South China Sea.	Mostly out of control, made worse by lack of territorial agreements
Over-harvesting	Fisheries	Lakes and inland seas	Almost all fish stocks have crashed
	Hunting/poaching	Most regions without religious taboos	Increased pressure as human consumption grows and wild stocks crash
	Firewood collection	Poor rural areas	Prevents natural regrowth of forests
	Wildlife trade	Most common in countries bordering China	Trade levels to China growing exponentially; in addition tourist items such as shells and corals endangered
	Destructive methods	Philippines, China, Indonesia, Thailand, South India	Dynamite, poison, fine nets, etc; made worse by lack of territorial agreements
	Biopiracy: theft of valuable genetic resources	Biorich naïve regions	By removing valuable genetic resources, biopirates rob local communities of potential earnings

Pollution	Rivers and lakes	All Asian countries	Increasing with human and industrial growth
	Marine	China, Vietnam and others	Silt pollution as well as toxic metals
	Acid rain	South China	Probably will be reported in other areas
	Oil spills	Main shipping routes	Increasing frequency
Alien invasives	Accidentals	All countries	Weed seed in grain ships
	Deliberate introductions	Use of exotics in forestry, fisheries, Borneo, Vietnam, Philippines, China and others	Lack of development of local species; risk increasing with raised levels of reforestation; introduced fish destroying local endemics in many areas
	GMOs	Most countries are undertaking release trials	Hugely increasing scale of threat as new forms developed
Desertification	Lowered water tables	Most arid regions of Asia	Changes in river flow related to deforestation; overuse of wells
	Spreading salt	Saline and estuarine areas	Reduced winter river flows (estuaries) or increased evaporation
	Spreading sand	China, NW India, coastal Vietnam	Inadequate ground cover to bind wind-blown dunes
	Spread of noxious weeds	Indian sub-continent	Related to overgrazing
Climate change	Rising sea levels	All coasts	Threat to mangroves, reefs and coastal communities
	Phenological changes	Forests	Failure to flower at correct times can lead to species failures
	Warmer climate	Melting glaciers	Shifting of vegetation zones prohibited by fragmentation of vegetation; coral bleaching
	Local changes	Increased seasonality related to deforestation	Conversion from evergreen to monsoon systems

