Original Article

Biodiversity Conservation in Asia

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Abstract

Asian’s remarkable economic growth brought many benefits but also fuelled threats to its ecosystems and biodiversity. Economic growth brings biodiversity threats but also conservation opportunities. Continued biodiversity loss is inevitable, but the types, areas and rates of biodiversity loss are not. Prioritising biodiversity conservation, tempered by what is tractable, remains a high priority. Policy and market distortions and failures significantly underprice biodiversity, undermine ecosystems and create perverse incentives, leading to over-consumption and under-conservation. Properly priced biodiversity creates price signals and incentives that account for all contributions from biodiversity and ecosystems. Habitat conservation remains the centrepiece of biodiversity conservation. The next steps forward include selected command-and-control measures and economic policies that eliminate perverse incentives and creating positive ones along with improved enforcement.

Key words: Asia, biodiversity conservation, policy, sustainable growth, economic incentives

1. Introduction

Asian’s remarkable economic growth brought many benefits through higher incomes and employment but also fuelled threats to its ecosystems and biodiversity through habitat degradation and biodiversity loss.1,2 Tropical forests cleared for agriculture and plantations and increased species intensity dwindled the number of plant and animal species and their genetic diversity. Growing pollution degrades ecosystems and further threatens biodiversity (species, ecosystems and genes). Species have gone extinct, and more are threatened. Invasive alien species, spread by expanding international trade, further threatens native biodiversity. Asia is also one of the world’s largest consumers of wildlife, wildlife products and natural resources. Asia’s continued economic growth and growing international trade will only feed this market and its impacts

1. Biodiversity, a contraction of ‘biological diversity’, is defined by the Convention on Biological Diversity as ‘the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems’ (SCBC 2010).

2. Biodiversity conservation balances the mix of species to assure a flow of benefits over a range of conditions rather than the optimum rate of exploitation of a single species. Biodiversity conservation contributes to producing and delivering ecosystem services and to ecosystem resilience, and ecosystem services are the primary motivation for biodiversity conservation. Ecosystems provide supporting, regulating, provisioning and cultural services (MEA 2005). Anthropogenic activities use ecosystem services, and the subsequent impact changes ecosystem functions and ecosystem service flows.
throughout Asia and the rest of the world, with dire consequences for mammals, birds, forests, grasslands and even rare plant species. This growth, however, also creates opportunities for conservation, and much of the way forward requires harnessing this growth towards conservation.

Growing, large-scale, commercial use for ranching and monoculture plantations, such as oil palm and paper fibre, provide food and raw materials for growing economies, but increasingly pose a more serious threat than small-scale, rural uses and rural poverty, and require policies that differ from conservation’s traditional focus (Butler & Laurance 2008). Growing illegal wildlife trade fuels poaching and criminal activities and threatens integrity of protected areas throughout Asia and extending into Africa.

Weak or distorted national economic policies promote biodiversity-depleting activities and inadequately promote conservation. Market distortions and failures, through markets that are missing or incomplete, do not capture the full costs and benefits of biodiversity, and thereby create perverse incentives to the detriment of biodiversity. Limited and insecure rural livelihoods further undermine biodiversity. Pressing demands on government budgets, resources allocated to economic growth and difficulties in financing biodiversity conservation mean that few states finance biodiversity conservation without demonstrable tangible and substantial benefits when they are low income. Opportunities arise, however, through economic growth as states grow wealthier (Economist 2013). Biodiversity conservation financing remains a critical stumbling block.

These losses in natural capital, although not valued in markets, are considerable, represent substantial foregone wealth and human welfare, and create illusory economic growth rates. The benefits of biodiversity, and the costs of this loss, when reflected within economic systems, markets and prices, and national income accounts, generate more accurate public policies, prices, sustainable growth rates and economic incentives. Despite efforts to conserve biodiversity and use it sustainably, responses have been insufficient to address the scale of biodiversity loss or reduce the pressure except in localised cases.

Policies—and actions—by Asian governments, civil society and the private sector are fundamental to biodiversity conservation, viable ecosystems, sustainable resource utilisation and rebuilding natural capital. Current policies are predominately ‘command-and-control’, relying on top-down laws, regulations, sanctions and especially protected areas (PAs) with insufficient financial resources for monitoring, compliance, surveillance and enforcement. A number, but far from all, of these traditional approaches are effective, and several will remain a cornerstone to future conservation but after design to enhance efficiency. More effective and cost-efficient policies will require building off of selective command-and-control policies and social norms and getting the economic incentives right, both positive incentives, such as creating concrete economic value and pricing for ecosystem services and biodiversity, and negative, such as sanctions and user fees. Enhanced monitoring and enforcement will also strongly contribute to biodiversity conservation.

This article examines terrestrial biodiversity and its conservation in Asia, reviewing its state, threats and potential policy responses. The Indo-Malay region, encompassing all of Southeast Asia, India and southern China is the primary focus, although the Himalayan Region, Tibetan Plateau and Northern and Western China, Japan, Korea and Siberia are also included, and Western Asia—the Middle East—is excluded. The seas, coastal zones and inland waterways are excluded. The five principal pressures directly driving biodiversity loss—habitat change, overexploitation, 3. Command-and-control policy relies on regulation (permission, prohibition, standard setting and enforcement) as opposed to economic incentives. Command-and-control regulations require entities to undertake specific activities to meet specific standards. By contrast, companies can look for the most efficient way with incentive-based approaches, instead of mandating specific activities.

4. In the updated Wallace biogeographic map, these regions correspond to Oriental, Sino-Japanese, eastern portions of Palearctic and the eastern portion of the Saharo-Arabian regions (Holt et al. 2012).
pollution, invasive alien species and climate change—are either constant or increasing in intensity (SCBC 2010). This article focuses on habitat and overexploitation while recognising the importance of the other three.

Section 2 surveys Asian habitat and wildlife threats and losses. Section 3 discusses economic growth and conservation. Section 4 evaluates traditional command-and-control biodiversity conservation policies. Section 5 considers economic incentive-based policies. Section 6 discusses monitoring, enforcement and compliance. Section 7 concludes.

2. Asia’s Threatened Species and Habitats

2.1 Biodiversity

Asia has great biodiversity importance and richness, ranking with South America as the richest place on earth for variety of living forms (MacKinnon 2002). Of the world’s 25 recognised biodiversity hot spots, seven are in Asia, covering the entire ASEAN region, plus the Western Ghats of India, Sri Lanka, southwest China and the eastern Himalayan countries of Nepal, Bhutan and India (Myers et al. 2000). The Hengduan Mountain area of China is the richest temperate ecosystem in the world (MacKinnon 2002). Southeast Asia contains the highest mean proportion of country-endemic bird and mammal species and second-highest vascular plant species compared to other tropical regions (Sodhi et al. 2010).

Asia covers 14 per cent of the world but contains half of the world’s population, with population density eight times higher than the global average (MacKinnon 2002). Humans annually mobilise about 40 per cent of the total land primary production.

In 2008, Asia and the Pacific recorded the world’s highest number of threatened species (UNEP 2010). The sharp decline in tropical species populations indicated in the Living Planet Index mirrors widespread habitat loss in those regions (SCBC 2010). Southeast Asia, which has a higher number of endemic species compared to the rest of Asia, ranks third in Asia in terms of threatened endemic plant species, with China and Japan ranked first and second, respectively (ASEAN Centre for Biodiversity 2010). According to the IUCN Red List, India has 413 globally threatened faunal species, which is approximately 4.9 per cent of the world’s total (MEFI 2009). The five principal pressures directly driving biodiversity loss are either constant or increasing in intensity (SCBC 2010).

Among the world’s tropical regions, Southeast Asia has the highest rate of habitat loss, almost the entire area is considered a biodiversity hotspot because of the high number of threatened endemic species, and future land use changes with economic growth are expected to cause extinctions across a wide range of taxa (Sodhi et al. 2010). Southeast Asia fell short of achieving the 2010 Biodiversity Target in the Convention on Biodiversity Framework (SCBC 2010). Out of 47,915 species assessed, 2,517 are threatened due to deforestation, wildlife hunting for food, as pets and for medicinal use, climate change, pollution population growth and other causes (ASEAN Centre for Biodiversity 2010).

Species of birds and mammals used for food and medicines on average face greater extinction risk than species as a whole, through combined over-exploitation, habitat loss and other factors. They are moving more quickly into a higher risk category.

2.2 Forests

About two thirds of terrestrial biodiversity lies in forest ecosystems (SCBC 2010). Many endemic plant and animal species dependent on forest ecosystem health are at risk owing, in part, to habitat loss and degradation. Forestry, mining, dams and oil and gas development open lands up to further degradation or clearance for conversion to agriculture, plantations, ranching and urbanisation.

Degradation or loss of habitats contribute to species declines and even extinction, and losses in ecosystem services, such as soil, water and carbon retention. Deforestation fragments forest, which lowers dispersal and isolates populations. Changes in forest composition always take place once natural
vegetation is removed. Natural forests are innate biodiversity repositories, and their destruction or conversion for other land uses removes this underpinning that maintains ecological diversity and resiliency. Medicinal plants face a high risk of extinction, with continuing dependence on wild collection (SCBC 2010). China’s demand for timber and pulp, a major driver of regional biodiversity loss, extends to neighbouring Asian countries and now into Africa.

Asia has lost two thirds of its original forests (MacKinnon 2002). The remaining non-tropical forests, disturbed and fragmented to varying degrees, are located mostly in less biologically rich montane zones (montane forests have a high proportion of local endemics). Asia lost almost a third of its tropical forest cover between 1980 to 2000 (Bryant et al. 1997). Asia, which had a net forest loss in the 1990s, reported a net gain over 2000–2010, primarily due to large-scale Chinese afforestation and despite continued high rates of net loss of forests in many South and Southeast Asia countries (SCBC 2010). Over 2000–2005, rates of primary forest loss were fastest in Cambodia, the Democratic People’s Republic of Korea, Indonesia, Mongolia, Papua New Guinea and Viet Nam, accounting for a quarter of the world’s total losses during that period (UNEP 2010). After Independence, India lost 4,696 m hectares of forestland to non-forestry purposes, but forest area has now stabilised (MEFI 2009).

Southeast Asia’s annual deforestation rate is among the highest in the world due to the growing population’s dependence on timber, fuel wood, and other forest products, coupled with conversion of forests for agricultural, industrial and urban purposes (Sodhi et al. 2010). Southeast Asia lost 555,587 km² of forests between 1980 and 2007 (ASEAN Centre for Biodiversity 2010). By 2007, forest cover of the entire ASEAN region was recorded at 43 per cent, comprising 5 per cent of the global total. Southeast Asia’s forest area declined at an annual average rate of 20,578 km² from 1980 to 2007. Regrowth of secondary forests partially mitigates the overall effect on species biodiversity from clearing pristine habitat, as do tropical tree crop and tea plantations (Sodhi et al. 2010). Illegal logging degrades and deforests many forest PAs. Rapid increase in large-scale oil palm plantations in Indonesia and Malaysia, and particularly in areas previously covered by primary tropical forest, is a major factor in biodiversity loss, causing both land degradation and habitat loss for many species (UNEP 2010). The pulp and paper industry is currently expanding in tropical Asia, with large areas of native forest cleared for pulp fibre, which are often replaced by monoculture timber plantations to supply long-term demand. Biodiversity may stabilise but at a lower level.

2.3 Mammals

Mammals have suffered the steepest increase in extinction risk in South and Southeast Asia due to hunting and habitat loss (SCBC 2010). Southeast Asia has the highest mammal species diversity in Asia but without hotspots of species richness. Centres of threatened species are concentrated in regions with high-impact human activities. Restricted-range species in Asia are frequent in southern India and Sri Lanka, south-western China, Vietnam, Taiwan, Malaysia, Indonesia and Philippines (Ceballos & Ehrlich 2006). Threatened species hotspots are found in the western Ghats in India, parts of Sumatra, Borneo, Sulawesi and Papua New Guinea and the Himalayan foothills southward to Singapore (MacKinnon 2002). Large charismatic megafauna, such as rhinoceros, tigers, elephants and orangutan, face considerable pressure, in part because their large habitat requirements (including that for predators’ prey) that face growing pressures from logging, ranching, agriculture and wildlife trade. Even smaller mammals, such as pangolins, face similar threats.

2.4 Birds

One out of eight, or 324, of the 2,700 Asian bird species are globally threatened, including 41 that are critical, 66 endangered and 217
vulnerable (Birdlife International 2003). An additional 317 near threatened species are close to qualifying as globally threatened, giving 664 (25 per cent) species in the Asian avifauna area of conservation concern at the global level. Bird species face an especially steep increase in extinction risk in Southeast Asia (SCBC 2010). Clearance, conversion and degradation of natural forests, grasslands and wetlands are by far the most important causes of bird endangerment. Exploitation for human use, the second most common category of threat, affects more than 50 per cent of all threatened bird species; of these, about 70 per cent are hunted for food and sport, and roughly 30 per cent captured for the wild bird trade (Birdlife International 2003) Most critical and endangered bird species are vulnerable because they have restricted ranges and/or are specialised to a particular habitat type, and they often occur in areas and habitats undergoing most rapid clearance.

2.5 Agriculture and Livestock

Biodiversity faces threats from increasing agriculture and livestock production (Butler & Laurance 2010). Agriculture depends on biodiversity for a variety of reasons, including as a source of present food security and insurance for future outbreaks of pests and diseases and climate change losses. Growing area devoted to agriculture and livestock and increasing reliance on monocultures, high yields and fast growth in turn lowers biodiversity and increases non-point source pollution. Excessive livestock stocking levels degrade grasslands and forests. Key agrobiodiversity functions may be lost that negatively affects long-term sustainability of agricultural systems’ food security, especially for poor populations living in marginal lands.

2.6 Illegal Wildlife Trade

Illegal wildlife trade, considered the most profitable unlawful trade in the world behind drugs and arms, amounts to an estimated US$10 to $15 billion (TRAFFIC 2008). Southeast Asia is a key supplier for global wildlife demand and a consumer and global transit point—roles that make the region a crucial area to address in the global fight against illicit trade. China’s international border is another ‘wildlife trade hotspot’. Wildlife smugglers, often part of organised criminal syndicates, take advantage of Asia’s strong transport infrastructure to traffic wildlife within and out of the region.

A significant proportion of wildlife trafficked through Southeast Asia is purchased by wealthy consumers from outside the region, notably China, Europe and the United States. Growing wealth in China leads to rising demand for exotic wildlife foods and rare species considered to have medicinal properties. Use of tiger and rhinoceros products in traditional Chinese medicines has been banned, but supply and illegal trade to meet this demand continues. 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, wildlife trade is reversed, with external demand threatening China’s wildlife. Growing illegal wildlife trade also threatens charismatic African megafauna and the integrity of African protected areas (PAs).

2.7 Regions and Countries

China, one of the most biodiversity-rich countries in the world due to its size and varied ecosystems and substantial endemism, faces biodiversity threats, as indicated by the large number of species on the Red Species Lists (Klok & Tiehan 2008). The proportions of the threatened animals and plants in various classes of species commonly range within 20–40 per cent (UNDP/GEF).

Centuries of intensive farming and human settlement across eastern China have whittled away at wilderness areas and left very little biodiversity in managed cropland (Klok & Tiehan 2008). The unique agricultural ecosystems developed over the past millennia have greatly deteriorated in quality, with increasing
specialisation on a limited number of crops of a single variety. Recovery of farmland biodiversity is constrained by spread of high-yielding varieties (and increasingly, genetically modified crops), intensive use of agrichemicals, rural industrialisation, pollution of freshwater and general infrastructure development. Most eastern and central provinces are biodiversity poor.

China’s residual areas of rich biodiversity are largely found in upland and western areas, especially in Yunnan Province, which has a wide range of microclimates and environments, from the Tibet plateau in the north to tropical forests in the south (Klok & Tiehan 2008). Biodiversity conservation in these areas is closely related to natural resource management, especially of forests.

Over-grazing is a major factor degrading grasslands (UNDP/GEF 2005). In Inner Mongolia and North China, grasslands are commonly over-stocked by 50–100 per cent. Over-grazing and long-term overstocking degrades the quality of grasslands in the arid and semi-arid regions of North China, leading to impaired ecosystem functions, substantial decline in forage yield and serious desertification. National government policy during 1950–1990 towards steppe grasslands pushed unsustainable exploitation, causing grasslands conversion to unsuitable cropland and led to the overstocking and over-grazing of the remaining grasslands (Klok & Tiehan 2008). Poor utilisation of water resources in arid and semi-arid regions further contributed to biodiversity degradation.

China’s unique desert ecosystems, which lie in China’s Northwest, are also degrading (Klok & Tiehan 2008). The total desert area is increasing due to desertification, and the quality and diversity of deserts is declining.

China’s forest coverage increased from a historical low of 85 m hectares in 1949 to over 160 m hectares in 2002, and forests now cover 17 per cent of the country (Klok & Tiehan 2008). Despite these historically unprecedented increases in forest coverage, forest quality continues to decline, in terms of biodiversity, age and biomass, because most new forest results from reforestation schemes that lead to thinly covered, mono-species plantations.

India, home to over 91,200 species of animals and 45,500 species of plants, has four identified hotspots (MEFI 2012). India is home to about 7.6 per cent of all mammalian species, 12.6 per cent of avian species, 6.2 per cent of reptilian species, and 6.0 per cent of flowering plant species. Increasing anthropogenic pressures threaten 413 fauna and 256 plant species. Total forest and tree cover constitutes 23 per cent of geographical area, with 16 major forest types and 251 subtypes. Development, poverty, logging, agriculture, cash crop plantations, mass tourism and river valley projects endanger biodiversity.

Japan has over 90,000 known species and over 300,000 unclassified species, with a high rate of endemic species (nearly 40 per cent of land mammals and vascular plants, 60 per cent of reptiles, and 80 per cent of amphibians) (Japan, Ministry of the Environment 2009). The Ministry of the Environment’s Red List classified more than 30 per cent of reptiles and amphibians, more than 20 per cent of mammals and vascular plants, and more than 10 per cent of birds as threatened due to destruction and fragmentation of habitats, overexploitations and alien species invasions. The number of threatened mammals decreased by 6 to 42, birds increased by 3 to 92, reptiles increased by 13 to 31 (30 in Nansei Islands), vascular plants increased by 25 to 1,690 and non-vascular plants increased by 134 to 463. Species distribution is expanding due to falling and aging human population and reduced agriculture. The ecological footprint of Japan in 2008 was about 1.5 times the global average, with large imports of resources. Nearly 14.3 per cent of Japan’s total land area (5.4 m hectares) is comprised of national parks, quasi-national parks and prefectural nature parks. Wildlife PAs consist of national wildlife and prefectural PAs, comprising 9.6 per cent of total land area (3.68 m hectares). Wilderness, nature and prefectural conservation areas comprise about 0.3 per cent of land area (100,000 hectares). Protected forests account for nearly 10 per cent of national forest area (780,000 hectares).
2.8 Rural Poverty and Biodiversity

Asian rural poverty is often intrinsically linked to ecosystem deterioration and biodiversity loss. The greatest burden of ecosystem degradation already falls on the poor, and it will continue to do so in increasing measure should current trends persist (MEA 2005). Many of those surviving below the national poverty line depend to a significant extent either directly or indirectly on biological resources for their well-being and survival, and are less able to access or afford alternative sources of livelihoods when biodiversity is depleted (TRAFFIC 2008). In the midst of worsening ecosystem trends, and in recognition of the close connection between poverty and the environment, a major focus of development efforts is economic growth and development that works in tandem with biodiversity conservation and creates incentives to conserve rather than erode it.

2.9 Protected Areas

PAs are a linchpin of biodiversity conservation, because habitat degradation and loss are fundamental to biodiversity and ecosystem loss (MEA 2005). Fragmented habitat also reduces the ability of species to adapt to climate change by limiting the possibilities to migrate to areas with more suitable conditions (SCBC 2010). The area designated as legally protected constitutes less than 9 per cent of the total surface area, below the global average (UNEP 2010). East and Northeast Asia have the highest proportion of PAs, while North and Central Asia have the lowest. The picture worsens when the quality and enforcement of the PAs is factored in, reducing PA effectiveness.

In India, a network of PAs and other conservation areas, totalling 661 units, has been instrumental in biodiversity conservation, especially wildlife (MEFI 2009). These PA Networks, comprising 4.8 per cent of the total geographical area, consist of 99 national parks, 515 wildlife sanctuaries, 43 conservation reserves and four community reserves, the latter two of which are community-oriented PAs. At present, there are 37 tiger reserves spreading over 17 states and 26 elephant reserves. India also has 15 biosphere reserves (of which four have been recognised by the United Nations Educational, Scientific and Cultural Organization (UNESCO) under world network of biological reserves, and three are under consideration) along with buffer zones open to some economic development; reserved forests and protected forests where logging, hunting, grazing and other activities may be permitted on a sustainable basis to members of certain communities; and village and panchayat forests administered by a village or a panchayat on a sustainable basis, with the habitat, flora and fauna accorded some degree of protection by the managing community. Almost all state-owned forests and other important ecosystems outside the PA network are under some kind of broad-based conservation planning.

Up to 12.6 per cent of the ASEAN region’s terrestrial land has been designated as PAs (ASEAN Centre for Biodiversity 2010). Official figures on PAs, however, can be misleading. For instance, only small areas may remain uncompromised with the remainder degraded or converted to other use and not primarily for biodiversity protection (Sodhi et al. 2010). China has about 10 per cent PA coverage, but other than a limited number of giant reserves, they comprise over 1,000 very small areas, most of which face enormous human pressures (MacKinnon 2002). Migration corridors between Chinese PAs would improve survival prospects for, especially, mammal ‘flagship’ species such as snub-nosed monkeys, pandas, wild camels and Tibetan antelope. Trends in Western China, under the aegis of the Western Development Strategy, are moving in a different direction. New road, rail, energy and other infrastructure projects are further dividing habitats, confining large wildlife to ever more precariously isolated pockets.

5. A protected area within the IUCN framework is (Dudley 2008, p. 8): ‘A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values’.

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2.10 International Conventions

Almost all Asian countries are party to the Convention on Biodiversity (CBD) and most are party to other conventions, including the Convention on Wetlands of International Importance and Convention on International Trade in Endangered Species of Wild Fauna and Flora, as well as such international initiatives as UNESCO’s Man and Biosphere program and World Heritage. Only five Asian countries have ratified the Convention on Conservation of Migratory Species and Wild Animals.

3. Economic Growth and Conservation

Economic growth brings forces that threaten biodiversity, especially in low-income countries, but also opens up opportunities for conservation as countries grow, incomes and wealth increase and technology advances (Economist 2013). Economic growth at some point brings improved attitudes towards conservation and increased appreciation of natural environments, legislation to protect endangered species, programs to eradicate invasive species, more and bigger protected areas, conservation investments to restore degraded habitat, better regulation of pesticides and environmental cleanup and increasingly effective states implementing and enforcing conservation legislation. The challenge is to harness and direct these conservationist forces accompanying growth while limiting concomitant countervailing forces, notably increased demand for natural resources and environment for production.

4. Command-and-Control Policies

Biodiversity conservation policies have traditionally focused upon ‘command-and-control’ measures that mandate specific actions (or suffer sanctions for non-compliance), most notably protected areas, but also laws prohibiting certain specified actions, broad-based export or import quotas or industry-wide production quotas. Governments also resort to moral suasion, in which states convince players to act in a socially desirable manner. Industry or country-wide policies are subject to several disadvantages, including the potential for free-riding behaviour by individual players on the conservation activities of others.

Many command-and-control policies are notoriously ineffective and inefficient, but selective ones are linchpins for conservation. Habitat loss is the principal threat to biodiversity (Economist 2013) so that land-use restrictions, zoning, protected areas and restoring ecosystems are important. With agriculture and agroforestry comprising much of the land use, agricultural and forest policies will be important.

Land-use restrictions and zoning laws dictate how much on-farm forest can be deforested and species-focused protection laws, an approach widely used in Asia. Lack of compliance, inadequate enforcement, pre-emptive destruction, spatial displacement, poor administrative targeting and misaligned incentives between private entities and social-ecological goals reduce their effectiveness. Evidence supporting the effectiveness of these approaches is limited (Barrett et al. n.d.).

Improved utilisation of areas already cleared or degraded lessens pressures to degrade pristine environments. Increasing productivity of farms, pastures, plantations and scrubland and consolidating gains on existing lands lessen pressures to clear forests and spread agriculture into pristine areas (Economist 2013). Boosting yields means increasingly intensified production that in turn means more fertiliser, pesticides and even genetically modified seeds. This brings its own set of problems, which in turn require sound policies. Concomitantly raising incomes and creating employment for rural poor further reduce pressures. Diverse agroforestry systems for smallholders that entail polyculture fields provide a biodiversity rich agriculture.

Reforestation and secondary habitat restoration rebuilds biodiversity and replenishes...
ecosystem services and carbon sinks. Replanting with monocultures (oil palm, rubber) and much secondary habitat restoration, however, while expanding forest cover, creates ecosystems with lower biodiversity and ecosystem services than natural habitat (Sodhi et al. 2010). China’s massive reforestation, increasing from 85 m hectares in 1945 to over 160 m hectares in 2002, covering 17 per cent of the country, suffers from such low quality (Klok & Tiehan 2008). Reforestation and habitat restoration that builds conservation corridors, reduces fragmentation and targets important areas is more cost-effective. Habitat restoration and enhancement in urban, not just rural, areas also replenishes biodiversity.

A strategy for controlling illegal wildlife trade calls for interventions along the entire market chain: in the PAs and other areas where poaching and collecting occurs, in the intermediate trade, at the retail level, and most importantly, at its source—the demand for wildlife products (Damania et al. 2008). Legal trade in wildlife requires certification and standards to disallow illegal wildlife traded under the guise of legal.

4.1 Protected Areas

Biodiversity conservation efforts rely heavily on PAs, such as parks and reserves (MEA 2005). PAs are heterogeneous in human uses permitted. Threats include: hunting, killing and collecting animals; logging and wood harvesting; gathering non-timber forest products; recreational activities; and management of adjacent lands, including buffers. Commercial and residential development, including housing and settlement on PAs, also pose risks. PA ecosystem conservation goals may conflict with poverty alleviation goals by reducing incomes or perpetuating poverty traps (Ferraro et al. 2011).

Community Conservation Areas protection, excluded from the standard PA discussion, includes sacred forests, wetlands and landscapes, village lakes and catchment forests that are voluntarily conserved by indigenous and local communities through customary laws or other effective means (SCBC 2010). These areas greatly expand the total conserved area to one fifth of India’s area (MEFI 2009).

Greater use of conservation corridors multiplies conservation benefits from smaller and more isolated PAs and links meta-populations. For example, the Terai Arc Landscape, which spans the base of the Himalayan foothills in northern India and southern Nepal, restores and connects 11 wildlife reserves and national parks harbouring wild tigers (Damania et al. 2008).

The extent and effectiveness of Asian PAs varies widely (MacKinnon 2002; Leverington et al. 2010; Ferraro et al. 2011). Evidence on Asian PA performance evaluated upon proper experimental design is limited. PAs in Thailand reduced poverty by about 30 per cent (Ferraro et al. 2013). Moreover, about 15 per cent of protected forest in Thailand would have been deforested in the absence of protection (Ferraro et al. 2011).

Not all PA types provide equal conservation effectiveness. For example, wildlife sanctuaries in Thailand were more effective than national parks in terms of protecting forest in the interior versus exterior areas of parks and preventing fragmentation conditional on the level of forest cover (Ferraro et al. 2013). Limited Asian evidence shows that on average, stricter rather than lesser protection reduced deforestation rates, but the additional impact was not always large and sometimes arose because of where stricter protection was assigned rather than regulatory strictness per se (Ferraro et al. 2013).

5. Economic Incentives Policies

Economic incentives establish conditions that induce exploiters and consumers of natural capital to consider the costs and benefits not presently captured by market values, i.e.

7. Leverington et al. (2010) provides a global comprehensive overview that includes Asia. The general conclusions hold for Asia as a whole, where overall Asian PA performance ranked average. Globally, empirical studies have found that PAs, on average, are effective in reducing deforestation, although not as much as advocates may have expected, in part because protection tends to be assigned to ecosystems at below-average risk of disturbance (Ferraro et al. 2011).
internalise external costs and benefits. These incentives realign private behaviour closer to broader economic-ecological objectives. Choice of economic incentive depends upon the particular circumstances, including market conditions, political and legal factors and social conditions; there is ‘no one size fits all’.

Incentive-based mechanisms include voluntary approaches (voluntary negotiations between conflicting parties, industry association product certification/labelling/standards), charges (taxes, user fees, entrance fees, effluent charges, administrative charges, deposit–refund systems), fiscal instruments such as taxes and subsidies (direct taxes, tax relief, differential taxes, grants or low-interest loans, low or uncollected forest rents, payments for environmental services), property rights approaches (tradable permits, property rights, tradable development rights, cap-and-trade, licenses, concessions, biodiversity offsets, credit programs, conservation easements and concessions), liability rules, bonds and deposits (security deposits, restoration bonds, assurance bonds), conservation banking, biodiversity mitigation and indirect approaches of community-based and integrated development and conservation projects that includes eco-tourism. Direct incentive approaches directly link economic incentives to desired conservation outcomes.

5.1 Property Rights

Biodiversity conservation is intimately related to habitat protection, which in turn is closely dependent upon land use and ownership and production decisions. Market forces play a major role.

Weak or ill-defined property rights inhibit conservation (Norton-Griffiths 2007). Inadequate legal rights for indigenous peoples or local communities allows in-migration, loss of control, erodes conservation incentives and can lead to loss of sustainable land uses by forest dwellers when large enterprises and governments take over forest resources (Grafton 2000; Norton-Griffiths 2007). Incentives facing larger enterprises favour monocultures and ignoring ecological impacts, since these enterprises do not bear the costs. For instance, nationalisation of forests contributed to deforestation in Sumatra and Borneo for private plantations.

Secure property rights create incentives to maintain and improve landholdings for smallholders and local communities. The Southeast Asian RUPES (Rewarding the Upland Poor for Environmental Services) program awards consolidated tenure security to local land users to reward for (promised) future environmental services (Asquith & Wunder 2008). In Sukhomajri, India, water rights, delinked from land rights that landless can locally sell, partially compensates them for reduced access to biomass for grazing in the upper slopes. In Bungo, Sumberjaya, Indonesia, service providers preferred secure land tenure as compensation.

Landowners typically lack property or use rights to wildlife, which are instead owned by states (Norton-Griffiths 2007). Agriculturalists, ranchers and foresters often have little incentive to protect wildlife habitat because the value of land in wildlife and undisturbed habitat is limited and less than potential commercial activities. Wildlife then has little or no value to those on whose land wildlife are found. Any damage caused by wildlife is seen as a loss. When wildlife has no market value to landowners, incentives are created to eradicate them or not prevent poaching. Conversely, strengthened rights of use by local communities allow them to capture the benefits from wildlife and thereby create positive conservation incentives. For example, project Snow Leopard placed usufruct rights on state-owned snow leopards, thereby underpinning a biodiversity market through ecotourism (coupled with an insurance scheme for domestic goats that are prey) (Hussain 2000). Snow Leopards now have positive net benefits to local communities, and an incentive is created

8. Property rights can be private, state, or group (common property), and the right mix varies by circumstances (Grafton 2000).

9. Usufruct rights are rights of use to property owned by another party.
to conserve rather than kill snow leopards that prey on domestic goats.

5.2 Direct Incentive Approaches

5.2.1 Payments for Ecosystem Services
Payments for ecosystem services (PES), an increasingly important direct incentive approach, include REDD+, payments to preserve cities’ watersheds and payments to communities (and to lesser extent households) for specific projects.\(^\text{10}\) PES sustainability is vulnerable to unsustainable financing and changes in government policies. PES are difficult to value, since formal biodiversity markets are not formed and prices are instead negotiated but should exceed recipients’ opportunity costs. PES face additional issues: REDD+, for example, reward carbon sequesterisation but do not directly pay for biodiversity conservation (bundling or package of services paid to same buyer, stacking), or may pay for a seemingly homogeneous product but receive lower quality products (adverse selection), projects may have been implemented regardless (additionality, moral hazard) or may sell the same service to different buyers (layering). PES can be combined with other biodiversity conservation policies, such as with community conservation in the community-based PES that preserves forests and controls sediment in Kulekhani, Nepal (Ottaviani & Scialabba 2011).

Asia increasingly applies PES. China introduced two of the largest PES programs in the world in terms of scale, total payments and duration (Task Force for Eco-Compensation Mechanisms and Policies in China 2007). The Chinese Sloping Land Conversion Program (7.2 m hectares land retired, 4.9 m hectares planted with trees) is PES to protect watershed. The Natural Forest Conservation Program, a Chinese PES program in the Wolong Nature Reserve for giant pandas, contributed to increases in forest cover but also had both positive (e.g. labour reduction for fuel wood collection) and negative (e.g. economic losses due to crop raiding by wildlife) effects on local households. With the Cooperative Afforestation CDM Pilot Project on Private Lands Affected by Shifting Sand Dunes in Sirsa, Haryana, India, landholders were enticed by payments and the promise of accrued benefits (Kissinger et al. 2013). Downstream beneficiaries pay upstream providers in the Fair Deals for Watershed Services project in Madhya Pradesh and Himachal Pradesh, India. The Climate Protection through Avoided Deforestation initiative in Laos sequesters carbon. In Indonesia, the RUPES project rewards farmers for erosion-control activities on coffee farms and a project in Bungia District, Jambi, Sumatra increases biodiversity inside of complex rubber agroforests.

5.2.2 Biodiversity Mitigation or Offsets
Biodiversity mitigation or offsets are increasingly used for climate change through the Kyoto Protocol Clean Development Mechanism, wetlands banking and species conservation but are under-utilised in Asia.\(^\text{11}\) They can be difficult to monitor and verify and can suffer from high transaction costs and poor policy design. Both compensatory and voluntary biodiversity mitigation should stand high in the pantheon of incentive-based approaches and should feature prominently in forest protection and logging. For instance, Sumatran or Bornean logging and subsequent plantation forests could be offset by required compensatory orangutan PAs. Non-compensatory mitigation will be required for rare, endangered and threatened species. For example, conversion of forest to oil palm erodes Sumatran rhinoceros and orangutan habitat and would require mitigation at a level well beyond no net loss, and supplementary financing could come through charges on oil palm land or exports. Low-cost forestry offsets under the clean

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10. REDD stands for the Reducing Emissions from Forest Degradation and Deforestation scheme of the post-Kyoto UN Framework Convention on Climate Change. Its derivative is REDD+, which recognises forest carbon stock enhancements (sequestration) from improved conservation and sustainable management of forests.

11. Biodiversity mitigation (offsets) entails conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects, so as to ensure no net loss of biodiversity. The aim is to make developers fully compensate for biodiversity losses associated with development.
development mechanism absorb carbon and conserve biodiversity but can suffer from ‘additionality’, i.e. whether offsets are truly additional in emissions reductions, such as China where there was little additionality. Mining in forested areas can require not just reforestation but also recognising that reforested areas are lower quality and require protection of additional lands to insure no net loss. Any system that rewards offset activities creates an incentive for host countries to adopt counter-productive policies to earn credit for altering those policies, such as clearing more forests and peatlands for oil palm plantations than otherwise intended in order to earn credit (moral hazard).

5.2.3 Standards, Certification, Supply Chains
Consumer and producer market standards, product certification, *sui generis* protection systems and sustainable supply chains are increasingly important, since large-scale threats, such as ranching and plantations and products increasingly entering global supply chains, now supersede small-scale, rural ones. Certification involves a third-party auditor that certifies the environmental soundness of a resource operator and the products. Certification verifies whether a forest or animal population is well managed, and through labelling, assures consumers that labelled products are supporting sustainable resource utilisation. Certification creates positive incentives but as a trade-related instrument is contentious. Growing certification reflects growing demand from final and intermediate product markets. Malaysia, adopting this initiative, created the Malaysia Timber Certification Council. The Indonesian Ecolabelling Institute, a non-profit constituent-based organisation, develops forest certification systems. Rainforest Alliance certifies coffee. Certification, part of brand development, can vary in quality and consumer and producer acceptance, and markets are often full of competing brands generating considerable consumer confusion. Effective certification and standards require markets settling upon broadly accepted industry-wide standards and means of monitoring and verification.

5.2.4 Charges and Fees
Setting new charges or rationalising existing charges, which incorporate all or part of the value of biodiversity and ecosystem services, can help price biodiversity, raise conservation revenue (and finance biodiversity conservation), and create incentives that align private behaviour more closely to economic-ecological objectives. Not all ecosystem services and biodiversity can be priced, but they can be decomposed into pieces, sometimes bundled together, and some of them then priced, such as to payments inhabitants in water catchment basins for urban areas to insure clean water.

Consumer fees to finance upstream water catchment benefits can be cheaper than bottled water or paying for urban water treatment plans (Asquith & Wunder 2008). Recycling charges with refunds for bottles, cans and some paper products has proven to be feasible throughout Asia. Logging and grazing licenses and fees are often granted based on net revenues that are below market value and exclude the loss of biodiversity, downstream damage through erosion or hydrological impacts or foregone climate sequesterisation (MacKinnon 2002). Including these non-market, external costs would raise fees and by making logging and grazing more expensive and reflective of total economic value, reduce usage and induce more sustainable practices. Indonesian timber provides a good example of mispriced logging fees. China is restructuring certain taxes to ensure that beneficiaries of good water conservation (agricultural, industrial and hydropower sectors) pay realistic fees (MacKinnon 2002). Through PES, these taxes used in catchment areas in compensatory programs reward poor communities to alter their grazing and agricultural practices, and whose development options are limited by the need to retain dense vegetation cover. These approaches are increasingly used throughout the world to provide more cost-effective urban water supplies.

Bonds and deposits, product surcharges that shift the responsibility for biodiversity depletion to individual producers and consumers, require the resource user to pay against the possibility of damage. As advance charges, the
costs of any damage provide an incentive to avoid biodiversity damage and reclaim the depositor bond. Indonesia used performance bonds for forestry and allowed refunds through reforestation, although the fee was far lower than replanting costs, giving logging companies insufficient incentive to reforest (O’Connor 1994). The bonds also created incentives to clear cut forests to start plantations to qualify for refunds. Malaysia uses deposits to encourage rehabilitation of mined areas.

5.3 Indirect Incentive Approaches

5.3.1 Community Conservation

Indirect incentive approaches integrate conservation and development by rewarding local communities for conserving habitat in ways that also improve their living standards, giving them a stake in conservation and include both community conservation and integrated conservation and development projects. Individuals and communities are not directly rewarded for pursuing conservation activities or directly punished for degrading activities. Indirect conservation attempts to promote livelihoods compatible with sustainable resource use in—or more typically around—PAs or by providing compensatory transfers to rural residents who use resources sustainably.

They enjoy some successes but often have limited impact as a result of persistent institutional barriers that limit local rights, pervasive rural poverty and difficulty in providing benefits exceeding opportunity costs (Barrett et al. n.d.). Untangling the Gordian knot of intertwined rural poverty and biodiversity conservation is critical but evades an easy answer. Community conservation can be combined with PES, such as the payments from a downstream village to an upstream village in the Indian Himalayas (Singh n.d.). To preserve a small dam, a downstream village pays an upstream village to cease grazing that causes soil erosion and silt accumulation.

5.3.2 Ecotourism

Ecotourism creates positive economic incentives, can be combined with community conservation and PAs, and when applicable, can be highly successful. Community-based ecotourism is one of the fastest growing industries in the world (Damania et al. 2008). Trophy hunting in sustainable populations creates conservation incentives, raises significant revenues and is successful with the community-based programs for markhor and ibex in Pakistan (Jackson 2004). Ecotourism in and around PAs in Thailand increased average consumption and lowered poverty rates (Ferraro et al. 2013). The most successful models for tiger tourism are found in Nepal, where a community-based tourism model has been developed that strongly emphasises benefit sharing, turning poachers into tour guides and allowing the regeneration of degraded forests (Damania et al. 2008).

6. Monitoring, Compliance and Enforcement

Monitoring and enforcement are critical for compliance. Almost all Asian countries have adequate laws to establish PAs and protect species and to prohibit or control trade (MacKinnon 2002). Monitoring and enforcement, however, are the weak points, with most countries only weakly enforcing laws. Law enforcement agencies, courts, consumers and firms see biodiversity offences as trivial and with little need for strict enforcement.

Altering the incentives of beneficiaries and violators is by far the best way to enhance compliance, with enforcement and penalties focused on strengthening negative incentives. Most importantly, insuring that those who conserve enjoy the benefits strengthens positive incentives, such as insuring that ecotourism benefits, bio-prospecting royalties or benefits from wildlife conservation flow to local communities rather than to external investors. Community surveillance is one of the most effective ways to monitor. For example, Project Snow Leopard combines ecotourism with low-cost insurance that protects goat herders against losses from snow leopard predation in Pakistan (Hussain 2000). Ecotourism revenues finance village projects and the insurance scheme. Compliance and monitoring
comes from villagers who now have an incentive to conserve snow leopards since benefits outweigh costs. Certification and standards strengthen compliance.

7. Concluding Remarks

Asia will continue to rapidly develop, fuelling increased demand for natural resources and threatening biodiversity. Economic growth that unsustainably depletes natural capital generates illusory growth rates. Economic growth threatens biodiversity but concomitantly creates conservation opportunities when channelling some of the growing economic surplus to finance conservation and investment. Importantly, strengthened attitudes favouring conservation and state effectiveness accompany economic growth.

Direct pressures on biodiversity require immediate consideration, but the longer term underlying causes of biodiversity loss also require attention, including population growth, unsustainable economic growth strategies that emphasise depleting natural capital to feed physical capital accumulation and unsustainable consumption patterns that do not account for all costs. Climate change (not discussed here) along with land use changes, are the two biggest immediate threats to biodiversity.

Biodiversity loss may be inevitable in the face of rampant growth, particularly when national incomes are low, but the types, areas and rates of biodiversity loss are not. Prioritising biodiversity conservation, tempered by what is tractable, remains a high priority. No single policy is a panacea, multiple policies are required to address different facets of the problem, and choices depend upon circumstances. Preferred policies, while ‘first best’, may not be feasible, whereas ‘second best’ policies are preferred to none.

Policies that accurately price biodiversity create incentives that align private behaviour with economic-ecological objectives, complement critical command-and-control policies such as laws, regulations and protected areas, and replace less effective command-and-control approaches. Economic incentive-based approaches become more important with economic growth as markets widen and deepen and become central to resource allocation. Compensatory biodiversity mitigation, eco-labelling, product certification, market standards, sustainable sourcing and supply chains, reformed tax codes and subsidy policies, zoning, fees capturing ecological costs and payments for ecosystem services are increasingly important tools to address growing industrial-scale habitat conversion for monocultural agriculture, ranching and plantations plus growing urban demand that now threaten biodiversity more than rural-driven, small-holder conversion. Strengthened and clarified property rights for land and wildlife are as important of a single step as any, underpin biodiversity markets, protect original inhabitants and align costs and benefits of conservation. Addressing growing legal and illegal wildlife trade, a high priority, requires new laws, but even more, stiffer penalties, monitoring and renewed commitments to enforcement. Improved agricultural and agroforestry productivity reduces pressures on other habitat. Creating and strengthening social norms through public education is a slow but effective means of conservation and a complement to sound command-and-control and economic incentive-based policies.

Habitat conservation remains fundamental to biodiversity conservation but is only one piece. It requires extending from natural to multiple uses and finding sustainable financing sources plus solutions to weak property rights and the conflicts between local communities and plantations and biodiversity conservation. Greater attention to management of biodiversity in human-dominated landscapes will be increasingly important as pristine habitats erode and fragment and climate changes.

The next major steps forward are: selective command–control policies, notably protected areas, better regulation of pesticides, species protection and land use; improved agricultural and agroforestry productivity; increased economic policies that complement and reinforce habitat conservation, eliminate perverse incentives and creating positive
ones; and strengthened monitoring and enforcement.

October 2013

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