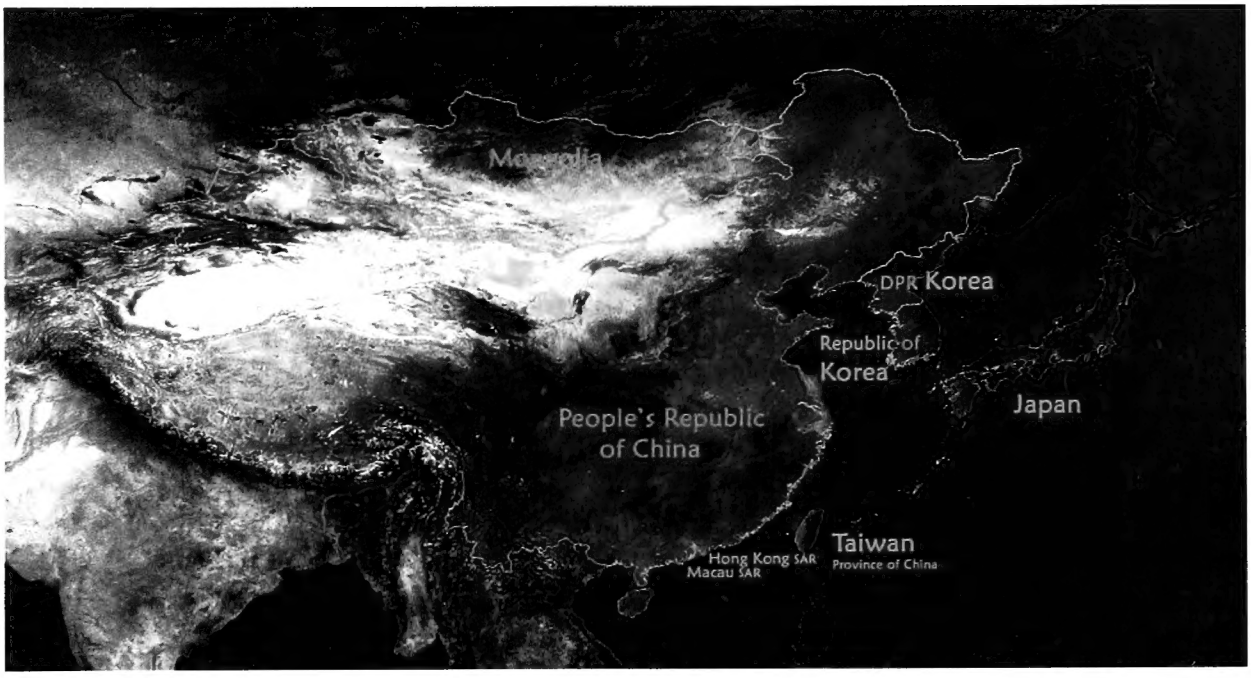
GIS Assessment of the Status of Protected Areas in East Asia



Compiled and edited by
J. MacKinnon, Xie Yan, I. Lysenko, S. Chape, I. May and C. Brown

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IUCN
The World Conservation Union

UNEP WCMC

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Abbreviations and Acronyms

BCAP	Biodiversity Conservation Action Plan
CAS	Chinese Academy of Sciences
CBD	Convention on Biological Diversity
CCICED	China Council for International Cooperation in Environment and Development
CI	Conservation International
CITES	Convention on International Trade in Endangered Species
CSIS	China Species Information System
CoP	Conference of Parties
DMZ	Demilitarized Zone
DPR	Democratic People's Republic
EIA	Environmental Impact Assessment
EBA	Endemic Bird Area
EMA	Endemic Mammal Area
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographic Information System
GLC	Global Land Cover
IAS	Invasive Alien Species
IBA	Important Bird Area
IM	Indo-Malayan (in ecoregion codes)
IRBM	Integrated River Basin Management
IUCN	World Conservation Union
JPL	Jet Propulsion Laboratory
km	kilometre
MAB	Man and Biosphere Programme
MODIS	Moderate Resolution Imaging Spectroradiometer
MPA	Marine Protected Area
NASA	National Aeronautics and Space Administration
NGO	Non-Government Organisation
NP	National Park
NR	Nature Reserve
PA	Protected Area /Palearctic (in ecoregional codes)
SAR	Special Administrative Region
SEPA	State Environment Protection Agency
SFA	State Forestry Administration
SOA	State Oceanic Administration
SSC	Species Survival Commission of IUCN
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organisation
WCMC	World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas of IUCN
WDPA	World Database on Protected Areas
WHC	World Heritage Convention
WWF	Worldwide Fund for Nature/Word Wildlife Fund

1. Introduction

East Asia is comprised of eight countries and territories: People's Republic of China (China), Hong Kong, Japan, Democratic People's Republic (DPR) of Korea, Republic of Korea, Macau, Mongolia and Taiwan, with a combined land area of 11.8 million km². The region constitutes a large and important part of the eastern Palearctic Realm. In 1996 IUCN published *A Regional Action Plan for Protected Areas in East Asia* (IUCN, 1996). The plan included, in addition to improving the management and legal framework for protected areas, an objective of reaching 10% protected area national or territorial coverage by 2000. In 1996, the protected area coverage of East Asia stood at 5.7%. The plan noted: "there are gaps in the protected area coverage in most, if not all, East Asian countries and territories. However, some countries have much further to go than others in putting into place an effective system. Particular examples include Mongolia and North [DPR] Korea". Nine years later, East Asia has a total protected area coverage of 16%. This review attempts to evaluate this considerably expanded protected area system to see if the gaps are now filled or whether additional areas are still needed.

1.1 Objectives

The objectives of this study were to:

i) Review aspatial and spatial data on the endangered bird and mammal species of the East Asia region.

ii) Review aspatial and spatial data on the protected areas (PAs) of East Asian countries by using the World Database on Protected Areas (WDPA) maintained by UNEP World Conservation Monitoring Centre (UNEP-WCMC).

iii) Undertake a GIS analysis of known species ranges/sites/habitats against existing and proposed PAs and identify critical gaps.

iv) Prepare a composite map of the East Asia region that:

- highlights the effectiveness and/or gaps in the spatial coverage of PAs in East Asia in relation to known species ranges/sites/habitats; and
- identifies existing or potential transboundary conservation linkages at national and sub-national (where appropriate/feasible) levels.

v) Present recommendations on improving the PA coverage in East Asia.

It is anticipated that the results of the review will enable international programmes, agencies and specialists to identify PA gaps, priority actions and information requirements that need to be addressed and can be better incorporated into their own programmes and activities within this region. The review is expected to complement other studies and detailed action plans. For instance species specialist groups may know about the taxonomy, distribution and status of their taxa but often lack data on the extent and condition of relevant habitats and the numbers, size and locations of PAs within species ranges.

1.2 Scope and Method

The study reviews the situation regarding PA extent, legal status and management constraints in each country and territory of East Asia, using a regional review and gap analysis by applying a simple GIS overlay approach. The WDPA has available a near complete GIS cover of PAs in the region and most large PAs are represented by polygons (boundary information). A few large PAs and many very small PAs are represented by circles of correct area around known centre points of the PAs held in the database.

The adequacy of the regional PA system is examined from a variety of viewpoints: altitude, national borders, ecoregions, habitat and important species ranges. The study evaluates only terrestrial and coastal land areas, not marine PA coverage apart to comment on its extent.

1.3 Limitations

The current study examines adequacy of PAs from the aspect of areal coverage, not management effectiveness. This can lead to a false sense of adequacy in the case of some species that are in fact highly endangered. It is important to clarify the limits of the present analysis so that a false sense of complacency is not generated through the present findings. For instance, vast areas of habitat of the Snow Leopard and Chiru are included inside existing PAs. Yet we know these species to be desperately endangered as a result of deliberate poaching and persecution. Conversely, protection of quite small sites that constitute breeding or roosting sites of, for example, bats or other congregating species, may provide excellent protection for those species that range over much greater areas that seem under-protected.

Some comments on data quality have to be made. UNEP-WCMC maintains a centralised global database that relies on data being supplied by individual government agencies, experts and specialist groups. It is hard to ensure that datasets are accurate and up to date as supply of data is voluntary and the now huge global number of PAs (>100,000 sites) in the WDPA present a significant logistical challenge to cross-check. Sometimes data is out of date, incomplete, inaccurate or data provided by two different sources may be incompatible. A common problem is that the area of a PA indicated on a map is often different from the area listed in government databases. For example, four huge reserves in Xizang (Tibet) are mapped much larger than their stated areas. As a result, the datasets used in the current review are of varying precision and detail. For instance, very great detail is available for China, for which point data distribution maps, pre-existing GIS covers and already completed gap analyses are available, whilst very little detailed information, apart from a list of protected areas, is available for DPR Korea. Communication distances, language barriers and problems of dealing with pictographic language characters make it difficult to check or query data from several of the countries of East Asia. Nevertheless, despite these problems, the figures for PAs as mapped as GIS coverage agree quite closely with the figures listed on official databases.

1.4 Methodology

Firstly, how do we assess 'adequate coverage'? We are unable to test whether management is adequate, or whether expected species are in fact present within expected PAs in viable numbers. We are limited to a purely spatial overlay. Does the species, habitat, or bioregion in question appear to have adequate spatial area included within the existing PA system? Many global strategies urge nations to aim for at least 10% PA coverage of their terrestrial area or ecosystems, including the Convention on Biological Diversity[1]. Many countries have already

[1] The CBD 7th Conference of the Parties in 2004 set a target that "at least 10 percent of world's ecological

reached or exceeded this figure. But percentage targets are crude mechanisms for measuring and achieving effective conservation. Some highly biodiverse but restricted habitats, regions or islands require a higher proportional protection than some species poor, large, homogenous landscapes. Also, much of the land within PAs is degraded or even cultivated, poorly managed, threatened by other factors such as invasive species or pollution and may not contain viable wild populations of many expected local species. We cannot say that 10% coverage is necessarily enough, nor can we say that 4% is definitely not enough.

For the purposes of this review we assessed five categories:

- > 20% PA coverage: very high PA coverage;
- 10-20% PA coverage: good PA coverage;
- >5-10% PA coverage: moderate coverage;
- 0-5% PA coverage: apparent coverage gap; and
- Zero PA coverage: definite coverage gap.

The assessment could be more refined if all IUCN protected area management categories were known. However, since this not the case this level of refined analysis was not possible. For example, the IUCN categories for the 2000 PAs in China, which make up about 65% of the entire regional sample, are not adequately applied. Therefore only two categories: 'PA 'or 'not PA' in the overlay analysis, have been used. However, the categories have been used in summary PA growth analyses for the region and for countries for indicative purposes, and to enable national agencies to review data currently held in the WDPA.

Two other types of information contained in the PA GIS can be used in formulating views and recommendations, namely: the locations of already proposed reserves and the degree of fragmentation of PAs and habitat within species ranges or important regions or areas.

1.5 Datasets and Elements of Analysis

The following sets of data were available to the reviewers for the current analysis:

- base map, including national boundaries (Digital Chart of the World - DCW);
- WWF Ecoregions (the only detailed classification to cover the whole region);
- China and Mongolia Bioregions (the basis for the planning of Mongolia's PA system, enables comparison of national bioregions with the international approach of WWF);
- major habitats (although full details are available for China, only the aggregated major habitat types from GLC were used as the only region-wide data available);
- altitudinal bands, using the DCW, to make bands at 1,000 metre intervals up to 5,000 metre altitude, with a single class for higher altitudes;

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regions [should be] *effectively* conserved" (SCBD 2004:383).

- BirdLife International Endemic Bird Areas (polygons);
- BirdLife International Important Bird Areas (centrepoints with names and areas);
- BirdLife International Threatened Bird Ranges (polygons for gross geographic range of most of the globally listed birds in the region);
- Endemic Mammal Areas (created from ranges of all Chinese mammals provided by the CSIS database in Beijing, as well as new ranges created for Japanese endemics on the basis of literature review);
- protected area data (WDPA data held as polygons and points by UNEP-WCMC); and
- a wide range of previous reports, maps and other reference material.

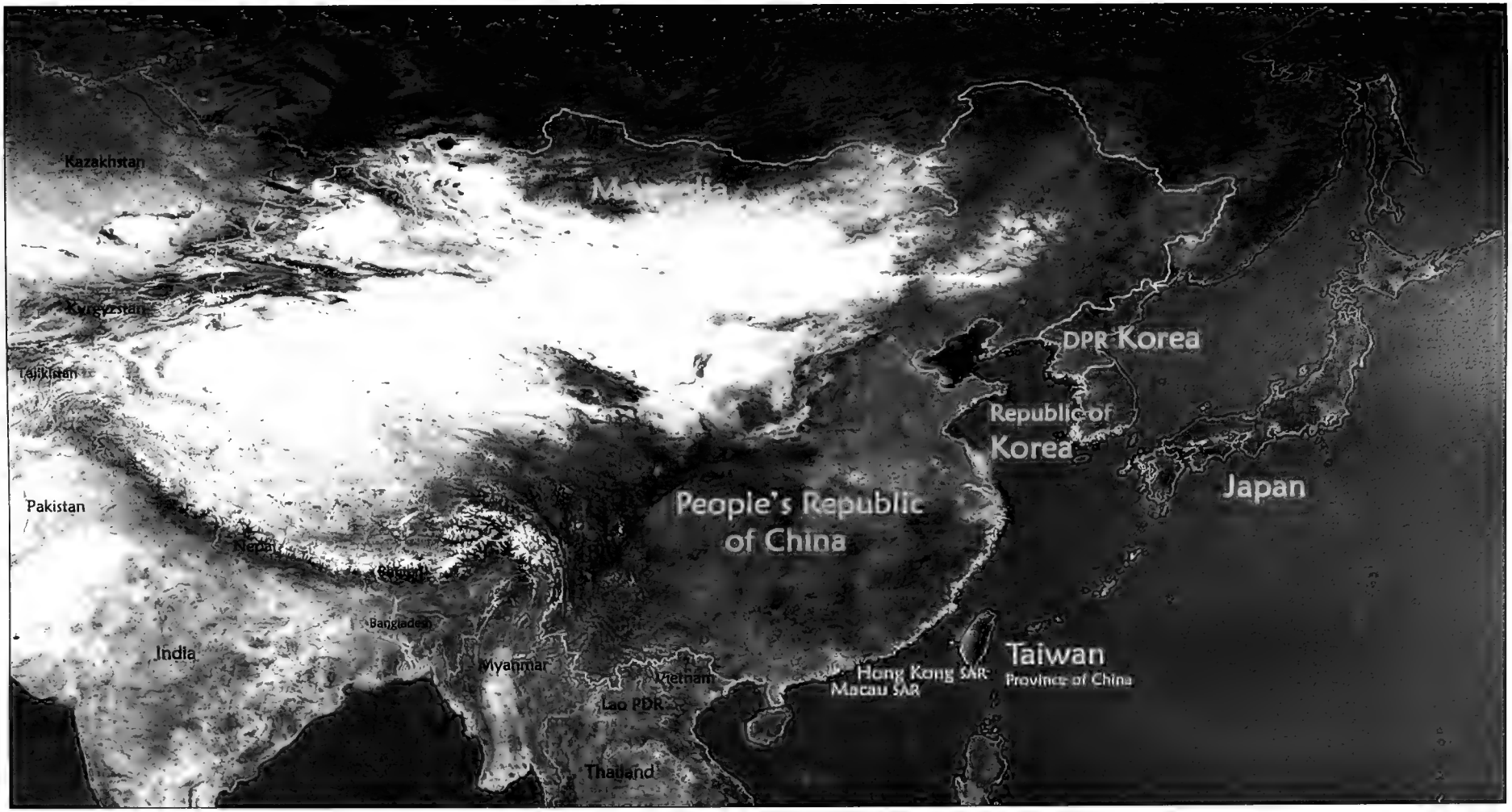


Figure 1: Satellite image of the East Asian region with the countries and territories included within this review
(MODIS image provided by JPL/NASA)

2. Overview of the East Asian Region

2.1 Geographic Extent of the Region

The East Asian region comprises the countries and territories of China, Hong Kong, Macau, Taiwan, Mongolia, DPR Korea, Republic of Korea, and Japan . This is by no means a biologically meaningful region of the world. Its boundaries are political rather than ecological but it constitutes a convenient portion of the very extensive Palearctic Realm, together with a small portion of the Indo-Malayan Realm in its southern fringes.

The region has a total land area of 11.8 million km^2 and includes a great range of diverse habitat, from the Altai Mountains in the west, to the great arc of Japanese islands in the east and the tropical seas and coral reefs of the extreme south. The region boasts the largest and highest plateau and highest peaks of the planet and also some of the deepest land depressions and most forbidding deserts. A satellite image of the region is shown in Figure 1.

2.2 Landform and Geography

The landform is ancient but has been much affected by tectonic activity. Much of the continental landmass was formerly the great Sea of Tethys but since the Indian subcontinental plate crashed into Asia some 15 million years ago, the landscape has been pushed ever higher to create the great Tibetan-Qinghai Plateau and the lofty Himalayas, which mark the collision line (see Annex: Map I). To the east, where the Asian continental plate is subducted by the Philippine plate the mountains of Taiwan have resulted and volcanic and tectonic pressures have thrown up the archipelago of Japan.

2.3 Population and Economic indicators

The human population in the region is over 1.5 billion, about 25% of the global total, and 84% of these live in China, which occupies 81% of the land area. The region contains some extremely well developed countries and territories with high per capita GDP such as Japan, Hong Kong, Macau and Republic of Korea, but also some of the poorest countries such as Mongolia and Democratic Peoples Republic of Korea. Per capita Gross Domestic Product (GDP) ranges from about US$550 in Mongolia to US$42,000 in Japan. China is intermediate with very strong development and growth in coastal areas, the fastest growing economy in the world, huge global trade levels but a GDP average depressed by the huge number of poor people living in the less developed interior of the country. Standard of living and consumption of natural resources are closely linked with wealth. The wealthier countries have much reduced levels of forest loss, but exploit forest products from poorer neighbouring countries.

2.4 Major Ecosystems

The East Asian region has a wide range of different ecosystems, from permanent ice and glaciers on the highest peaks to tropical lowland forests and a variety of other forest types, warm and cold deserts, steppe grasslands, lakes, rivers, marshes and marine habitats. The region supports a huge human population and many ecosystems have been dramatically modified as a result of more than six thousand years of human activities.

Habitat across the region is determined by three factors: altitude, latitude and rainfall. The western parts of the region are at high altitude and have low rainfall. The Tibetan plateau is both high and dry. It is pocked with thousands of lakes fed by melting snow from the various ranges of high mountains. Many of these lakes are saline. To the north of the Tibetan-Qinghai

Plateau several basins are formed between the mountain chains of Altai, Tianshan and Kunlun. The depressions are sandy and stony deserts, becoming moister and more grassy as one travels further east. Great steppes (named after the *Stipa* spp. that dominate them) stretch through much of Mongolia, Inner Mongolia and the Ordos Plateau. Northeast China and the Korean Peninsula are comprised of temperate forests – conifers on the high ground and most northerly latitudes and oak forests in the valleys with extensive swampy wetlands and lakes in the broader valley bottoms. To the east of the Tibetan-Qinghai Plateau, the land falls quickly to rolling plains, the great valleys of the Yellow and Changjiang (Yangtze) rivers and smaller mountain ranges. These were forested lands, temperate in the north and on mountains, subtropical to the south and in the valleys. The large island of Taiwan is mountainous with a narrow subtropical lowland fringe and tropical southern tip. The tropical zone extends around the southern coast of China, Hainan Island and into southwest Yunnnan and southeast Xizang (Tibet). Tropical islands with coral are found in southernmost Japan, Taiwan and the South China Sea.

Annex: Map II shows the region classified into nine major habitat categories derived from the global land classification GLC. This classification clusters vegetation classes with similar remote sensed albido, rather than on the basis of ecological relationships. Table 1 lists the major subtypes:

Table 1: Major Habitats and Sub-habitats of the East Asian Region

Major Habitat Class	Habitat Sub-types
Snow, ice and rock	▪ Glaciers ▪ Barren Screes above snowline
Alpine and meadows	▪ Alpine pasture ▪ Alpine scrub ▪ Alpine meadows
Conifer forest	▪ Taiga larch forest ▪ Sub-alpine cold fir/spruce/hemlock ▪ Temperate pine ▪ Mixed conifer/broadleaf forest ▪ Tropical pine forest ▪ Casuarina beach forest ▪ Conifer plantations
Broadleaf forest	▪ Temperate oak ▪ Temperate poplar ▪ Subtropical evergreen forest ▪ Tropical monsoon forest ▪ Tropical evergreen/semi-evergreen forest ▪ Tropical limestone forest ▪ Secondary forest ▪ Mangrove forests
Steppe and scrub	▪ Steppe grassland ▪ Highland grassland ▪ Floodplain grassland ▪ Scrub vegetation
Desert/semi-desert	▪ Cold alpine desert ▪ Sandy desert ▪ Stony desert ▪ Artemesia scrub
Freshwater	▪ Freshwater Lakes ▪ Saline Lakes ▪ Large rivers ▪ Reservoirs

Major Habitat Class	Habitat Sub-types
Wetlands	▪ Alpine marshes ▪ Swampy reedbeds ▪ Coastal wetlands
Urban/artifical	▪ Irrigated cropland ▪ Dry cropland ▪ Shifting agriculture ▪ Urban areas ▪ Secondary grassland ▪ Orchards

2.5 Biological Richness

The region is of great biological richness. China itself is one of the five richest countries in the world in terms of species number. Several biological hotspots are recognised, including the Eastern Himalayas and Hengduan Mountains. Southwest Yunnan falls within the Indochina biodiversity hotspot defined by Conservation International.

That the tropical and subtropical portions of the region rank as biologically very rich is perhaps expected, but the region also contains by far the richest temperate ecosystems of the planet. The rich mesophyll forests of temperate Central China are amazingly abundant in tree and other plant species, including several relict species. China's 2005 World Heritage Site nomination of the Sichuan Giant Panda Sanctuary contains the Qionglai Mountains, an area with over 10,000 plant species - approximately the same as the whole of Germany.

Levels of endemism are high in some areas. The islands of Japan, Taiwan and Hainan contain many endemic forms, but mainland China also has several regions of high endemism. These are demarcated by the distribution of identified Endemic Bird Areas (EBAs) and Endemic Mammal Areas (EMAs) (see section 4.5 below), but these areas are also rich in endemic plant species.

Table 2: Biodiversity Richness in East Asian Countries and Territories

Country	Mammals			Birds			Higher Plants		
	Total	Endemic	Threatened	Total	Endemic	Threatened	Total	Endemic	Threatened
China	394	77	42	1,244	67	86	30,000	17,500	343
Japan	132	38	17	583	21	31	4,700	200	706
Mongolia	134	6	8	390	2	11	2,272	229	1
R. Korea	49	0	6	390	0	19	2,500	224	69
DPR Korea	55	0	7	371	0	16	2,500	107	7
Taiwan	63	10	6	445	14	12	4,000	1,075	95

2.6 Features of Special Interest

East Asia has the highest mountains, largest plateau, greatest temperate deserts and steppes in the world. Its unique features include the Three Parallel Rivers region of southwest China, inscribed as a Natural WH Site in 2003, where the great rivers of Salween, Mekong and Yangtze run close together before parting ways to flow into the Indian Ocean, South China Sea and Pacific Oceans respectively. The great loess plain of north-central China is another unique feature and the great yellow dust storms that it generates still plague the lives of

hundreds of millions of people. Unique karst limestone scenery dominates much of the south of the region.

Some of the famous and striking species of the region include the Giant Panda, other endemic mammals such as Red Panda, Takin, Golden Monkeys, Northeastern Tiger, fabulously coloured pheasants and great congregating areas for wintering cranes and geese.

2.7 Zoogeographic Divisions

Most of the region falls within the Palearctic Realm, but tropical regions in southern China, Taiwan and southern Japan fall within the Indo-Malayan Realm. The Japanese Ogasawara Islands in the Pacific Ocean are normally classed as being within Oceania. The region falls within 17 biogeographical provinces of the Udvardy (1975) classification system and has been further classified into a total of 77 separate ecoregions by WWF (2002).

2.8 Summary of Protected Area Development

At the regional level the PA cover of the East Asian region is 16% of the land area. Elements of analysis in this review will show that this is not evenly distributed. There are different degrees of coverage by country and territory. Hong Kong has almost 50% PA coverage, whilst DPR Korea has only 2.7%. Despite the anomaly of Hong Kong, there is a bias towards low human density regions, high mountains and barren areas of little productive use. Nevertheless, it is difficult to find any major gaps in the system. Whether we look by geographic region, altitude band, ecoregion or in terms of species distributions, all types are at least to some extent included within the protected areas system, if not always comprehensively represented.

The growth in the PA system has been rapid. China alone has established an average of more than 100 new protected areas per year for the last 17 years. In total there are now sites with a total area of 1.76 million km^2. Figures 2 shows the cumulative increase in area and numbers of protected areas over time.

2.9 International Sites

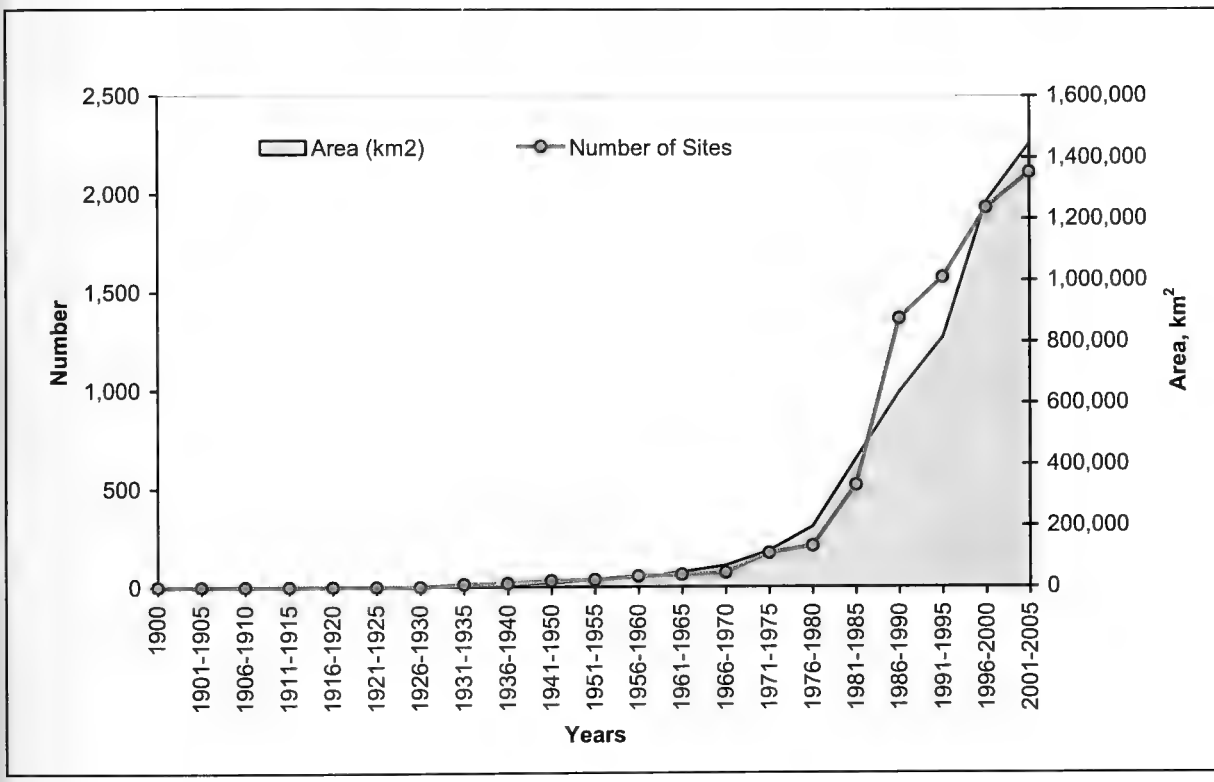
In addition to national protected area systems, several of East Asia's best protected areas are also important international sites. Table 3 summarises the details by country.

Table 3: East Asian International Protected Sites

Country	No. of Sites	Protected Area (km^2)
Biosphere Reserves		
China	24	45,437
Japan	4	1,158
DPR Korea	1	1,320
Republic of Korea	2	1,224
Mongolia	4	69,170
Total	35	118,309
Ramsar Sites		
China	20	25,468
Hong Kong	1	10
Japan	13	841
R. Korea	2	10
Mongolia	11	14,395
Total	47	40,723

Country	No. of Sites	Protected Area (km^2)
Natural and Mixed World Heritage Sites		
China	8	20,226
Japan	2	277
Mongolia	1	9,467
Total	**11**	**29,970**

Figure 2: Growth in Protected Area Number and Extent in East Asia 1900-2005
(Source: World Database on Protected Areas 2005)



3. Review of Countries and Territories

3.1 People's Republic of China

Extent and Landscape

China has a total land area of 9.6 million km^2, this is 81% of the total region. Hong Kong and Macau have recently been returned to China and are established as Special Administrative Regions (SARs) under the 'one country two systems' policy. As such they have autonomy in most areas of their administration and their protected areas are managed separately from Central Government laws. For this reason they are here treated as separate territories.

China has a huge range of landscape and ecological features from mountain chains, to deserts, to grasslands, to forests ranging from boreal to tropical evergreen and mangroves. It contains parts of 58 out of the total 77 WWF Ecoregions of the whole region, of which 30 ecoregions have 100% occurrence in China. Apart from the island groups of Japan and Taiwan it exhibits all of the features already described for the region as a whole.

Biological Characteristics

As a consequence of the vast size, varying nature and complex geological history of China a very wide range of habitat types and very large numbers of species are represented. Approximately 30,000 species of higher plants belonging to 353 families and 3,184 genera occur, of which 190 are endemic. China contains the richest temperate regions in the world and ranks globally as one of the richest countries in terms of overall plant diversity. The country is also recognised by Conservation International (CI) as a mega-diversity country on account of its rich vertebrate and other zoological wealth. About 10% of all vertebrates of the planet occur in this country, including many rare and endemic forms such as the famous Giant Panda.

Table 4: WWF Ecoregions in China
(in order of percentage cover of each ecoregion)

Ecoregion Name	Code	National Extent (km^2)	National Percentage (%)
Guizhou Plateau broadleaf and mixed forests	PA0101	269,500	100
Jian Nan subtropical evergreen forests	IM0118	661,110	100
Yunnan Plateau subtropical evergreen forests	PA0102	240,300	100
Nujiang Langcang Gorge alpine conifer and mixed forests	PA0516	82,000	100
Hengduan Mountains subalpine conifer forests	PA0509	99,400	100
Southeast Tibet shrublands and meadows	PA1017	460,800	100
Qionglai-Minshan conifer forests	PA0518	80,200	100
Sichuan Basin evergreen broadleaf forests	PA0437	98,100	100
Daba Mountains evergreen forests	PA0417	168,300	100
Changjiang Plain evergreen forests	PA0415	438,000	100
Huang He Plain mixed forests	PA0424	434,200	100
Bohai Sea saline meadow	PA0902	11,600	100
Yellow Sea saline meadow	PA0908	5,300	100
Central China loess plateau mixed forests	PA0411	359,600	100
Northeast China Plain deciduous forests	PA0430	232,500	100
Nenjiang River grassland	PA0903	23,200	100

Ecoregion Name	Code	National Extent (km^2)	National Percentage (%)
Ordos Plateau steppe	PA1013	215,500	100
Helanshan montane conifer forests	PA0508	24,700	100
Qilian Mountains conifer forests	PA0517	16,700	100
Qilian Mountains subalpine meadow	PA1015	73,200	100
Qin Ling Mountais deciduous forests	PA0434	123,279	100
Qaidam Basin semi-desert	PA1324	192,000	100
Taklimakan desert	PA1330	741,900	100
Tarim Basin deciduous forests and steppe	PA0442	54,500	100
Jungger Basin semi-desert	PA1317	304,200	100
North Tibetan Plateau – Kunlun Mountains alpine desert	PA1011	374,400	100
Tibetan Plateau alpine shrublands and meadows	PA1020	272,100	100
Central Tibetan Plateau alpine steppe	PA1002	629,500	100
Yarlun Tsangpo arid steppe	PA1022	59,500	100
Hainan Island monsoon rainforests	IM0169	15,500	100
Northeastern Himalayan subalpine conifer forests	PA0514	40,626	88
South China – Vietnam subtropical evergreen forests	IM0149	183,692	82
Eastern Himalayan alpine shrub and meadows	PA1003	86,389	71
Manchurian mixed forests	PA0426	354,143	70
Emin Valley steppe	PA0806	44,916	69
Tian Shan montane steppe and meadow	PA1019	190,209	68
Mongolian Manchurian grassland	PA0813	578,094	65
Eastern Gobi desert steppe	PA1314	178,315	63
Da Hinggan-Dzhagdy Mountains conifer forests	PA0505	151,479	61
Changbai Mountains mixed forests	PA0414	46,154	49
Western Himalayan alpine shrub and meadows	PA1021	33,354	48
Tian Shan montane conifer forests	PA0521	12,787	46
Suiphun-Khanka meadows and forest meadows	PA0907	14,410	43
Amur meadow steppe	PA0901	51,672	42
Northern Indochina subtropical forests	IM0137	144,758	33
Alashan Plateau semi-desert	PA1302	217,967	32
Pamir alpine desert and tundra	PA1014	30,806	26
Karakoram – West Tibetan Plateau alpine steppe	PA1006	25,093	18
Altai alpine meadow and tundra	PA1001	15,337	17
Altai montane forest and forest steppe	PA0502	16,986	12
Tian Shan foothill arid steppe	PA0818	8,027	6
Altai steppe and semi-desert	PA0802	1,970	2
Northern Triangle subtropical forests	IM0140	2	<1
East Siberian taiga	PA0601	282	<1
Daurian forest steppe	PA0804	2,610	1
Northwestern Himalayan alpine shrub and meadows	PA1012	635	1
Eastern Himalayan subalpine conifer forests	IM0501	651	1
Eastern Himalayan broadleaf forests	IM0401	Marginal	<1

Conservation Policy and Law

Population density in the east of China is very high, especially in the agriculturally fertile valleys and plains, but population density in the west is very low. The standard of living and rate of development is growing very fast, especially in coastal regions. This is placing huge pressure on all kinds of natural resources as well as causing impacts on environmental quality in the form of pollution, acid rain and siltation. Deforestation is blamed for both denuding upper catchments and silting up drainage channels and lakes, resulting in regular devastating floods. Overgrazing and deforestation combined with global warming are having serious effects on water supply and much of northern China now faces annual water shortages. Major engineering schemes (giant dams and canals) designed to meet these two challenges are having further impacts on the natural environment.

With the fastest growing economy in the world, China is poised to become the next economic superpower and its capacity to conserve or consume natural resources is crucial to conservation of East Asia and beyond. A heavy dependence on traditional medicines and food sources harvested from the wild, including the consumption of a wide range of animal species, is placing an additional burden on wildlife populations. Additionally, growing trade places demands on the timber and wildlife of neighbouring countries, as well as exposing China to new threats of alien invasive species.

Nevertheless, China's policies on nature conservation and environmental protection are good;. there are dozens of laws and regulations issued by departments at different levels. Separate laws cover wildlife protection, forestry, marine conservation, wetlands conservation and environmental impact assessment. China has adopted the policy of establishing a national system of PAs to conserve species, ecosystems and natural sites and national policy on protected areas is enshrined in several key documents and regulations of the state. Key examples are listed in Table 5.

Table 5: Key National Policies, Documents and Regulations in China

Policy	Instrument	Date
Programme launched to improve rural livelihoods	Decree No. 1	2003
Programme launched to reverse clearing of steep land for farms	Programme for returning farmland to forest and grassland	1999
Programme launched to narrow economic gap between rural interior and urban east/south of China	Great Western Development	1999
Logging ban applied to large areas following disastrous floods.	Prime Minister's Decision	1998
Regulations for Marine reserves established	Management Approaches of Marine Nature Reserves	1995
Recognition of need to protect geological sites	Rules for Conservation Management of Geological Relics	1994
Rules for Nature Reserves endorsed by State Council	Regulations of Nature Reserves	1994
China accepts global responsibilities and need to share benefits from uses of biodiversity	Convention on Biological Diversity (CBD)	1992
Wide range of policy issues restated and approved	China Biodiversity Action Plan	1992
Need for species protection recognised	Law of Wildlife Protection	1988
Recognition of important wetlands	Ramsar Convention	1988
PA role in ecological conservation needs recognised	Principles on China's Ecological Conservation	1987

Policy	Instrument	Date
Regulations for PAs promulgated	Management Approaches of Nature Reserves of Forest and Wildlife, Law of Grassland	1985
China recognises heritage value of PAs and joins WHC	World Convention on Protection of Cultural and Natural Heritage	1985
PAs recognised as legal entities	Law of Forest	1981
First 3 MAB reserves established	National MAB Committee	1980
PAs recognised as important part of national planning	Notice of Strengthening, Planning and Scientific Investigation in Nature Reserves	1979
First PA established in China	Declaration of Dinghushan as PA	1956

Despite this long list, there is no comprehensive law for the establishment of nature reserves, the main PA designation. Currently these are established under ministerial regulations only. Moreover, the law does not provide much flexibility in terms of zoning and management options. The result is that most protected areas are managed in ways that flout the word and spirit of the law. Work is currently ongoing to develop new legislation for nature reserves, PA zonation, and wetlands regulations at national and provincial levels.

Protected Area History and Current Extent

China has been active in the establishment of protected areas (PAs) since the first PA was established in Dinghushan (Guangdong Province) in 1956. Since that time new PAs have been added to national lists, slowly from 1950s until 1979 and then at an accelerating pace after the Cultural Revolution period to the present time. Nine different agencies establish and manage protected areas.

Since only one regulation exists to define a nature reserve all these sites have the same legal category, though small parks are very different in character from huge reserves. Further, protected areas are established for a variety of different purposes, by different agencies and at different levels of government (national down to county).

Most nature reserves are assigned to one of three major types – wildlife protection, ecosystem protection or natural relic protection, although the distinction is not so clear and most reserves have elements of more than one objective. Table 6 indicates the numbers falling into these major types.

Table 6: Types of Nature Reserves in China

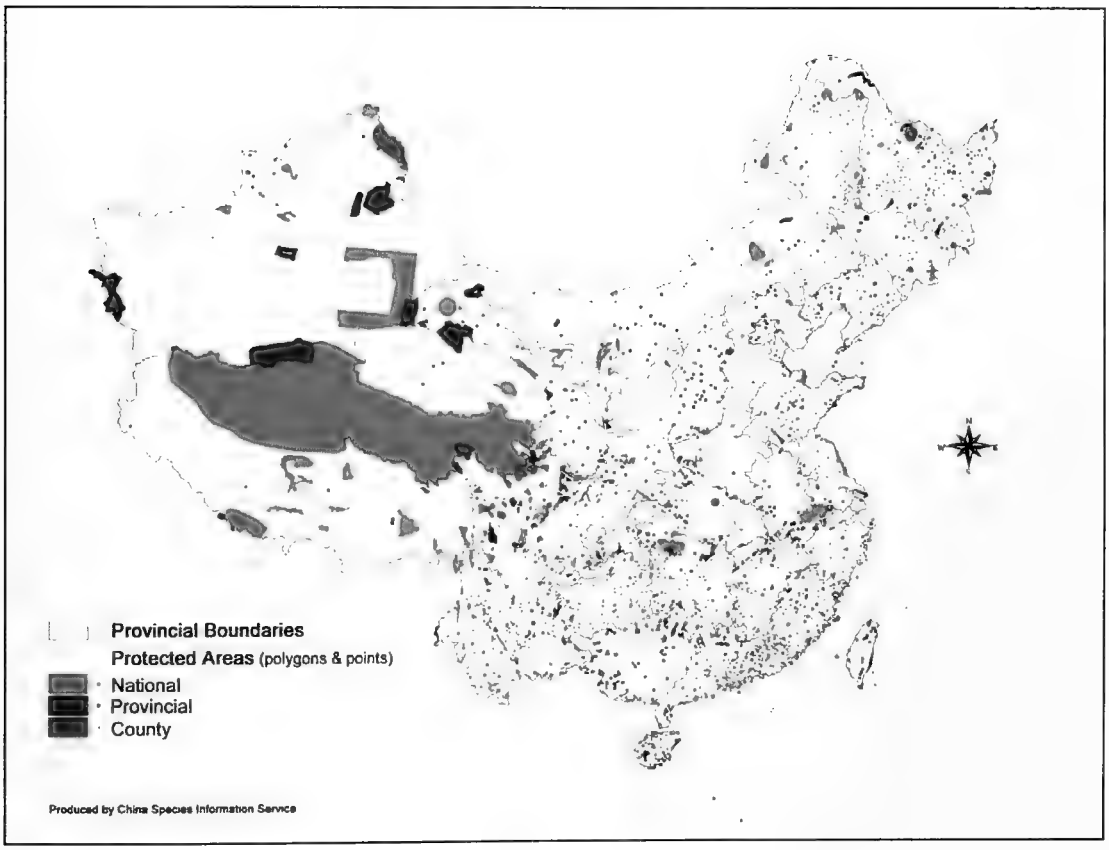
(Department of Natural and Ecological Conservation, SEPA 2002)

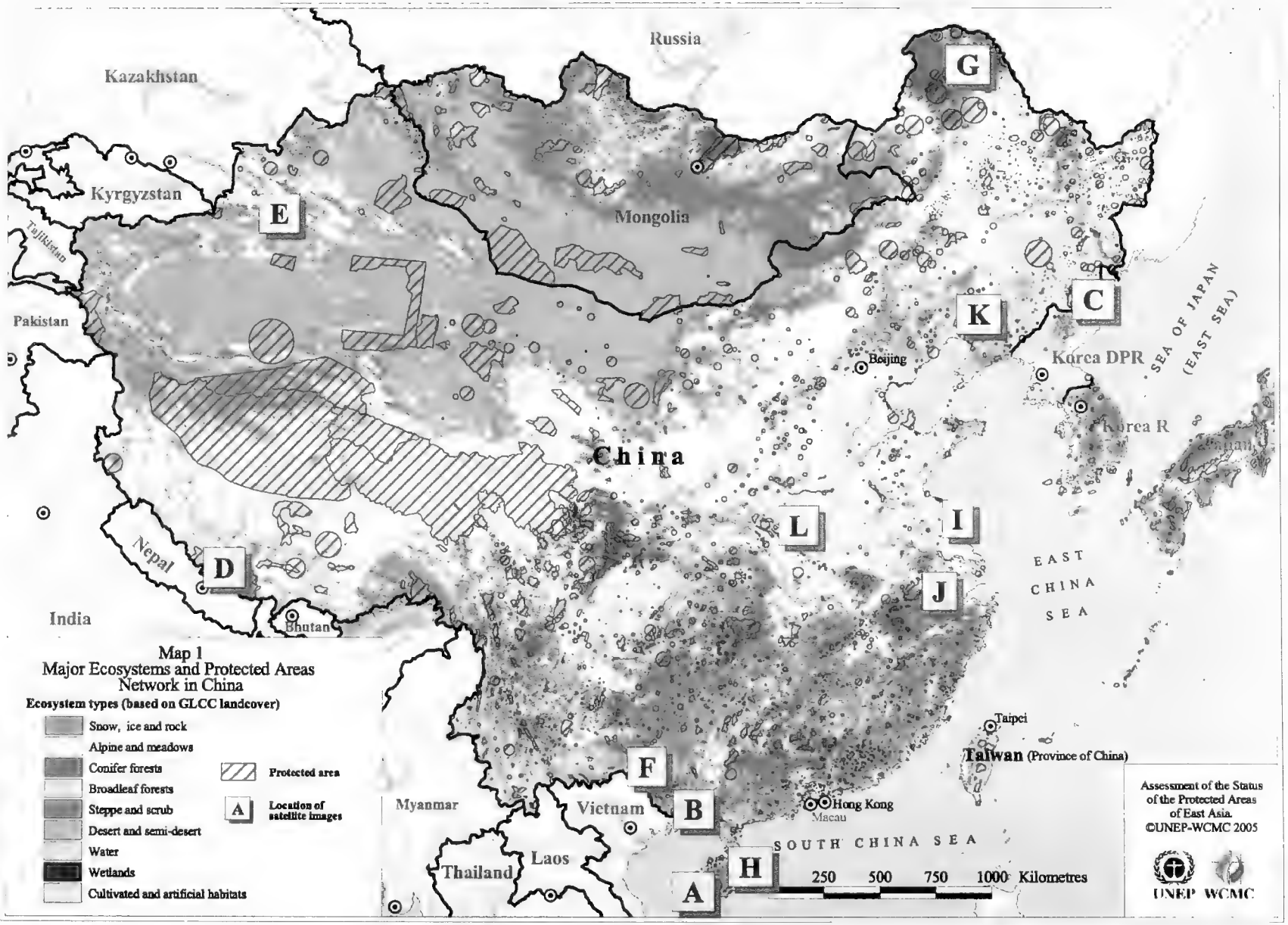
Type	Number - end 2001	Area - end 2001 (km^2)
Natural Ecosystems Type		
Forest ecosystem	769	2,245.08
Prairie and meadow ecosystem	33	350.56
Desert ecosystem	20	3,623.85
Inland wetland and watershed ecosystem	137	2160.66
Ocean and coast ecosystem	40	100.75
Wildlife Type		
Wild animals	325	4,149.75
Wild plants	111	212.99
Natural Relics Type		
Geological relics	90	109.61

Ancient organism relics		26	35.74
	Total	**1,551**	**12,989**

Today, more than 2,000 nature reserves, under the charge of nine agencies, have been established in mainland China, covering about 15% of the land - almost 1.44 million km^2. Protected areas already cover about 15% of the country. Table 8 lists basic statistics and Figure 3 and Map 1 show their spatial distribution, the latter with major ecosystem types (note that the boundary information in Figure 2 is more up-to-date than the WDPA-sourced data). Figure 4 presents 12 selected satellite images of different PAs across China in different landscapes (see Map 1 for location key). It is noted that in the populated east and south of China there are very large numbers of very small reserves, whilst in the depopulated west there are a few huge reserves. Qiangtang Nature Reserve, for instance, is the same size as Italy.

Figure 3: Protected Area System in China
(Source: Xie Yan and Lishu Li 2002)




Russia
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Kyrgyzstan
Tajikistan
Pakistan
Mongolia
China
Nepal
India
Bhutan
Myanmar
Vietnam
Laos
Thailand
Beijing
Korea DPR
Korea R
SEA OF JAPAN (EAST SEA)
EAST CHINA SEA
SOUTH CHINA SEA
Taipei
Taiwan (Province of China)
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Map 1
Major Ecosystems and Protected Areas Network in China
Ecosystem types (based on GLCC landcover)
Snow, ice and rock
Alpine and meadows
Conifer forests
Broadleaf forests
Steppe and scrub
Desert and semi-desert
Water
Wetlands
Cultivated and artificial habitats
Protected area
Location of satellite images
250 500 750 1000 Kilometres
Assessment of the Status of the Protected Areas of East Asia.
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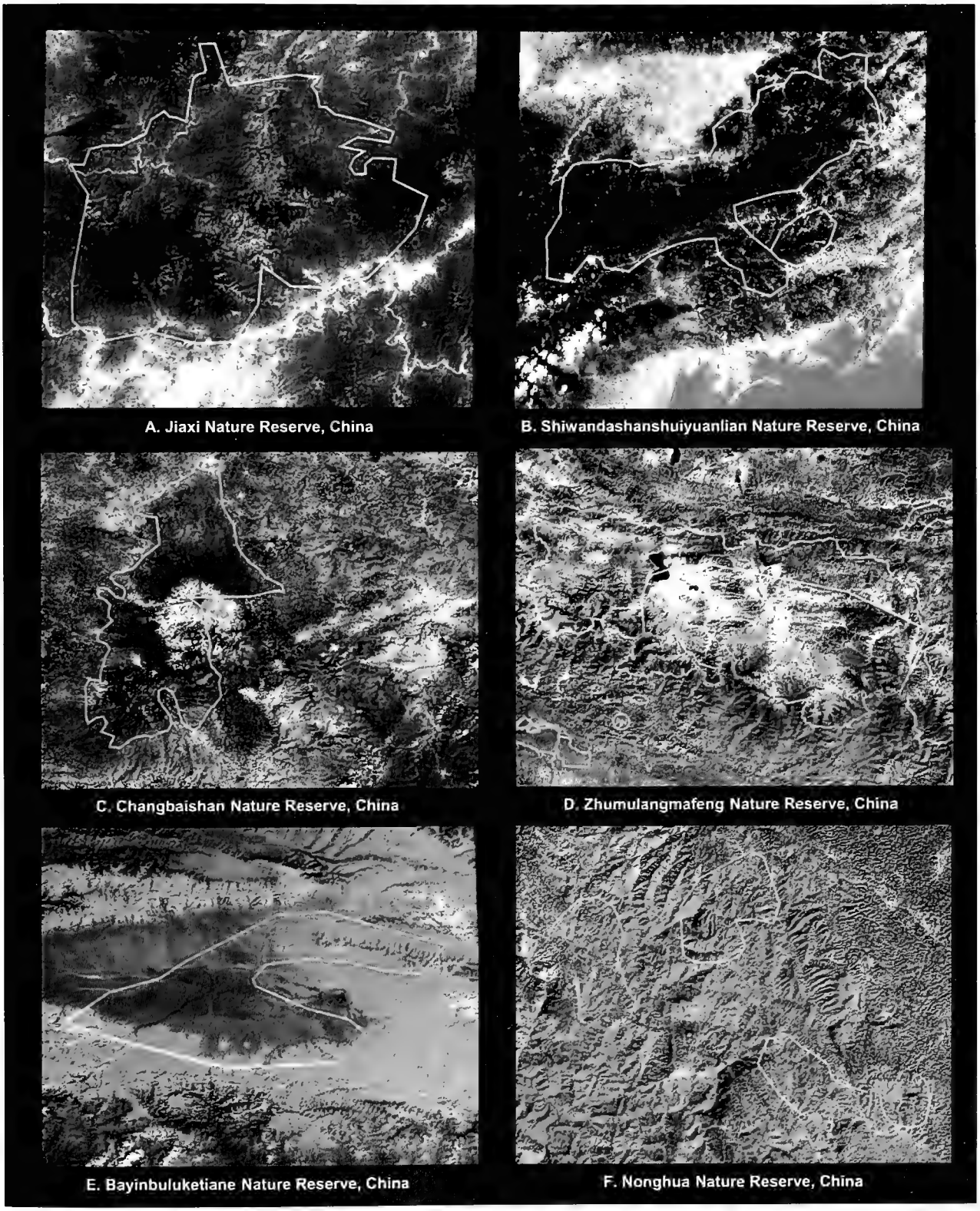
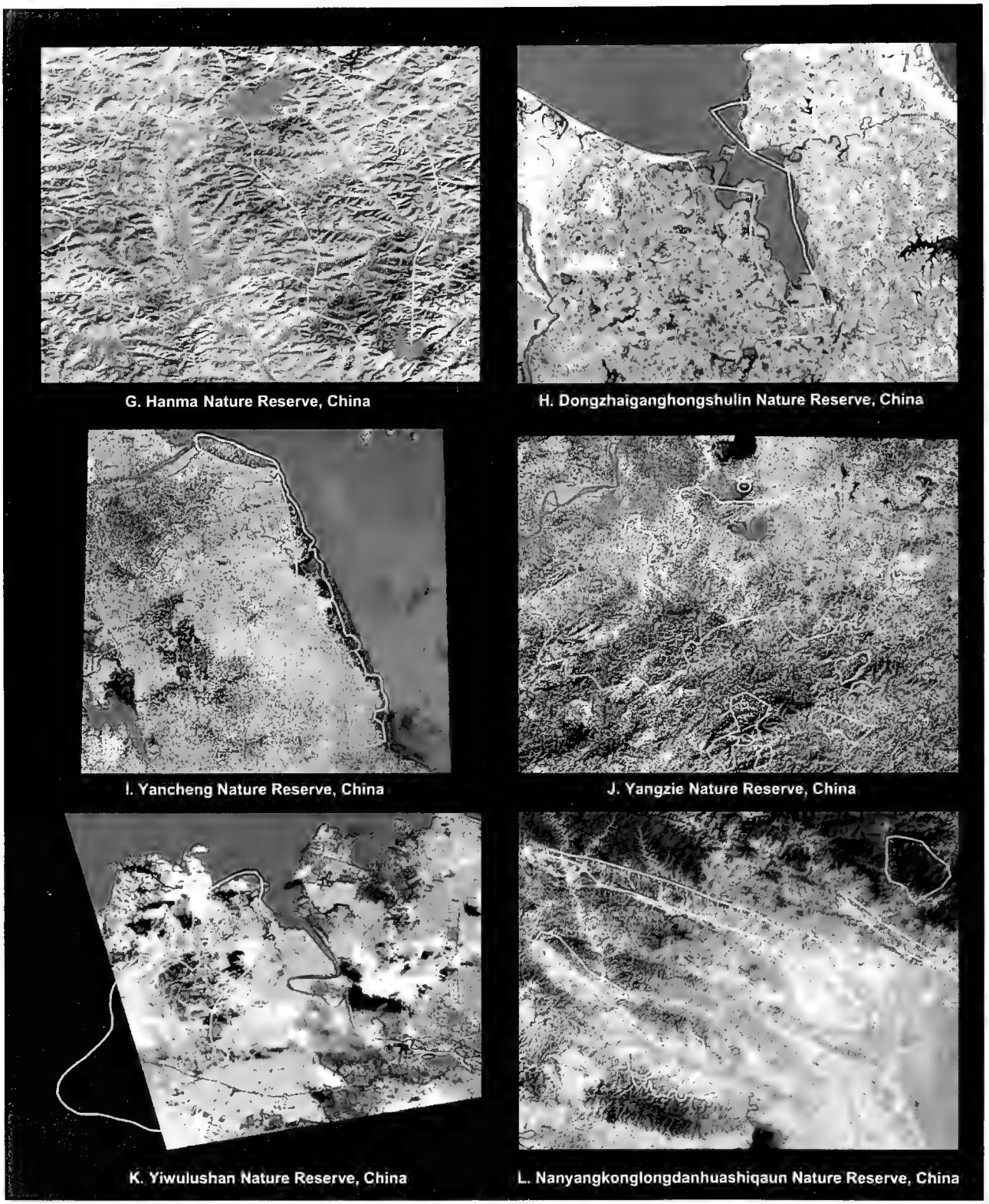
Figure 4: Satellite Images of 12 Protected Areas in China (JPL NASA)
(Note: PA boundaries may not be exact and colour varies between images depending on spectral characteristics of particular image compositions)





G. Hanma Nature Reserve, China

H. Dongzhaiganghongshulin Nature Reserve, China

I. Yancheng Nature Reserve, China

J. Yangzie Nature Reserve, China

K. Yiwulushan Nature Reserve, China

L. Nanyangkonglongdanhuashiqaun Nature Reserve, China

Table 7 presents national PA basic statistics, but it should be noted that the allocation of most of China's protected areas to IUCN Category V is quite arguable. Many human activities occur in these sites but their declared management objectives are closer to Category I than Category V. National experts should reclassify the list as soon as possible.

Table 7: Numbers, Categories and Size of China's PAs

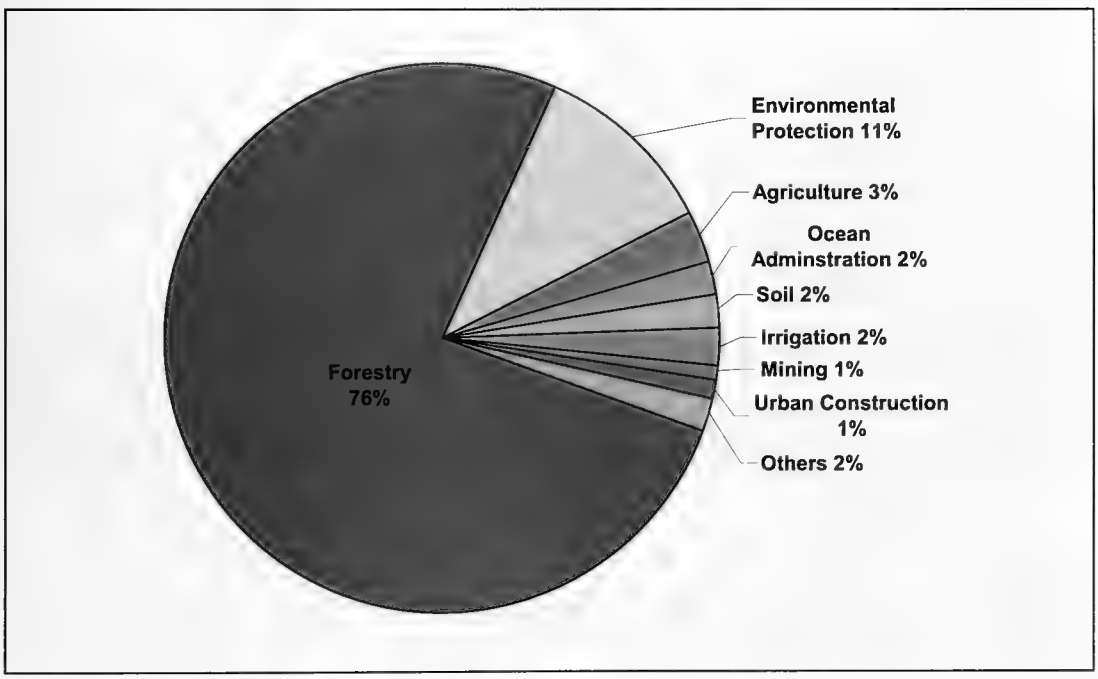
IUCN Management Categories	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas					2	1,954	68	3	2,027
Area Protected (km^2)					934	1,407,311	59,118		1,467,363
Pecentage of terrestrial area					0.01%	14.7%	0.6%	0.0%	15.4%

Protected Area Management Agencies and Standards

About 20 different agencies are involved in the establishment and management of protected areas in China. Most of the nature reserves are managed by the State Forestry Administration (SFA), others are established and managed by the State Environment Planning Agency (SEPA), Ministry of Urban Construction, Water Supply Department, Ministry of Agriculture or State Oceans Administration (see Figure 5). There is rather poor coordination between the different agencies concerned. New reserves are established in the absence of a systems plan or review process, so there are many duplicate reserves.

Figure 5: Sectoral Responsibility for Protected Areas in China

(Source: Xie Yan and Lishu Li 2002)



Many of the larger nature reserves have been declared National Nature Reserves rather than being managed at provincial or county level. Xie Yan and Lishu Li (2004) note that the proportion of protected areas managed at national level is too great (67%) and that more areas should be administered at provincial level.

Standards of management are rather poor. The PA system has grown so fast, most staff lack any specialist training, there are no accepted standards, often inadequate operational budget, little supervision and lack of flexible regulations. As a result a great many-money making ventures spring up within protected areas that are often in contradiction to their legal status and stated management objectives. This problem makes it difficult to assign IUCN categories to most sites. Their legal management objectives should make most of them category I but actual *de facto* management would leave them as mostly V or VI.

Transfrontier Initiatives
China borders on a total of 12 different countries. There are many transfrontier connections between protected areas in China with those in neighbouring countries. Important examples include the:

- Lake Kanka reserve between northeast China and Russia;
- Changbaishan Mountain between China and North Korea;
- the Gobi Desert reserves and Altai Mountains reserves between China and Mongolia;
- Karakoram Reserves in China and Pakistan;
- Qongmalonga/Everest and other Himalayan connections with Nepal;
- Gaoligong Mountains between China and Myanmar;
- Shangyang-Hanma connection between China and Laos;and
- Lian Shan mountains and Guangxi Limestone reserves between China and Vietnam.

Many of China's wetland reserves form part of international flyways and migration pathways and are thereby connected through migration with other sites in Russia, South Korea and Southeast Asia.

A special concern is China's huge and growing place in international trade, especially wildlife trade. China is attempting to deal with this problem domestically and in various bilateral and international fora.

3.2 Hong Kong

Extent
The Special Administrative Region of Hong Kong was returned to China in 1997. It has a total land area of 1,097 km² consisting of part of the Chinese mainland, Hong Kong Island and some smaller islets.

Biological Characteristics

Hong Kong falls within the South China-Vietnam subtropical evergreen forest ecoregion. However, Hong Kong has suffered at least two phases of virtually total deforestation followed by reforestation efforts. Secondary forests occur in several places but the landscape is dominated by bare hills clothed in secondary grasslands. Bush fires are a regular problem. Probably the only small area of semi-original forest left is in Tai Po Kau Nature Reserve. Forest cover is increasing and new species keep being identified and added to the Hong Kong lists as enthusiasts document their wildlife thoroughly, but there are also probably 'refugees' from more degraded forests in adjacent Guangdong Province. Significant secondary mangroves and restored fishponds are found in Mai Po Marshes Nature Reserve. A few northern coral reefs are also protected. White dolphins are protected in marine waters.

Conservation Policy and Law

Although returned to China in 1997, Hong Kong remains relatively autonomous in terms of land management and conservation. As a Special Administrative Region, it continues to follow the policies and laws established under its period of British control. Hong Kong is separately a signatory of many international conventions and programmes. The Wild Animals Protection Ordinance of 1976 prohibits the hunting or sale of protected species and restricts access to wildlife reserves. County Parks Ordinance, Marine Parks Ordinance and the Ramsar Convention are also legal instruments for enforcing conservation. Hong Kong is a signatory to CITES. Unfortunately, Hong Kong is also well known as a centre for wildlife trade and consumption.

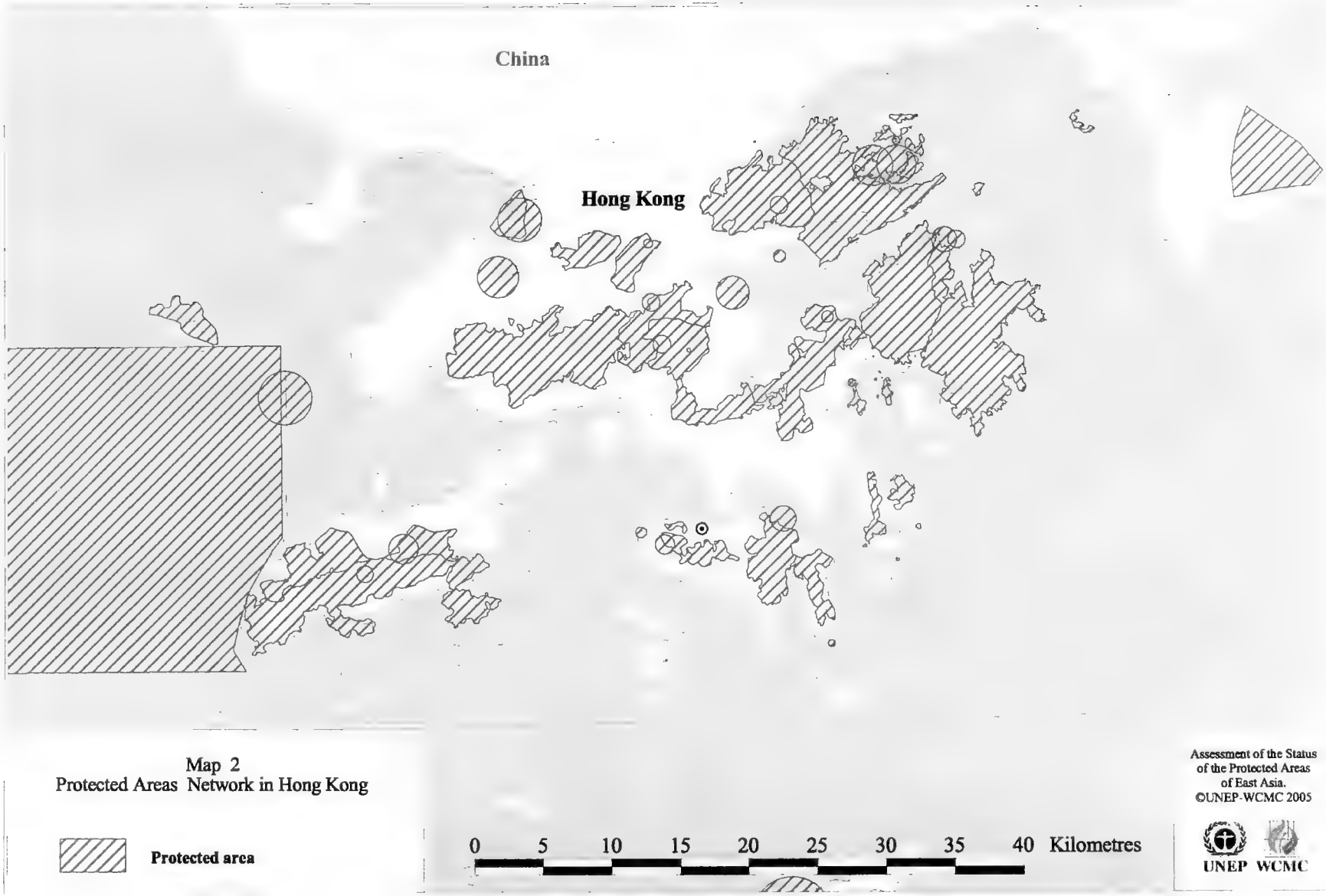
Protected Area History and Current Extent

Between 1997-2000, 21 country parks were designated covering almost 40% of the territory. Marine protected areas have been established since 1996.

Hong Kong has a very high percentile cover by protected areas, but this area is almost entirely made up of 'Country Parks' which consist of rather open wild secondary habitat used largely for hiking. Mai Po Marshes, originally established as a Restricted Area in 1995 has been upgraded to a Ramsar Site. Table 8 presents the basic statistics, and Map 2 and Figure 6 the spatial distribution of the sites. Note that due to lower resolution problems it was not possible to include a meaningful major ecosystems layer on Map 2.

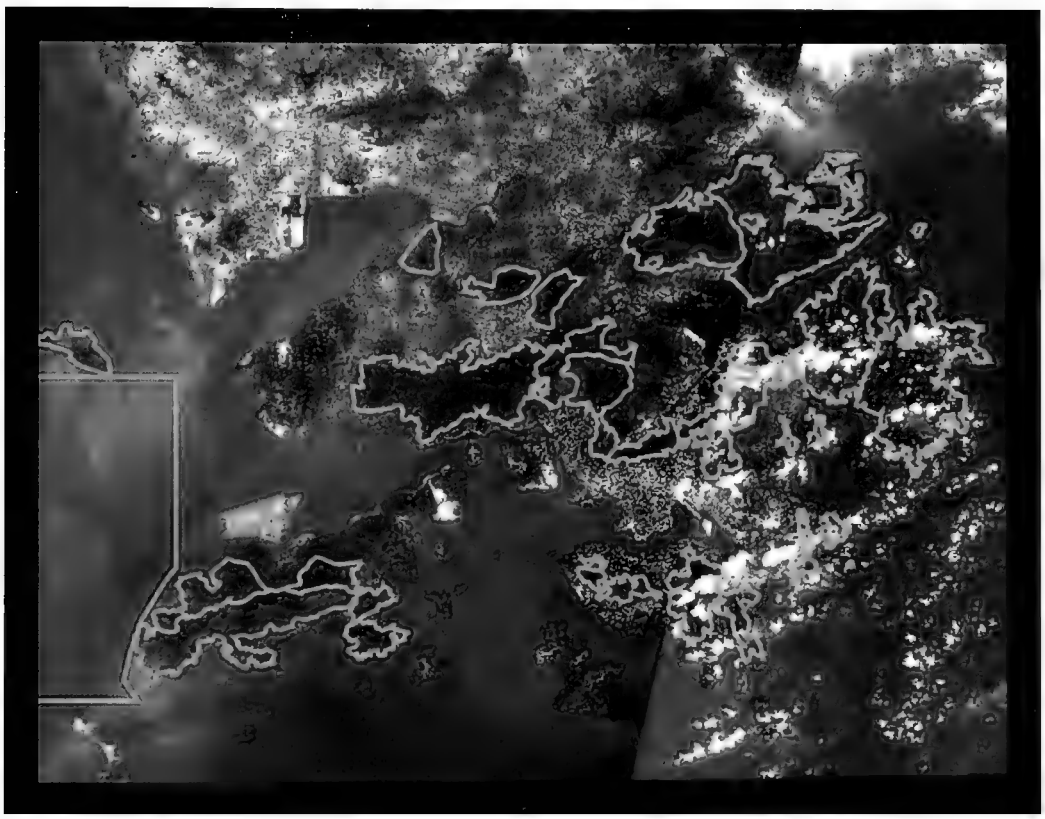
Table 8: Numbers, Categories and Size of Hong Kong's PAs

IUCN Management Categories	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas					19	27		56	102
Area Protected (km²)					25.3	425.7		95.9	546.9
Pecentage of terrestrial area					2.4%	40.1%		9.0%	51.5%



Map 2
Protected Areas Network in Hong Kong

Figure 6: Satellite image of Hong Kong and its Protected Areas
(Courtesy JPL/NASA)



Protected Area Management Agencies and Standards
Whilst the extensive system of Country Parks is maintained by the Agriculture, Fisheries and Conservation Department of the Hong Kong Government, Mai Po Marshes and Hoi Ha Wan are managed with WWF Hong Kong assistance. Standards of management are very high and there are close links between the university in Hong Kong and the agencies responsible for different sites.

Transfrontier Initiatives
Hong Kong has no international borders. It does, however, have administrative borders with Guangdong Province and, starting in 1996, has initiated cooperative programmes with the authorities of Futian Mangrove Reserve adjacent to Mai Po Marshes. Mai Po Marshes is now an important stopping point for migratory waterfowl and forms part of the East Asian Flyway. Mai Po Marshes is also used as a training centre for wetlands managers from all over China. A programme of the Kadoorie Farm and Botanic Gardens has been working closely with several provinces of Southern China assisting in the surveying, planning and extension of their tropical forest protected areas.

3.3 Macau

Extent

Macau is a tiny territory of only 25 km², with the highest point 172 metres. Population is 0.44 million with a growth rate of 0.87% per annum. The territory consists of an island and small area of the adjacent mainland. The territory was for a long time a Portuguese colony but was returned to China in December 1999, following Hong Kong, as a Special Administrative Region (SAR).

Biological Characteristics

Macau lies within the South China-Vietnam subtropical evergreen forests ecoregion. The climate is subtropical maritime monsoonal. However, the territory is entirely urban, despite having 20% 'green areas' in the way of parkland. The territory has a coastline of 41 km, including some beaches.

Conservation Policy and Law

The urban nature of the territory, leaves little room for nature conservation. Apart from a policy to retain 20% of the land as green spaces, these are secondary and artificial and there is no attempt to establish protected areas.

Protected Area Current History

Macau has no listed protected areas meeting the IUCN definition.

3.4 Taiwan

Extent and Landform

Taiwan has a total land area of 36,000 km^2 located between 21°45'-25°56'N and 119°18'-124°34'E, straddling the Tropic of Cancer with one large island and 88 neighbouring islets. To the east of the island, the ocean drops to deep-sea trenches 3,000-6,000 metres in depth.

Two-thirds of Taiwan is dominated by the main mountain chain with 62 peaks over 3,000 metres and the highest peak of Yu Shan reaching 3,997 metres. Small, swiftly flowing rivers drain down to narrow coastal plains wider to the west than the east, and the 1,100 km of coastline contains several bays with mangroves. Offshore islets have some coral reefs. Climate is subtropical maritime monsoon type with a small tropical zone at the extreme south tip of the island.

Biological Characteristics

Taiwan is moderately rich in species but it is most important biologically as a site of high endemism in almost all taxa, reflecting its long isolation from the Asian mainland. About 29% forest cover remains. Two of the WWF Ecoregions fall entirely within the territory.

Table 9: WWF Ecoregions in Taiwan

Ecoregion Name	Code	National Extent (km²)	National Percentage (%)
Taiwan subtropical evergreen forests	IM0172	33,400	100%
South Taiwan monsoon rain forests	IM0171	2,600	

Conservation Policy and Law

The population of 49 million is concentrated along the west coastal plain so that the central mountains and narrow eastern coastal plain remain rather wild and depopulated. Taiwan's policies on nature conservation have four main components: habitat preservation, forest

resources conservation, protection of endangered species and participation in international species protection. Three main laws assist in protecting its natural ecosystems:

- 1989 Wildlife Conservation Law
- 1982 Cultural Heritage Preservation Law
- 1972 National Parks Law

These together with the Forest Law, Environment Impact Evaluation Law, and Water and Land Conservancy Law provide a firm basis for conservation activity.

Protected Area History and Current Extent

For over 30 years Taiwan has been developing its own PA system, including: Nature Reserves, National Parks, Earthquake Monuments, Wildlife Refuges, Major Wildlife Habitats, National Scenic Areas and Forest Reserves. A total of 49 PAs total cover 12% of the land area (see Map 3).

Table 10: Numbers, Categories and Size of Taiwan's PAs

IUCN Management Category	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas	19		6		15		9		49
Area Protected (km²)	645		3,228		250		217		4,340
% terrestrial area	1.8%		0.0%		0.7%		0.6%		12.1%

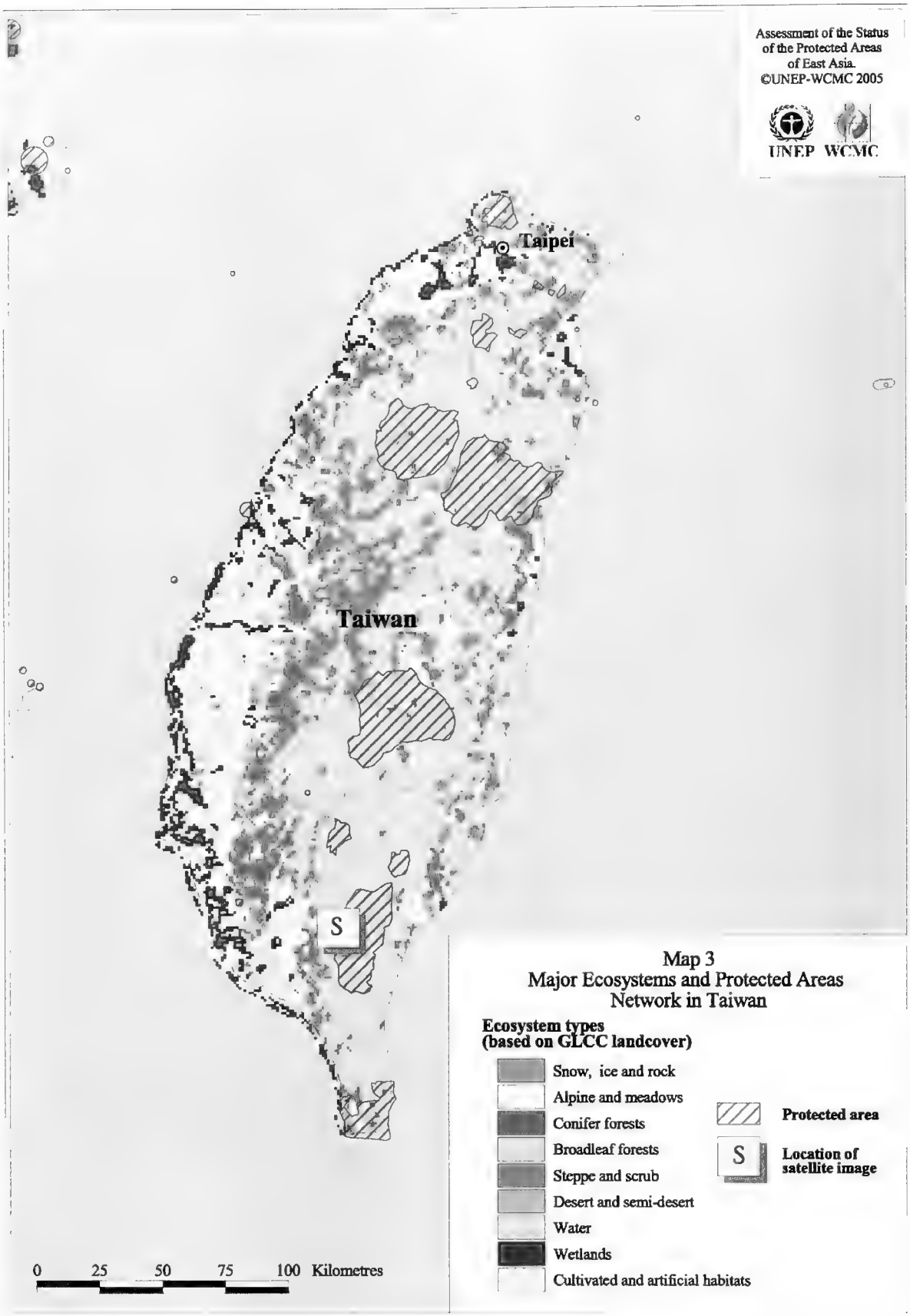
Protected Area Management Agencies and Standards

The Council of Agriculture oversees nature conservation, while the Ministry of Interior Construction and Planning Administration and individual National Parks Headquarters manage national parks. The Environmental Protection Administration is in charge of EIA and pollution prevention. These agencies are assisted by Taiwan's National Park Society, other NGOs and scientists.

Standards of management, research and management of ecotourism are generally high. Many of the national parks are visited by large numbers of visitors (for example, Kenting: 4 million p.a. and Yu-shan: 2 million p.a.).

Transfrontier Initiatives

Taiwan has no direct land neighbours but relations with China across the Taiwan Straits has consequences about the degree of cooperation possible in terms of joint protection, control of trade etc. China claims Taiwan as a province, whilst Taiwan has maintained its own government and administration since the forming of the People's Republic of China on the mainland. Both mainland China and Taiwan claim large expanses of the South China Sea, including the important Spratly and Paracel archipelagos. Several ASEAN countries also claim portions of these disputed islands and waters and such lack of clear responsibility has frustrated appropriate conservation measures for these important areas of coral community species.


Assessment of the Status
of the Protected Areas
of East Asia.
©UNEP-WCMC 2005
UNEP WCMC
Taipei
Taiwan
S
0 25 50 75 100 Kilometres
Map 3
Major Ecosystems and Protected Areas
Network in Taiwan
Ecosystem types
(based on GLCC landcover)
Snow, ice and rock
Alpine and meadows
Conifer forests
Broadleaf forests
Steppe and scrub
Desert and semi-desert
Water
Wetlands
Cultivated and artificial habitats
Protected area
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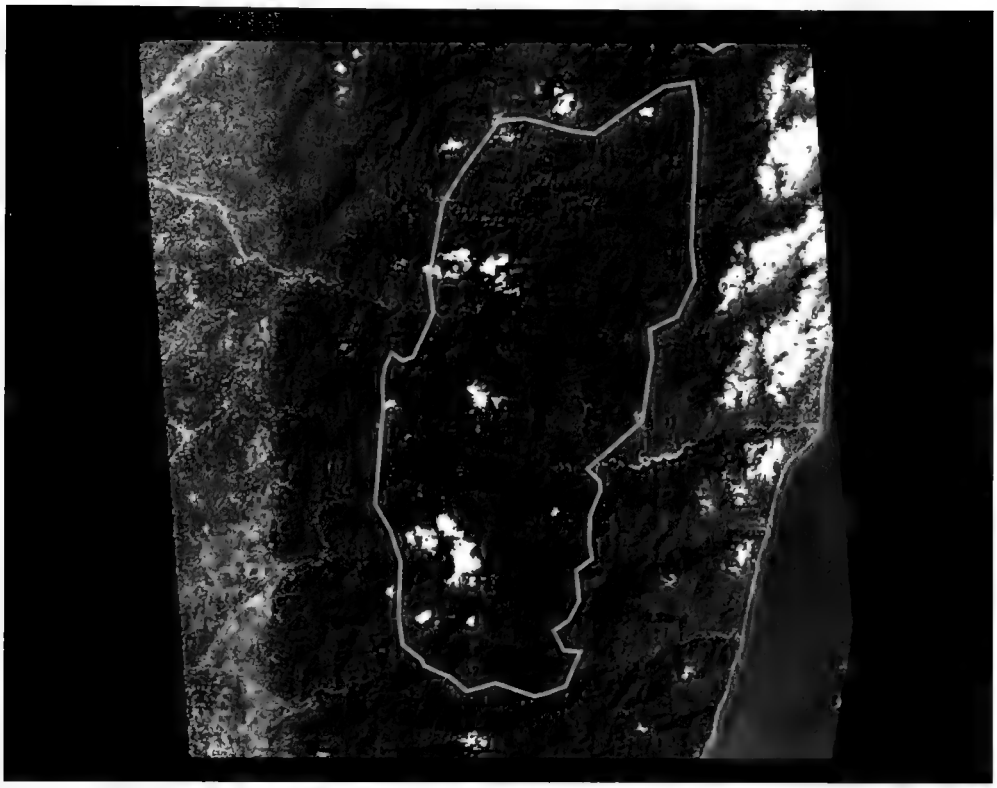
Location of
satellite image

Figure 7: Satellite image of Tawushan Nature Preserve, Taiwan
(Courtesy JPL/NASA)



3.5 Mongolia

Extent and Landscape

Mongolia is one of the largest land-locked countries in the world, covering an area of 1.56 million km^2. But with a population of only 2.3 million inhabitants, it remains one of least densely populated nations in Asia. Mongolia is a land of diverse landform including lakes, wetlands, grasslands, forests, deserts and mountains and across this wide mosaic, the people are traditional pastoralists.

Biological Characteristics

Ecologically, Mongolia constitutes a meeting zone in Central Asia where the Gobi Desert, Altai Mountains, Siberian taiga forest and Central Asian steppes converge. Much wild habitat and important species populations remain, though worsening climate and intensified hunting are growing problems. Mongolia is not rich in species but has some unique ecosystems and rare species. It contains important sections of a total of 15 of the WWF Ecoregions and marginally the Sayan intermontane steppe unit. Species for which Mongolia remains an important refuge include the Snow Leopard *Uncia uncia*, Mongolian Saiga Antelope *Saiga tatarica mongolica*, Argali *Ovis ammon*, Wild Camel *Camelus bactrianus*, Brown Bear *Ursus arctos*, Wild Ass *Equus hemionus* and the White-naped Crane *Grus vipio*.

Table 11: WWF Ecoregions in Mongolia
(in order of percentage cover of each ecoregion)

Ecoregion Name	Code	National Extent (km²)	National Percentage (%)
Khangai Mountains alpine meadow	PA1007	37,167	100
Khangai Mountains conifer forest	PA0512	2,900	100
Gobi Lakes Valley desert steppe	PA1315	139,703	100
Selenge-Orkhon forest steppe	PA0816	202,301	89
Great Lakes Basin desert steppe	PA1316	135,197	86
Eastern Gobi desert steppe	PA1314	178,315	63
Altai montane forest and forest steppe	PA0502	90,369	63
Daurian forest steppe	PA0804	94,614	45
Mongolian-Manchurian grassland	PA0813	308,600	35
Alashan Plateau semi-desert	PA1302	217,967	32
Altai alpine meadow and tundra	PA1001	25,559	28
Sayan alpine meadow and tundra	PA1016	21,540	27
Trans-Baikal conifer forest	PA0609	38,060	19
Sayan montane conifer forest	PA0519	38,294	11
Junggar Basin semi-desert	PA1317	33,899	11

Conservation Policy and Law

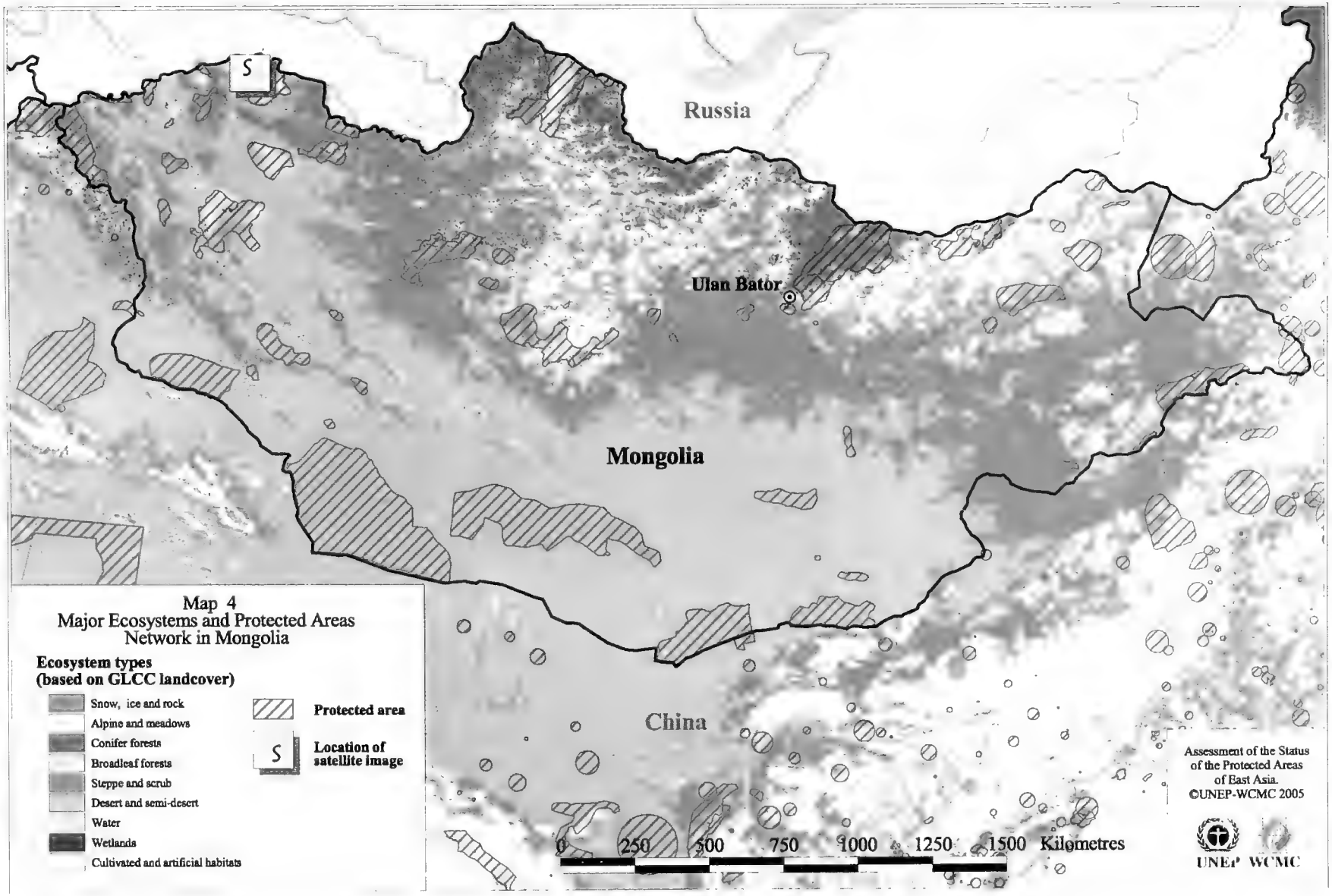
Semi-nomadic herders ride horses and camels to take their herds of sheep, cattle and goats from one pasture to another in wide annual cycles. Good environment has been important for the Mongolian traditional herding way of life and remains essential for the fostering of tourism but is threatened by new economic developments in Mongolia and the fast growing urban population. New roads are opening up formerly inaccessible areas and the recent free market in addition to the introduction of firearms and international trade links are placing increasing pressure on biological resources. The government has adopted a policy of strong environmental protection and has established a Ministry of Nature and Environment. Assistance in planning a national system of protected areas was provided by UNDP and resulted in the publication of the Biodiversity Conservation Action Plan for Mongolia in 1996 (BCAP).

Protected Area History and Current Extent

The BCAP divided the country into six major biogeographical zones and 45 subdivisions and these units formed the basis of planning a PA network. The 26 protected areas existing at that time have been subsequently increased to 51, covering almost 14% of the country (see Map 4). More sites remain as proposals.

Table 12: Numbers, Categories and Size of Mongolia's PAs

IUCN Management Category	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas	3	9	16	22				1	51
Area Protected (km²)	62,120	40,010	88,370	19,390				7,990	217,910
% terrestrial area	4.0%	2.6%	5.6%	1.2%				0.5%	13.9%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Russia
Ulan Bator
Mongolia
China
Map 4
Major Ecosystems and Protected Areas
Network in Mongolia
Ecosystem types
(based on GLCC landcover)
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Cultivated and artificial habitats
Protected area
S
Location of satellite image
0 250 500 750 1000 1250 1500 Kilometres
Assessment of the Status of the Protected Areas of East Asia.
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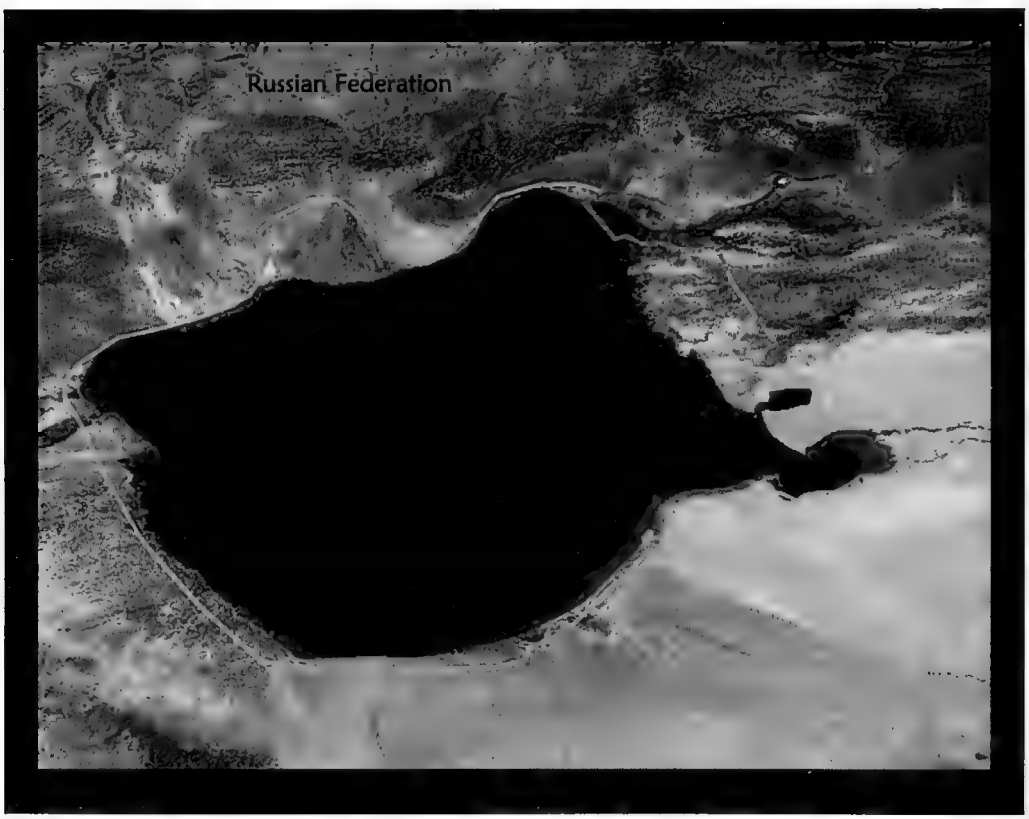
Protected Area Management Agencies and Standards

Protected areas are established and managed by the Mongolia Ministry for Nature and the Environment. The ministry has little resources to manage such large areas but has received assistance from UNDP GEF, WWF and others in planning and capacity development. Major problems remain as a result of worsening climate and increased hunting.

Transfrontier Initiatives

There are excellent opportunities to develop better collaboration with neighbouring countries on the management of adjacent reserves along its borders. Already Mongolia has collaborated with the Russian Federation in the World Heritage inscription of the 10,689 km² transboundary Uvs Nuur Basin in 2003. The site is comprised of twelve protected areas and takes its name from Uvs Nuur Lake, a large, shallow and saline lake, important for migrating birds, waterfowl and seabirds (see Figure 7).

Figure 8: Satellite image of Uvs Nuur Basin Strict Protected Area, Mongolia
(Courtesy JPL/NASA)



3.6 Democratic People's Republic of Korea

Extent and Landform

North Korea has a total area of 120,540 km². It lies between China and South Korea with a limited border with Russia. Landform is rugged, with mostly hills and mountains separated by deep, narrow valleys; coastal plains are wide in the west, discontinuous in the east. Changbai (Paekdu) Mountain is the highest peak at 2,744 metres.

Biological Characteristics

Approximately 59% of the land area is forest, 15% scrub, 21% agricultural and 5% urban. Deforestation rates remain high. As well as different forest types, the country contains some important wetlands. DPR Korea contains parts of three WWF Ecoregions.

Table 13: WWF Ecoregions in DPR Korea
(in order of percentage cover of each ecoregion)

Ecoregion Name	Code	National Extent (km²)	National Percentage (%)
Changbai Mountains mixed forests	PA0414	47,281	51
Central Korean deciduous forests	PA0413	27,992	27
Manchurian mixed forests	PA0426	46,195	9

Conservation Policy and Law

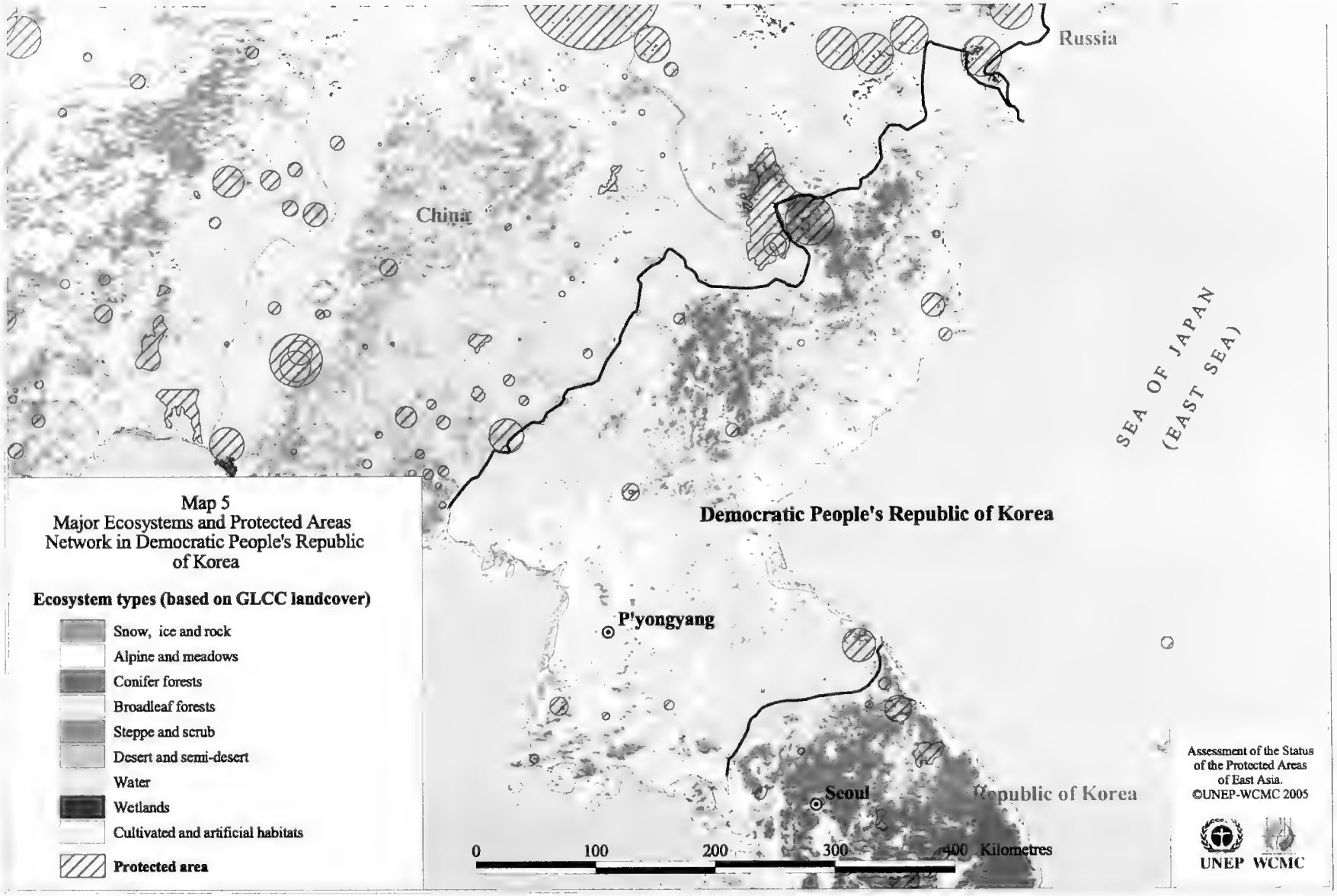
The government of DPR Korea has recognised the importance of protection of the environment and especially rare species and important biological sites for many years. Legislation for establishing protected areas dates back to 1946. Protected areas are established and managed by the Department of Forestry Management, Ministry of Forestry with advice from its scientific authority the North Korean Academy of Sciences (IUCN 1996). DPR Korea has one Biosphere Reserve and is signatory to the Convention on Biological Diversity, but otherwise participates little in international conservation programmes and in line with other aspects of its development remains isolated and poorly known in its environmental programmes.

Protected Area History and Current Extent

Protected areas have been developed gradually over many years. The current protected area system remains limited and covers only 2.6% of the national territory, but sites are distributed over all districts and in all three ecoregions of the country. There is plenty of scope for further strengthening of this system since extensive natural habitat remains, the human density is generally quite low and pressures from other developments currently not high.

Table 14: Numbers, Categories and Size of DPR Korea PAs

IUCN Management Category	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas			9	12	10				31
Area Protected (km²)			1,501	108	1,550				3,159
% terrestrial area			1.25%	0.09%	1.29%				2.62%


Russia
China
SEA OF JAPAN
(EAST SEA)
Democratic People's Republic of Korea
P'yongyang
Scoul
Republic of Korea
0
100
200
300
400 Kilometres
Map 5
Major Ecosystems and Protected Areas Network in Democratic People's Republic of Korea
Ecosystem types (based on GLCC landcover)
Snow, ice and rock
Alpine and meadows
Conifer forests
Broadleaf forests
Steppe and scrub
Desert and semi-desert
Water
Wetlands
Cultivated and artificial habitats
Protected area
Assessment of the Status of the Protected Areas of East Asia.
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UNEP WCMC

Almost nothing is known of DPR Korea standards. Poverty can be expected to place a great pressure on wood and other forest resources, while it appears that the government has little resources or equipment to undertake research and protective management.

Transfrontier Initiatives

The country undoubtedly contains significant populations of some endangered species and its geographic location provides scope for important transfrontier linkages with neighbouring countries. For example, two cases in point are efforts by the Republic of Korea with UNDP assistance to establish a protected area over much of the DMZ adjacent to the southern border of DPR Korea, and the establishment of Changbai Shan Nature Reserve and Biosphere Reserve in Jilin Province in China. DPR. Korea is also home to important wetlands that form part of the network of East Asian flyway reserves and staging points for other migratory waterbird species such geese, swans and cranes.

3.7 Republic of Korea

Extent and Landform

South Korea has a total land area of 99,000 km^2, consisting of the southern half of the Korean Peninsula and 3,153 islands, of which 464 are inhabited. The country consists of several mountain ranges divided by wide valleys and contains a variety of forest types, wetlands and coastal areas.

Biological Characteristics

South Korea is only moderately rich in biodiversity and has few endemic species. Only in the evergreen forests of the extreme south are there endemic plants and rather higher levels of species richness. Unfortunately, this zone is heavily degraded by human developments and in general only forests at higher elevation remain. The country contains one WWF Ecoregion and parts of two others.

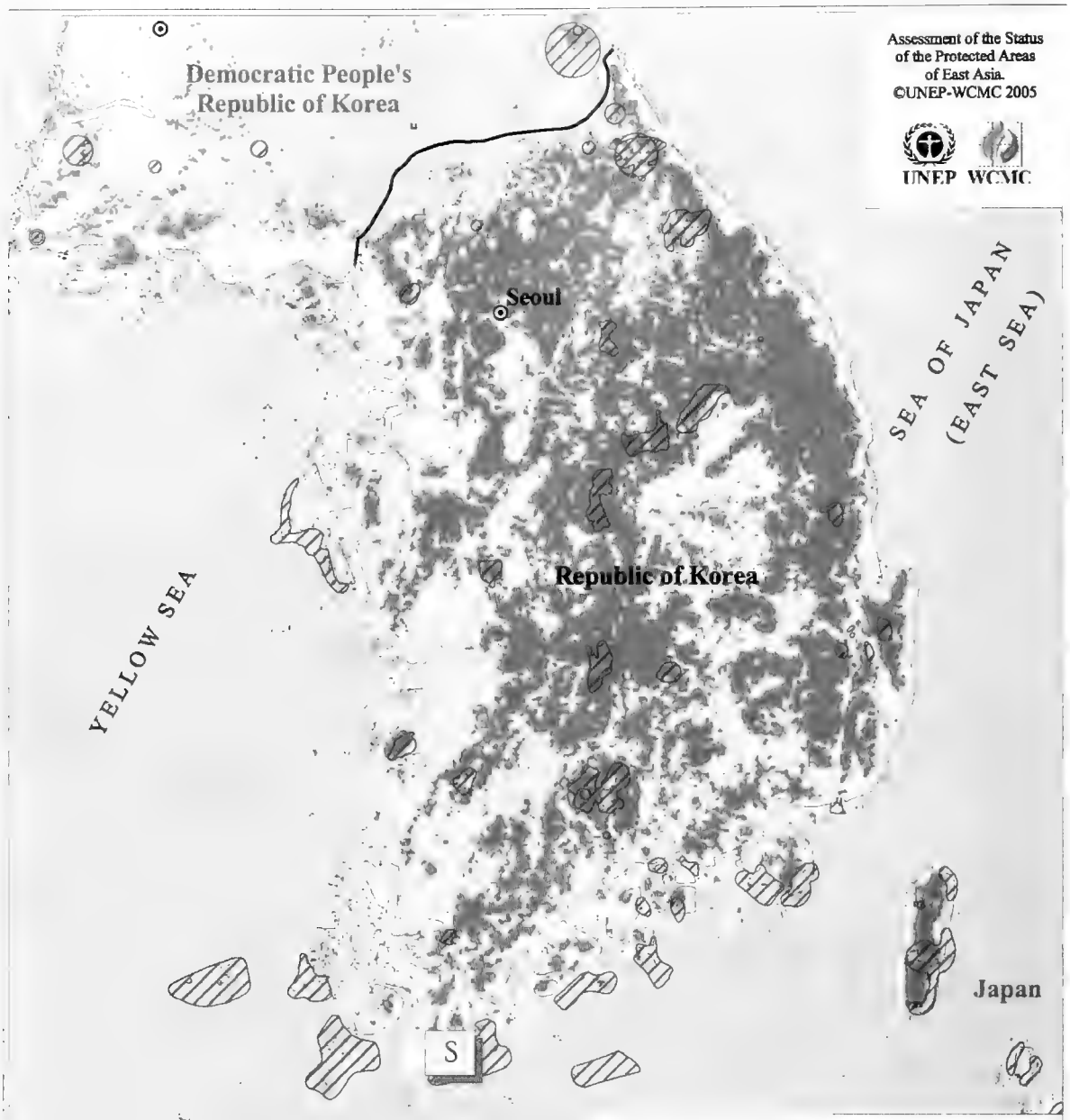
Table 15: WWF Ecoregions in Republic of Korea
(in order of percentage cover of each ecoregion)

Ecoregion Name	Code	National Extent (km^2)	National Percentage (%)
South Korean evergreen forests	PA0439	14,060	100
Central Korean deciduous forests	PA0413	75,625	73
Manchurian mixed forests	PA0426	5,713	1

Conservation Policy and Law

The government was much influenced by the First World National Parks Congress held in 1962, and started to pay greater attention to conservation of its natural resources. The Ministry of Construction was originally entrusted with the development of national parks in 1967. However, the Korean Ministry of Environment has been managing the system of Natural Ecosystem Conservation Areas since the issue of the Natural Environment Conservation Act in 1991. A National Parks Association of Korea was established in 1971.

Other legal instruments relevant to PA establishment and management are the Wetlands Conservation Act (1999), Natural Parks Act (last revised 2001) and Special Act for the Ecosystem Conservation of Uninhabited Islands (1997), such as Tokdo . Korea also ratified the Ramsar Convention in 1997.



Map 6
Major Ecosystems and Protected Areas
Network in Republic of Korea

Ecosystem types
(based on GLCC landcover)

- Snow, ice and rock
- Alpine and meadows
- Conifer forests
- Broadleaf forests
- Steppe and scrub
- Desert and semi-desert
- Water
- Wetlands
- Cultivated and artificial habitats

Protected area

S **Location of satellite image**

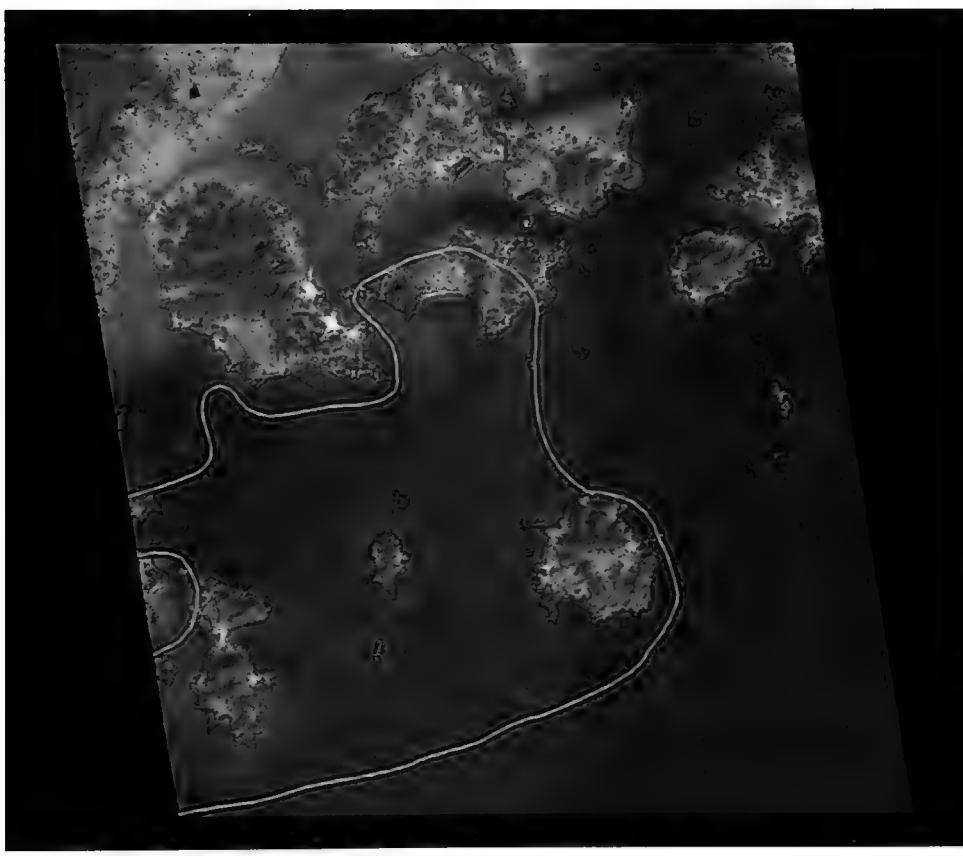
Protected Area History and Current Extent

The first national parks were established in 1967 and growth since that time has been steady. Korea currently has only 44 protected areas, several of which are marine or small islands. The terrestrial total of 7% is below the regional average and also the 10% target established at Bali in 1982. Given the high proportion of the country that remains forested, there appears to be good scope to increase the area. Coverage is particularly poor on the southern tip of the peninsula, which is biologically the richest and most distinct region in the country and constitutes an entire WWF Ecoregion. Details of South Korean protected areas by IUCN category are given below. However, it should be noted that the government is currently reviewing the assignment of IUCN management categories as recorded in the WDPA. There is likely to be a change in assignment of some PAs to Category II.

Table 16: Numbers, Categories and Size of Republic of Korea PAs

IUCN Management Category	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas					20	20		4	44
Area Protected (km²)					501	6,473		38.85	7,012
% terrestrial area					0.5%	6.5%		0.04%	7.1%

Figure 9: Satellite image of part of Tadohae-Haesang Sea Marine National Park, Republic of Korea (Courtesy JPL/NASA)



Protected Area Management Agencies and Standards
Relevant divisions of the Ministry of Environment undertake the planning, establishment and management of the protected area system. Standards of effectiveness are quite good, but the pace of development of the system has lagged behind most other countries of the region.

Transfrontier Initiatives
Relations with neighbouring DPR Korea remain strained but there has been some warming and collaboration in recent years and road and rail links are sometimes reopened. As noted above, a major transfrontier initiative is the potential development of a protected area along the 250 km, by 4 km wide, DMZ. Negotiations have been made with DPR Korea about their cooperation in establishing this area as a transfrontier Biosphere Reserve. The combined area could be suitable as a Peace Park.

3.8 Japan

Extent and Landform
Japan consists of an archipelago stretching 3,000 km from the subarctic zone in the north to the subtropical zone in the extreme south, made up of four large islands and over three thousand small islands. The total land area is 378,000 km^2. The archipelago perches on the junction between the tectonic plates of continental Asia and the Philippines. As such, the position of the islands has been quite dynamic and various connections between different islands and between the continent and various island groups have had profound effects on their colonisation and evolution. Several mountains exceed 3,000 metres and some are active volcanoes. Earthquakes are common.

Biological Characteristics
Biologically the country is moderately rich with over 7,000 known vascular plant species, 188 mammals and 665 birds (Nature Conservation Bureau, 1995). A high proportion of these species are endemic to Japan. According to the National Survey on the Natural Environment, forests occupy 67.5% of Japan's land area: 27% natural forests; 37% secondary forests including wooded areas in the countryside; and the remaining 37% planted forest. Large natural forests are concentrated mostly in Hokkaido, only in small forests in other regions. Most remaining forests are montane coniferous. Evergreen broad-leaved forests are rarely found in large areas now. Tidal flats and mangrove forests that grow in estuaries are ecosystems with a high level of biological diversity. The mangrove forests of Iriomote Island are the largest in Japan. Secondary forests are employed to produce charcoal and firewood. As a result of decreasing human intervention, succession has proceeded and a sharp reduction in certain species is may occur.

Natural alpine grassland and subalpine meadows occur on high mountains. Secondary grasslands have replaced forests at lower altitude and are used for grazing. Japan has some important moorlands, although lowland wetlands have been largely converted into rice paddies. Extensive coastal mudflats are important for resident and migrant waders and other waterfowl. Rivers and lakes serve as important habitats for aquatic plants and animals as well as fish and birds. Many rivers are traversed by structures that make it difficult for fish to move downstream to estuaries and show large declines in abundance.

As an archipelago, the marine areas of Japan are important as sources of fish, crustaceans and edible seaweeds. The warm and cold currents between the islands have a dramatic enriching effect. Corals grow only on the southernmost islands. A sharp decrease in coral reefs is evident in the Ryukyu Islands, caused by damage resulting mainly from the feeding of

Crown-of-Thorns starfish (*Acanthaster planci*) and sedimentation by red clay.

The three large islands Honshu, Shikoku and Kyushu collectively referred to as Hondo, have enjoyed former interconnections and share a similar biota. The northern island of Hokkaido was separated from Hondo during the recent geological past but has had connections via Sakhalin Island with Siberia. The Ryukyu and Ogasawara island groups in the extreme south have remained very isolated for long periods and show high levels of endemism. To the northeast of Japan lie the Kuril Islands, some of which were formerly part of Japan but have been administered by Russia since 1945, and are another small region of high endemism. Nine of the WWF Ecoregions lie entirely within Japan.

Table 17: WWF Ecoregions in Japan

Ecoregion Name	Code	National Extent (km^2)	National Percentage (%)
Taikeyo evergreen forests	PA0440	138,300	All 100
Taikeyo montane deciduous forests	PA0441	41,900	
Nihonkai montane deciduous forests	PA0428	82,300	
Nansei Islands bubtropical evergreen forest	IM0170	4,100	
Ogasawara subtropical moist forests	OC0109	100	
Nihonkai evergreen forests	PA0427	21,600	
Honshu alpine conifer forests	PA0511	11,500	
Hokkaido montane conifer forests	PA0510	45,800	
Hokkaido deciduous forests	PA0423	25,500	

Conservation Policy and Law

Japan has a strong policy towards environmental conservation. Three policy documents of relevance have been formulated - the Basic Policy for Natural Environment Conservation, the Basic Policy for Rare Wild Animals and Plant Species Conservation and the Basic Plan for Forest Resources. Many laws cover different aspects of conservation. These include:

- Basic Environmental Law
- Nature Conservation Law 1972
- National Parks Law 1931
- Natural Parks Law 1957
- Law for the Conservation of Endangered Species of Wild Fauna and Flora
- Law for the Protection of Birds and Mammals and Hunting 1918/1972
- Law for the protection of Cultural Properties 1919
- Forest Law
- Forestry Basic Law 1964
- Fisheries Law

- Preservation of Fisheries Resources Law
- Urban Green Space Conservation Law
- City Parks Law

Japan is active in many international fora such as the CBD, the World Heritage Convention, CITES, Ramsar and the MAB Programme. In implementing Article 6 of the Convention on Biological Diversity Japan prepared a National Strategy on Biological Diversity in 1995.

There is little consumption of wildlife and pressure on timber resources. The main pressure on natural forests has been land for agriculture or development. Japanese culture has for centuries valued the balance of nature and respected the need to conserve forest in water catchments. However, Japan is also a country that has sourced its timber from neighbouring countries in Asia and therefore, like China, has had an offshore impact on the region's ecosystems.

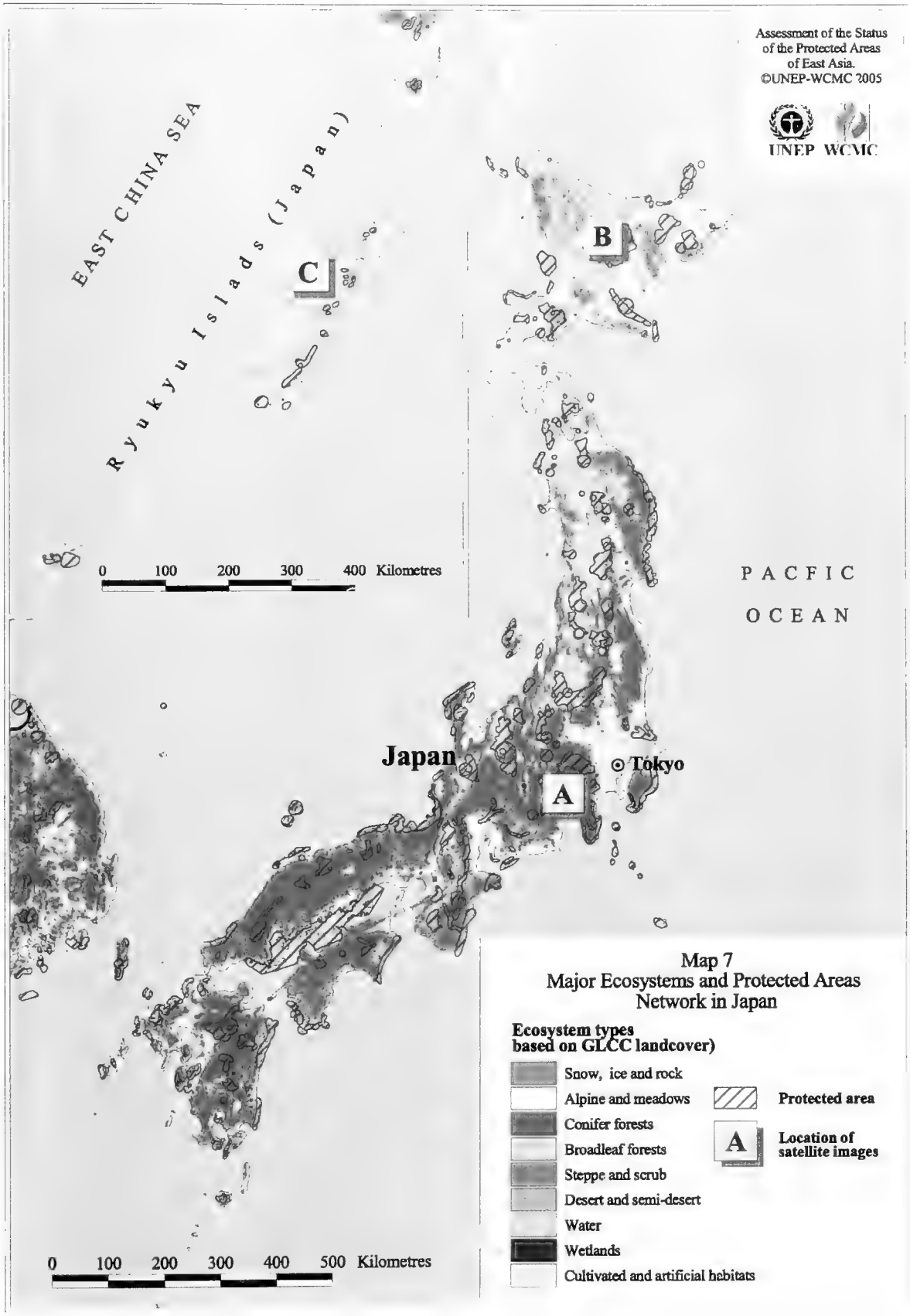
Protected Area History and Current Extent
Japan's first National Park was established in 1934. The park system has expanded gradually over the years. Three categories of PA exist in Japan: national parks, quasi-national parks and prefectural natural parks. In total there are currently 961 sites covering a total of 17% of the country.

Table 18: Numbers, Categories and Size of Japan's PAs

IUCN Management Category	Ia	Ib	II	III	IV	V	VI	No category	Total
Number of Protected Areas	21	25	47		55	145		668	961
Area Protected (km^2)	68.7	3,386	5,316		2,851	30,854		21,740	642,149
% terrestrial area	0.02%	0.90%	1.41%		0.75%	8.17%		5.75%	17.00%

Protected Area Management Agencies and Standards
Japan's PAs are managed by the Nature Conservation Bureau of the Ministry of Environment. A special National Parks Division has direct responsibility. Japan maintains high standards of research, monitoring, protective management, habitat restoration and ecotourism. More than 100 million visitors enjoy the parks each year.

Transfrontier Initiatives
Japan shares no land border with neighboring countries. However, Japan does claim part of the southern Kurils that are currently administered by Russia but cooperation regarding PAs does not seem feasible. Japan participates in regional programmes for protection of wetlands, migrating bird sites and works in China on a number of joint projects including conservation of Red-Crowned Cranes and Crested Ibis.


Assessment of the Status
of the Protected Areas
of East Asia.
©UNEP-WCMC 2005
UNEP WCMC
EAST CHINA SEA
Ryukyu Islands (Japan)
B
C
0 100 200 300 400 Kilometres
PACFIC
OCEAN
Japan
Tokyo
A
0 100 200 300 400 500 Kilometres
Map 7
Major Ecosystems and Protected Areas
Network in Japan
Ecosystem types
based on GLCC landcover)
Snow, ice and rock
Alpine and meadows
Conifer forests
Broadleaf forests
Steppe and scrub
Desert and semi-desert
Water
Wetlands
Cultivated and artificial habitats
Protected area
A
Location of
satellite images

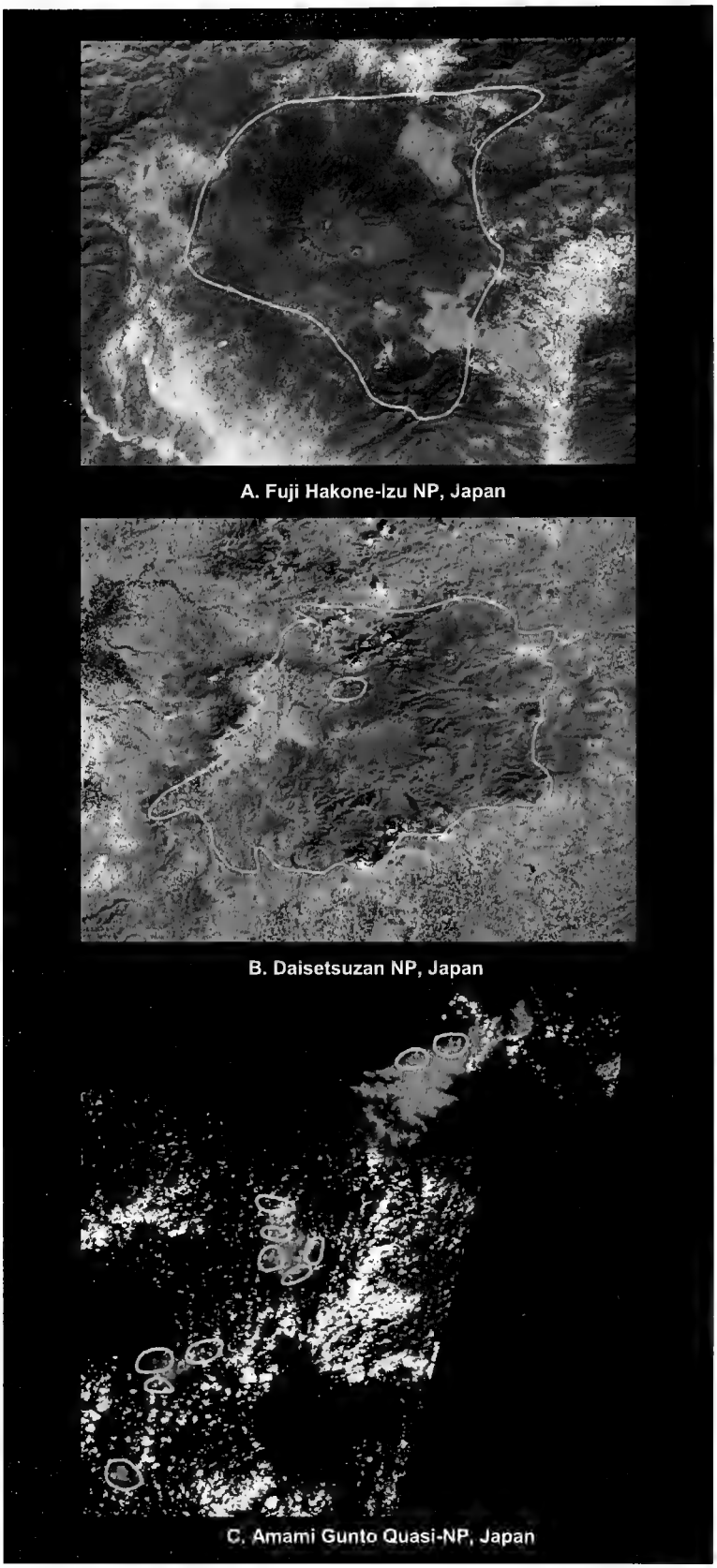


Figure 10: Satellite images of Three National Parks, Japan
(Courtesy JPL/NASA)

4. GIS Analysis

4.1 National, Territorial and Administrative Boundaries

By overlaying the GIS cover for PAs over the national or territorial boundaries we can see that the regionally high percentile PA cover is not uniform across the region. Table 19 lists the figures for each country and territory. The tiny SAR of Macau has no scope for PA development and both Koreas have yet to reach 10% protected area coverage.

Table 19: Protected Area Extent in East Asia

Country/Territory	Total area (km^2) by GIS	PA Extent (km^2) by GIS	% PA Extent by GIS
China	9,346,685	1,558,351	16.7
Hong Kong	1,009	393	39.0
Japan	373,737	60,904	16.3
DPR Korea	122,393	3,200	2.6
Republic of Korea	98,930	4,060	4.1
Macau	19	0	0.0
Mongolia	1,564,707	208,836	13.4
Taiwan	3,6120	4,152	11.5
Total East Asia	**11,543,600**	**1,839,896**	**16.0**

Within China, Xie Yan and Lishu Li (2004) have undertaken a finer level of analysis. The country is divided into several hundred counties. In the densely populated areas these are quite small but in depopulated areas they tend to be large. Overlaying the PA cover over the county map shows a surprising number of counties that have no PA cover . Some may indeed have no need or scope to develop protected areas. But when variety in terrain, vegetation and water system are taken into account many gaps become apparent where protected areas are needed to cover areas with fast landform changes, special vegetation or lowland water sources.

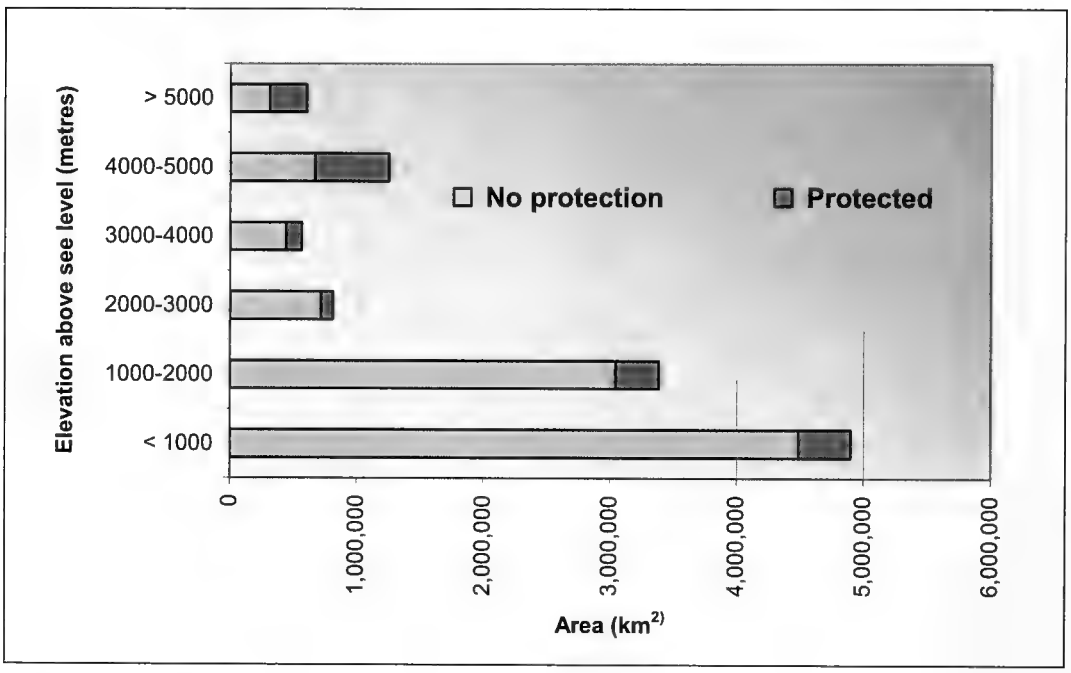
4.2 Altitude

A similar analysis can show the level of protection in relation to altitude. The analysis reveals that although all terrestrial altitude bands are protected in PAs by more than 5% cover, there is a marked skew towards greater PA coverage at increasing altitude, showing mountains are more readily protected than lowlands. This skew is the reverse of either total area of the altitude band or its relative biological richness. Selection has favoured inclusion of rare bio-poor habitats rather than common bio-rich ones. Moreover, quite large areas of so-called PAs at lower altitude are identified by the GLC as cultivated or artificial.

Table 20: Degree of PA Extent at Different Altitudes in East Asia

Elevation Range	Total area, km^2	Within PA (km^2)	Protected, %
< 1000	4,899,352	412,012	8.4
1000 - 2000	3,385,485	338,761	10.0
2000 - 3000	811,843	94,111	11.6
3000 - 4000	564,015	123,228	21.9
4000 - 5000	1,250,112	579,917	46.4
> 5000	602,160	291,867	48.5
Total East Asia	**11,512,967**	**1,839,895**	**16.0**

Figure 11: Protected Area Cover in East Asia at Various Altitude Ranges



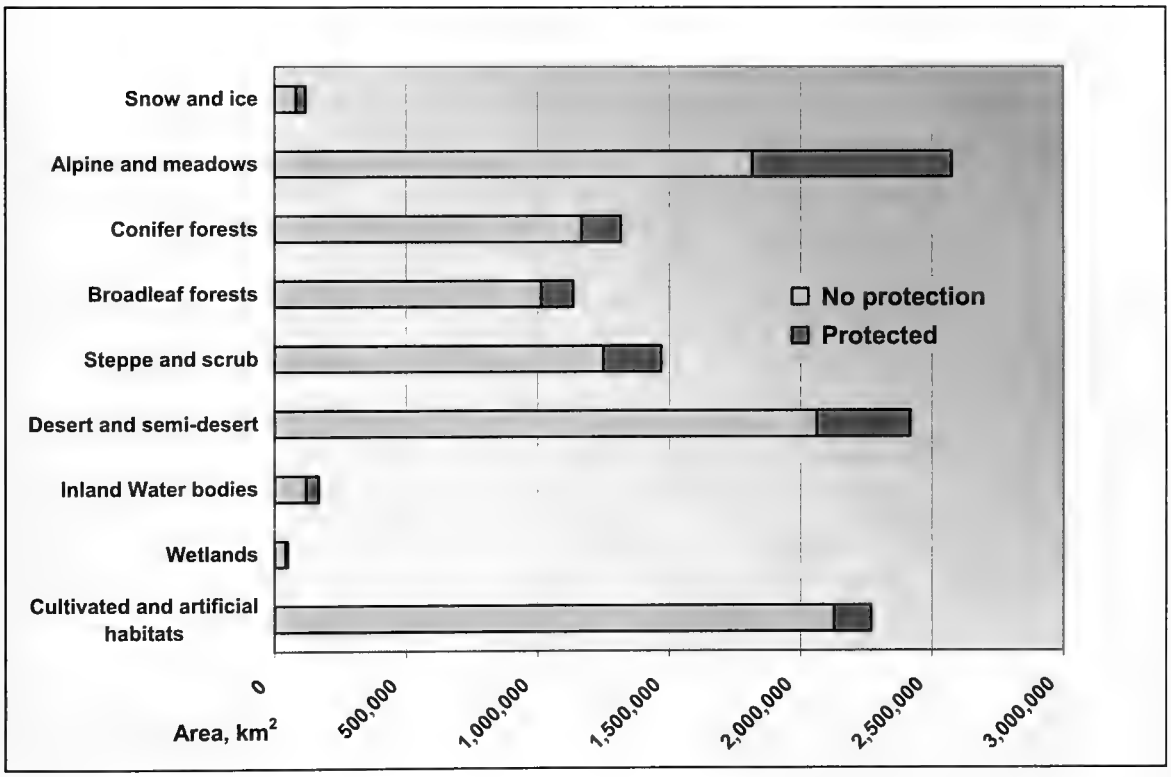
4.3 Habitat Type

To examine whether the regional PA system is protecting examples of all habitat types, the PA GIS cover was overlaid on a habitat classification based upon the GLC database. This method provides a score based on analysis of the total area and total protected area of each major habitat type. The results of the analysis are presented below.

Table 21: Degree of PA Extent for Major Habitats in East Asia

Habitat Type	Total Area (km²)	Within PA (km²)	Protected (%)
Snow, ice and rock	117,488	36,243	30.85
Alpine and meadows	2,574,592	758,838	29.47
Conifer forests	1,316,075	149,569	11.36
Broadleaf forests	1,134,983	122,914	10.83
Steppe and scrub	1,469,219	218,670	14.88
Desert and semi-desert	2,417,030	356,555	14.75
Freshwater	166,943	47,090	28.21
Wetlands	48,540	8,231	16.96
Cultivated and artificial habitats	2,268,098	141,787	6.25
Total terrestrial	**11,512,968**	**1,839,895**	**16.0**

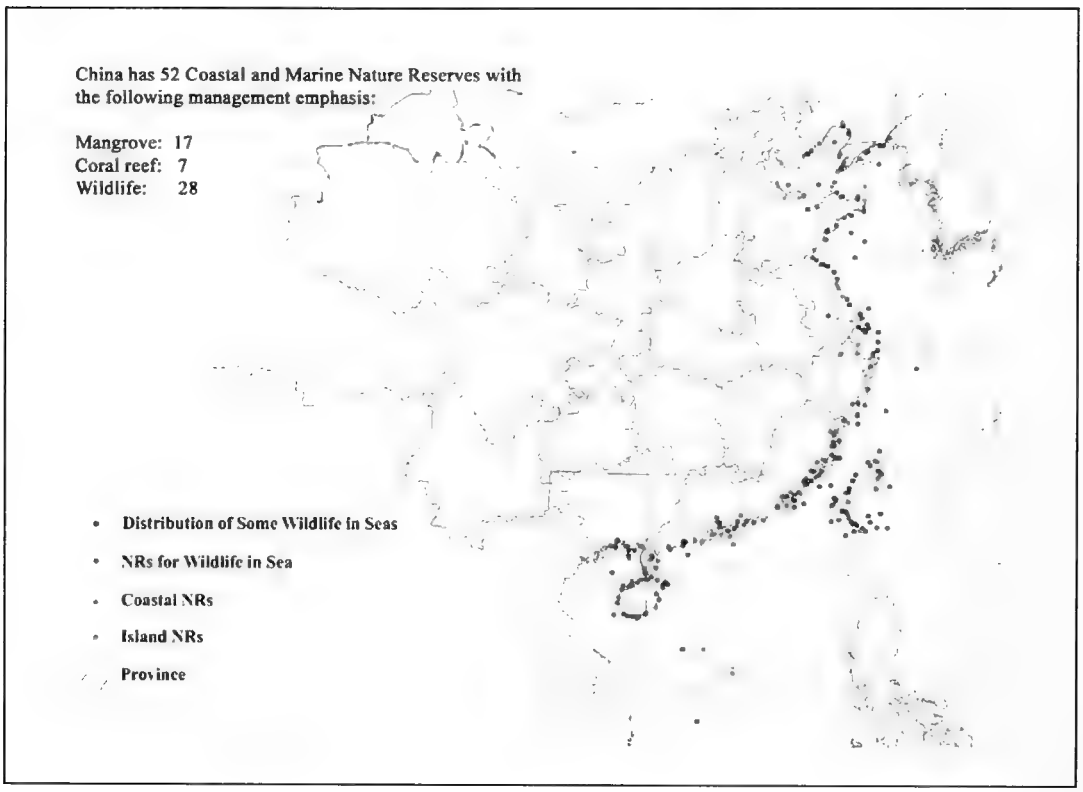
Figure 12: Protection of Major Habitats in East Asia



The analysis shows that all major terrestrial habitat types are reasonably well included within the PA system but again there is a clear bias towards open and mountainous areas with low value for agriculture or other human uses. The least well-covered types are broadleaf and conifer forests, which happen to be the most valuable in terms of biodiversity as evidenced by the numbers of bird species found there. It is also worth noting that more than 6% of PA is classed as cultivated or artificial lands, mostly at low altitude.

Xie Yan and Lishu Li (2004) have also mapped 80 marine protected areas for China (see Figure 13) but point out that 52 of these are selected for species rather than habitat protection and that most of these are in fact coastline and islands so that there is not a single protected area from Shandong to Zhejiang specifically for the protection of marine life. There are clearly gaps in the marine environment coverage.

Figure 13: Distribution of Coastal and Marine Protected Areas in China
(Source: Xie Yan and Lishu Li 2002)



4.4 Ecoregions

GIS cover of East Asian PAs was overlaid with the map of 77 WWF Ecoregions. Annex: Map III shows the ecoregions shaded to illustrate the degree of PA cover. Table 22 presents the details of the analysis:

Table 22: Size and Extent of PA Cover of WWF Ecoregions within East Asia

Code	Ecoregion	Extent (km²)	Extent Protected	
			(km²)	(%)
OC0109	Ogasawara subtropical moist forests	94	72	76.9
PA1011	North Tibetan Plateau-Kunlun Mountains alpine desert	362,960	238,655	65.8
IM0501	Eastern Himalayan subalpine conifer forests	651	414	63.6
PA1020	Tibetan Plateau alpine shrublands and meadows	272,010	160,835	59.1
PA1002	Central Tibetan Plateau alpine steppe	615,466	295,260	48.0
PA0511	Honshu alpine conifer forests	11,501	5,026	43.7
PA0512	Khangai Mountains conifer forests	2,900	1,247	43.0

Code	Ecoregion	Extent (km²)	Extent Protected	
			(km²)	(%)
PA0609	Trans-Baikal conifer forests	38,060	16,054	42.2
PA0908	Yellow Sea saline meadow	4,885	1,946	39.8
PA1017	Southeast Tibet shrublands and meadow	460,541	157,981	34.3
PA1016	Sayan Alpine meadow and tundra	21,540	6,987	32.4
PA1003	Eastern Himalayan alpine shrub and meadows	86,389	27,687	32.1
PA1007	Khangai Mountains alpine meadow	37,167	11,888	32.0
PA0508	Helanshan montane conifer forests	24,705	7,640	30.9
IM0170	Nansei Islands subtropical evergreen forests	3,575	968	27.1
PA0907	Suiphun-Khanka meadows and forest meadows	14,410	3,814	26.5
PA1015	Qilian Mountains subalpine meadow	73,285	18,620	25.4
PA1022	Yarlun Tsangpo arid steppe	59,385	13,401	22.6
PA0505	Da Hinggan-Dzhagdy Mountains conifer forests	151,479	32,891	21.7
PA0517	Qilian Mountains conifer forests	16,654	3,589	21.6
PA0510	Hokkaido montane conifer forests	45,542	9,780	21.5
PA1001	Altai alpine meadow and tundra	40,896	8,763	21.4
PA0902	Bohai Sea saline meadow	11,430	2,402	21.0
PA0428	Nihonkai montane deciduous forests	82,111	15,612	19.0
PA1302	Alashan Plateau semi-desert	674,300	124,725	18.5
PA0514	Northeastern Himalayan subalpine conifer forests	40,626	7,427	18.3
PA0518	Qionglai-Minshan conifer forests	80,139	14,652	18.3
PA1006	Karakoram-West Tibetan Plateau alpine steppe	25,093	4,193	16.7
PA1021	Western Himalayan alpine shrub and Meadows	33,354	5,341	16.0
PA0441	Taiheiyo montane deciduous forests	41,886	6,517	15.6
PA0427	Nihonkai evergreen forests	21,365	3,306	15.5
PA0516	Nujiang Langcang Gorge alpine conifer and mixed forests	77,430	11,884	15.4
PA1316	Great Lakes Basin desert steppe	135,197	20,022	14.8
IM0171	South Taiwan monsoon rain forests	2,490	364	14.6
PA1014	Pamir alpine desert and tundra	30,806	4,110	13.3
PA0901	Amur meadow steppe	51,672	6,675	12.9
PA1330	Taklimakan desert	742,614	91,038	12.3
PA0426	Manchurian mixed forests	406,051	48,222	11.9
PA1317	Junggar Basin semi-desert	272,547	32,287	11.9
IM0172	Taiwan subtropical evergreen forests	32,970	3,760	11.4
PA0440	Taiheiyo evergreen forests	135,063	15,183	11.2
PA0519	Sayan montane conifer forests	38,294	4,214	11.0
PA0101	Gizhou Plateau broadleaf and mixed forests	269,138	28,949	10.8
PA0434	Qin Ling Mountains deciduous forests	123,279	13,009	10.6
PA1324	Qaidam Basin semi-desert	192,124	19,751	10.3
IM0169	Hainan Island monsoon rain forests	15,486	1,424	9.2
PA0502	Altai montane forest and forest steppe	107,355	9,813	9.1
PA0813	Mongolian-Manchurian grassland	886,694	79,588	9.0
IM0137	Northern Indochina subtropical forests	144,758	12,170	8.4
PA0417	Daba Mountains evergreen forests	168,172	12,978	7.7
PA0442	Tarim Basin deciduous forests and steppe	54,530	4,081	7.5
PA0415	Changjiang Plain evergreen forests	436,998	29,193	6.7
PA0903	Nenjiang River grassland	23,259	1,550	6.7

Code	Ecoregion	Extent (km²)	Extent Protected	
			(km²)	(%)
PA0423	Hokkaido deciduous forests	25,136	1,615	6.4
PA0430	Northeast China Plain deciduous forests	232,424	14,493	6.2
IM0149	South China-Vietnam subtropical evergreen forests	183,692	10,913	5.9
PA0804	Daurian forest steppe	97,224	5,546	5.7
PA0102	Yunnan Plateau subtropical evergreen forests	239,865	13,537	5.6
IM0118	Jian Nan subtropical evergreen forests	661,110	34,242	5.2
PA0414	Changbai Mountains mixed forests	93,435	4,703	5.0
PA0411	Central China loess plateau mixed forests	359,865	17,795	5.0
PA0509	Hengduan Mountains subalpine conifer forests	99,298	4,803	4.8
PA1019	Tian Shan montane steppe and meadow	190,209	8,683	4.6
PA0818	Tian Shan foothill arid steppe	8,027	351	4.4
PA0806	Emin Valley steppe	44,916	1,786	4.0
PA1013	Ordos Plateau steppe	215,596	7,896	3.7
PA1314	Eastern Gobi desert steppe	282,357	10,180	3.6
PA0437	Sichuan Basin evergreen broadleaf forests	98,010	3,410	3.5
PA0816	Selenge-Orkhon forest steppe	202,301	6,957	3.4
PA0424	Huang He Plain mixed forests	433,474	14,273	3.3
PA0413	Central Korean deciduous forests	103,617	3,075	3.0
PA0439	Southern Korea evergreen forests	14,057	352	2.5
PA0521	Tian Shan montane conifer forests	12,787	238	1.9
PA1315	Gobi Lakes Valley desert steppe	139,703	2,207	1.6
PA0802	Altai steppe and semi-desert	1,970	2	0.1
PA0601	East Siberian taiga	282	0	0.0
PA1012	Northwestern Himalayan alpine shrub and meadows	635	0	0.0
	- Rock and ice	49,120	11,044	22.5
	Total Terrestrial	**11,490,436**	**1,836,056**	**16.0**

A total of 77 WWF ecoregions lie within or partly overlap the East Asian Region. We have measured the area of protected areas in each and allocated these to five degrees of cover as follows:

- Exceptional coverage (>20%)
- Well covered (10-20% PA coverage)
- Moderately covered (5-10% PA coverage)
- Poorly covered (<5% PA coverage)
- Not covered (zero coverage)

The result shows that 59% of ecoregions have more than 10% PA cover and 19% have between 5-10% PA cover. Two ecoregions apparently lack PA cover within the East Asian region and a further 15 have less than 5% cover (Figure 14). Table 23 lists these less well protected ecoregions and provides some comments on their status.

Figure 14: WWF Ecoregions Distribution by Extent of Protection

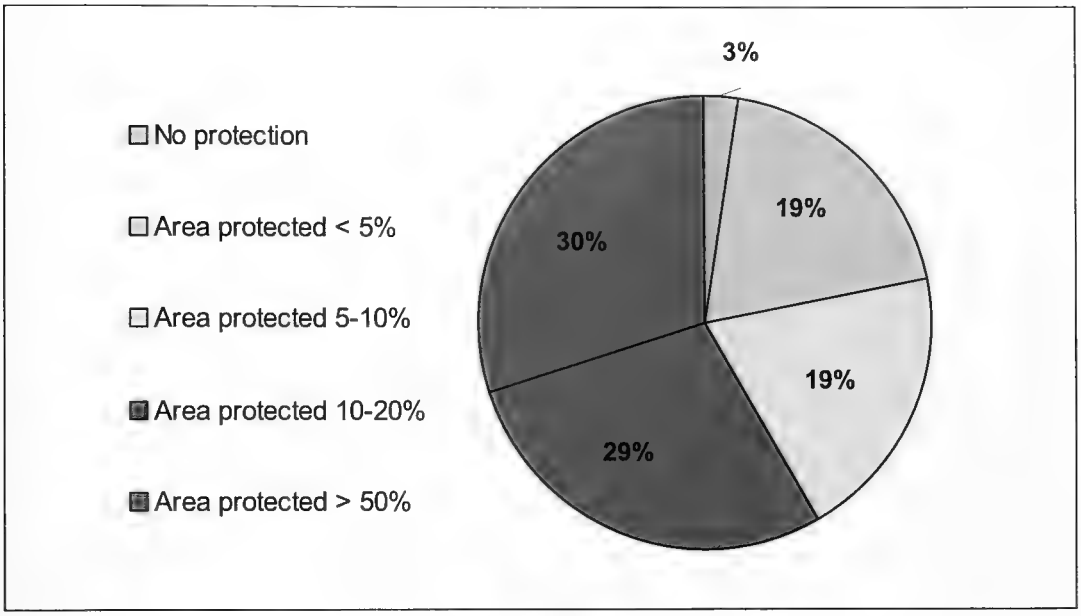


Table 23: WWF Ecoregions in East Asia with less than 5% PA Cover

Ecoregion Name	East Asian Proportion (km²)	% PA Cover	Biodiversity Significance	Comments
Central China loess plateau mixed forests	1,439,458	4.95	Not very significant.	Ecological arguments for forest protection remain high and greater efforts are needed to restore good cover.
Central Korean deciduous forests	414,467	2.97	Moderate interest, low endemism.	Little forest remains but there is scope for increased PA cover and DMZ efforts by UNDP are going forward.
Huang He Plain mixed forests	1,733,895	3.29	Formerly very valuable.	Now so populated and degraded that options for PA development are very limited
Sichuan Basin evergreen broadleaf forests	392,040	3.48	The unit is not particularly important.	The basin is so highly populated that very little suitable habitat for PA development remains.
Southern Korea evergreen forests	56,227	2.50		
Hengduan Mountains subalpine conifer forests	397,190	4.84	A temperate area of unique richness, recognized as a biodiversity hotspot.	CI and other agencies are working closely with Chinese authorities to increase and upgrade the PA cover within this important ecoregion.

Ecoregion Name	East Asian Proportion (km²)	% PA Cover	Biodiversity Significance	Comments
Tian Shan montane conifer forests	51,147	1.86	Important for water catchment, moderate interest biologically	Very remote region, few government resources available but there is scope for additional PAs.
East Siberian taiga	1,129	0.00	A rare habitat type within the region but very common further north in Siberia	Only very marginal in China and largely destroyed in disastrous forest fire in 1997.
Altai steppe and semi-desert	7,881	0.12	Moderate importance for some ungulates	Saiga are being reintroduced.
Emin Valley steppe	179,665	3.98	A rare type within China but largely used for farming and grazing.	Some scope for more PAs.
Selenge-Orkhon forest steppe	809,206	3.44		
Tian Shan foothill arid steppe	32,110	4.37	Low biodiversity interest.	Largely used for winter grazing.
Nenjiang River grassland	93,038	6.66	Important wetlands.	Largely full of agricultrue and reed cutters but some scope for further PA development.
Northwestern Himalayan alpine shrub and meadows	2,540	0	Only very marginally included in China	Easy to declare examples as PAs.
Ordos Plateau steppe	862,384	3.66	Moderate significance	Urgently needs habitat restoration for ecological functions
Tian Shan montane steppe and meadow	760,837	4.57	Low biodiversity interest but should be represented.	Large used for summer grazing. Some additional Pas could be made.
Eastern Gobi desert steppe	1,129,429	3.61	Important for Mongolian gazelle and some local forms.	Largely fenced as ranchlands. Two proposals for transfrontier PAs with Mongolia are under consideration. Some reserves exist on Mongolian side of border.
Gobi Lakes Valley desert steppe	558,811	1.58	Significant scenery and some spectacular wildlife.	Surprising there are so few PAs. Should be flagged as a priority.
Ocean	31,991,524	0.67	Critical gap	Not mapped to territorial limits but clearly an urgent gap

Within China, an independent biogeopgraphical classification has been undertaken by objective dendrographic clustering of 124 basic geographical units on the basis of distributions of 171 mammal species and 509 plant species held in the CSIS database of the Institute of Zoology of the Chinese Academy of Sciences (Xie Yan *et al.* 2004). The analysis results in a hierarchical classification dividing the country into four areas, nine sub-areas, 27 regions and 41 sub-regions (Figure 15 and Table 24). There is a reasonable similarity with the

WWF with some ecoregions but some differences in precise geographic boundaries and some levels of aggregation.

Figure 15: China Biogeographic Units
(Source: Xie Yan *et al.* 2004)

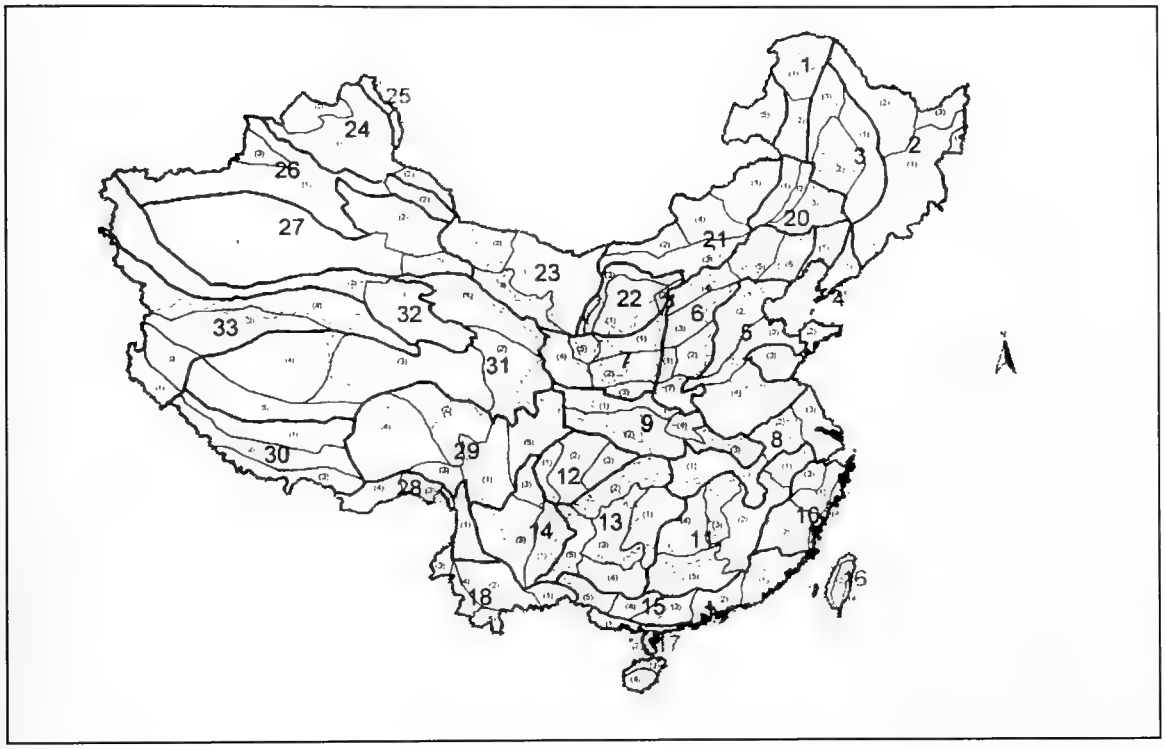


Table 24: China Biodiversity Divisions compared with WWF Ecoregions
(Source: Xie Yan *et al.* 2004)

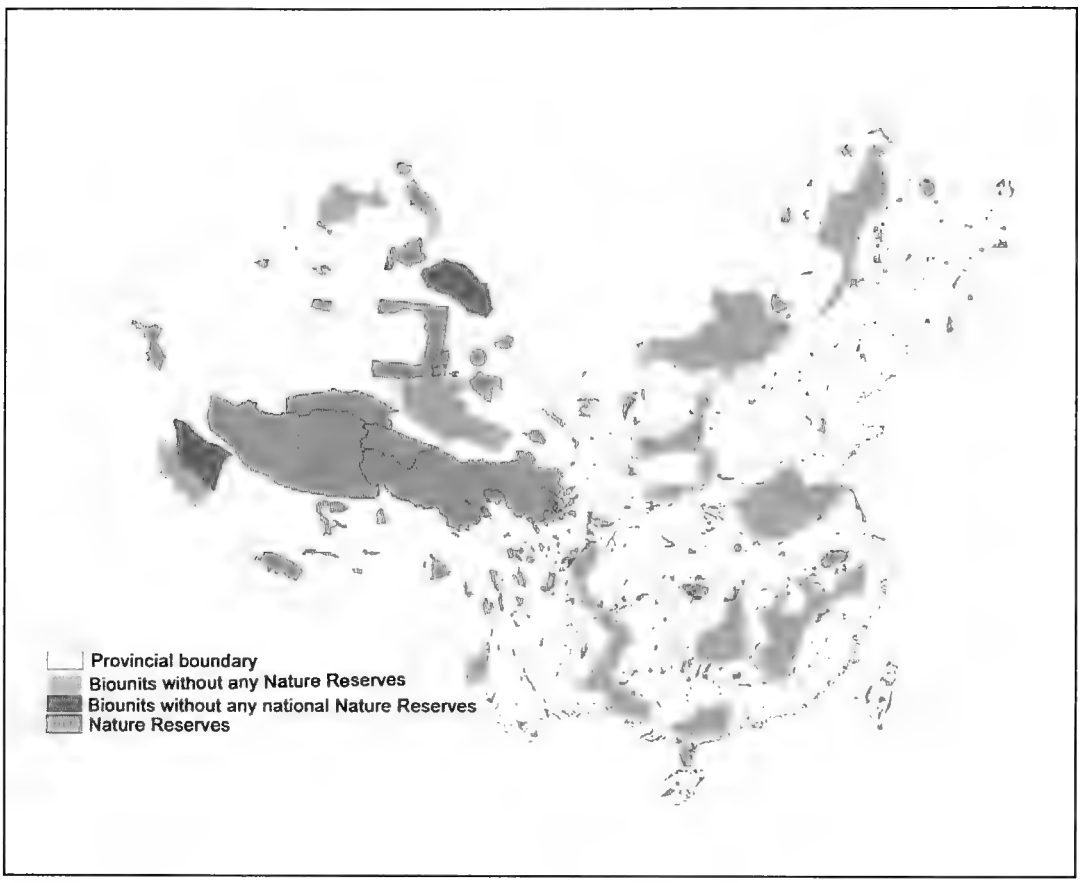
Areas	Sub-areas	Regions	Sub-regions	WWF Ecoregions
1: Northeast China Area	1a: Inner Mongolia Steppe and Northeast China Plain	1: Da Hinggan Ling	A: North Central Da Hinggan Ling Coniferous Forest	PA0505 plus PA0601
			B: South Da Hinggan Ling Grassland	Part of PA0813
		2: Northeast China Plain	A: Northeast China Plain Northern Forest Grassland	Most of PA0430
			B: Xiliaohe River Arid Steppe	Part of PA0813 + PA0903
		3: Inner-Mongolia Arid Steppe and Desert Grassland		PA1314 plus part of PA0813 plus marginally PA0804
		4: Ordos Plateau Arid and Desert Grassland		PA1013 Plus PA0411

Areas	Sub-areas	Regions	Sub-regions	WWF Ecoregions
	1b: Xiao Hinggan Ling and Changbai Mountains	5: East of Northeast China	A: Northeast China Eastern Hill Coniferous/Broadleaf Mixed Forest	PA0426 Plus PA0414 +PA0901 +PA0907
			B: Lower Liao River Agriculture	Part of PA0430
	Ic: North China	6: North China	A: North Hebai and West Liaoning Hills Deciduous Shrub	PA0141
			B: North China Plain Northern Agriculture	Part of PA0424 plus PA0902
			C: Hebei and Shanxi Hills Semi-xerophytic Deciduous Broadleaf and Forest Grassland	Part of PA0411
			D: Shandong Peninsula Deciduous Broadleaf Forest	Part of PA0424
		7: Huangtu Plateau Forest Grassland and Arid Grassland		Part of PA0424 plus PA1508
11: Southeast China Area	11a: Central China	8: Hauaibei Plain and plains in the Middle and Lower Yangtze River	A: Hauibei Plain Agriculture	Part of PA0415
			B: Middle and Lower Yangtze River Plain Agriculture	Part of PA0415 plus PA0908
			C: Dabie-Tongbai Mountains Deciduous Shrub	Part of PA0415
		9: Qinling and Daba Mountains Mixed Forest		PA0417 plus PA0434
		10: Sichuan Basin Agriculture		PA0437
	11b: Highlands and plains onn the south of the Yangtze River	11: Southeast China Hills and Basins Evergreen Boeadleaf Forest		Part of PA0118
		12: Yangtze River Southern Bank Evergreen Broadleaf Forest		Part of PA0118
		13: Yunnan-Guizhou Plateau Evergreen Broadleaf Forest		PA 0101 plus part PA0118
	11c: Coasts and Islands of South China	14. South of Nan Ling Evergreen Broadleaf Forest		c. PA0149
		15 South Yunnan Tropical Monsoon Forest		c. PA0137 +IM0140
		16: Hainan and Leizhou Peninsula Tropical Rain Forest and Monsoon Forest		c. PA0169
		17: Taiwan Island Evergreen Broadleaf Forest and Monsoon Forest		PA0172 plus PA0171

Areas	Sub-areas	Regions	Sub-regions	WWF Ecoregions
111: Southwest China Area	111a: Southeast and South of Qinghai-Tibetan Plateau	18: South China Sea Islands Tropical Rain Forest		IM0148
		19: South Sichuan and Yunnan Plateau Evergreen Broadleaf Forest		c. PA0102 +PA0518 +PA0509 + PA0516
		20: East Tibet and West Sichuan Incisive Hill Coniferous Forest and Alpine Meadow		c. PA1017 plus PA0509
		21: Himalayas Mountains	A: Himalayan Southern Wing Montane Tropical and Subtropical Forest	IM0401 plus IM0501
			B: South Tibet Montane Shrub grassland	PA0514 + PA0516 + PA1003 + PA1022
	111b: Central and North Qinghai-Tibetan Plateau	22: Northeast Qinghai-Tibetan Plateau	A: East and South Qinghai Montane Alpine Cold Grassland and Alpine Grassland	Part PA1002 plus part PA1020
			B:Qaidam Basin and Qilian Mountain Desert and Grassland	PA1324 plus PA0517 plus PA1015
		23: West and Central Qinghai-Tibetan Plateau	A: Central Qinghai-Tibetan Plateau Alpine Cold Grassland	PA1002 plus part of PA1020 plus PA1014
			B: Ngari Plateau Alpine Cold Desert and Desert Grassland	PA1006 plus PA1021
1V: Northwest China Area		24: Alashan Plateau Temperate Desert		PA1302
		25: East Tian Shan Temperate Desert		Part of PA1302
		26: North Xinjiang	A: Altai Mountain Grassland and Coniferous Forest	PA0502 plus PA1001
			B: Junggar Basin Temperate Desert	PA1317 plus PA0806
			C:Tianshan Mountains Grassland and Coniferous Forest	PA1019 plus PA0521
		27: Tarim Basin and Kunlun Mountains	A: Tarim Basin Desert	PA0442 plus PA1330
			B: Kunlun Mountains Alpine Cold Desert	PA1011

By overlaying the Chinese PA system over these Chinese biounits Xie Yan and Lishu Li (2004) have identified biounits that lack any PAs and several that lack any PAs at national level (Figure 16).

Figure 16: China Biogeographic Units without Protected Areas or without National Level Protected Areas (Source: Xie Yan *et al.* 2004)



By also scoring each biounit on the basis of vertebrate importance (usingdistributions of over 1,100 mammals, amphibia and reptiles, and over 700 freshwater fish species) we can see that some of these gaps fall in areas of high biodiversity importance (Figure 17).

Figure 17: Important Areas for Vertebrate Diversity and Protected Areas in China
(Source: Xie Yan *et al.* 2004)

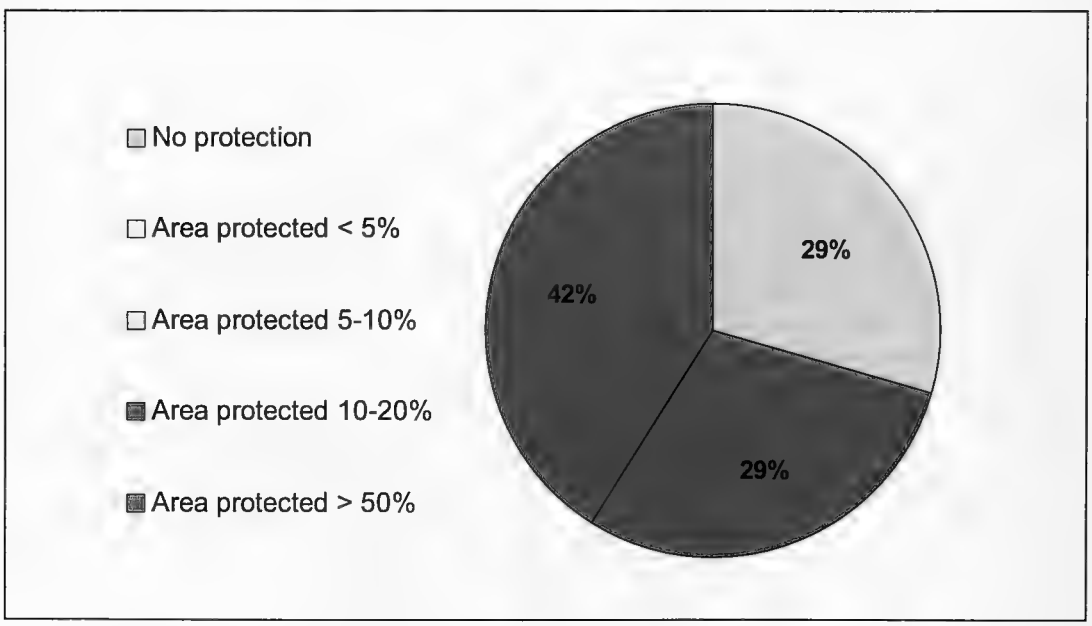
4.5 Centres of Endemism

To test whether the PA system was well focused upon those areas that have been identified as having high endemism value, the GIS cover of PAs was overlaid on maps of Endemic Bird Areas (EBAs) and Endemic Mammal Areas (EMAs). Sixteen EBAs occur within East Asia, defined as areas where the ranges of more than one restricted range bird species overlap. In practice such EBAs constitute one of the best strategies for protecting bird species as the global EBAs in total protect more than 85% of all known bird species in only 3% of the terrestrial area. The results of the analysis indicate that all EBAs are relatively well covered by the PA system (see Annex: Map IV, Table 25 and Figure 18). However, some of the most important EBAs are those least covered, namely: Yunnan mountains, Shanxi mountains, Southeast Chinese mountains, Chinese subtropical forest and to a lesser extent, Taiwan.

Table 25: Protected Area Coverage of Endemic Bird Areas

EBA No.	EBA Name	No. restricted range species	EBA Area (km^2)	Area within Pas (km^2)	% PA Cover
127	Taklimakan Desert	2	60,418	4,790	7.9
134	Eastern Tibet	2	63,225	30,729	48.6
133	Southern Tibet	2	59,695	11,597	19.4
130	Eastern Himalayas	22	18,038	9,625	53.4
135	Qinghai mountains	2	232,628	27,619	11.9
137	Central Sichuan mountains	11	115,242	22,087	19.2
138	West Sichuan mountains	3	175,672	60,816	34.6
140	Chinese subtropical forest	5	129,458	10,078	7.8
139	Yunnan mountains	3	185,652	11,327	6.1
142	Hainan	4	13,201	1,586	12.0
136	Shanxi mountains	2	188,631	12,169	6.5
141	Southeast Chinese mountains	5	595,382	39,771	6.7
149	Taiwan	15	35,904	4,148	11.6
148	Nansei Shoto	10	4,734	1,114	23.5
147	Ogasawara Islands	1+3 extinct	64	64	100.0
129	Central Himalayas	3	28	28	100.0
146	Izu Islands	3	306	244	79.6

Figure 18: Endemic Bird Areas Distribution by Extent of Protection in East Asia



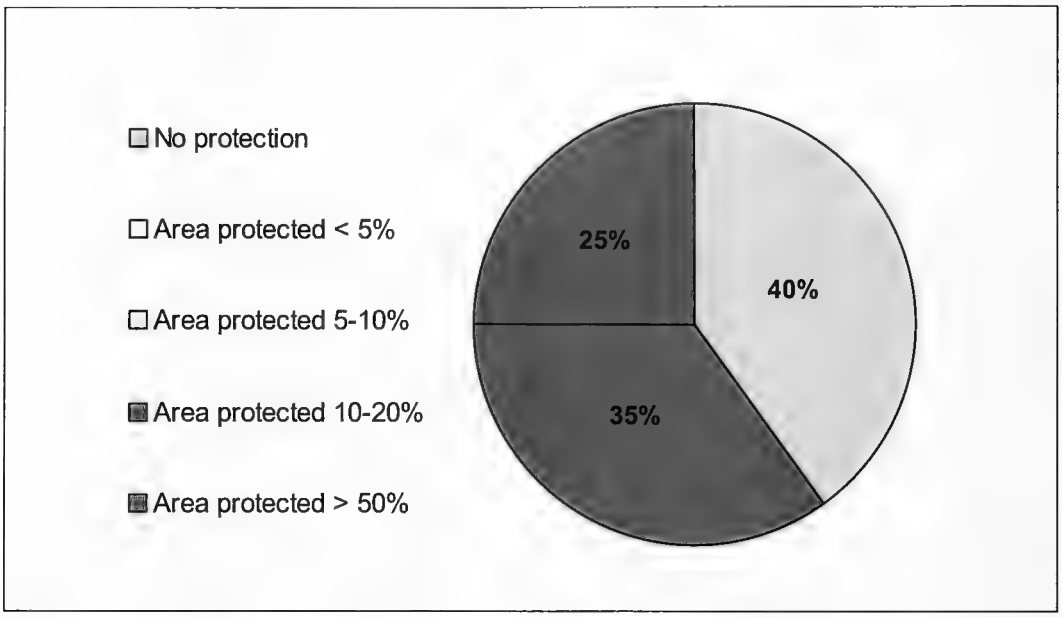
The distributions of 112 East Asian mammals with restricted ranges were mapped. The areas where the ranges of more than one of these overlapped were classed as 'endemic mammal areas' (EMAs). A total of 20 EMAs were identified for the analysis (see Annex: Map V).

The results of the analysis are very similar to the EBA cover. Most EMAs are well covered with PAs (Table 26 and Figure 19) but the least well covered are some of the most important and bio-rich EMAs such as: Southwest Yunnan, Southwest Guangxi, Hengduan Mountains, Hainan Island, Changbai Mountains,Southeast China Mountains, Qilian Mountains, and the Daba/Qingling Mountains.

Table 26: Protected Area Coverage of Endemic Mammal Areas

EMA No.	EMA Name	No. of Restricted Range Mammals	EMA Area (km^2)	EMA_within PAs (km^2)	% PA Cover
1	Gaoligong Mts.	18	40,850	7,302	17.9
2	SW Yunnan	10	143,764	10,156	7.1
3	SW Guangxi	3	35,720	3,466	9.7
4	W. Sichuan Mts.	12	139,565	24,181	17.3
5	NE Guizhou Mts.	2	47,548	5,336	11.2
6	Hengduan Mts.	6	166,577	12,214	7.3
7	East Himalayas	7	284,968	51,265	18.0
8	Hainan Island	5	23,666	1,956	8.3
9	Taiwan Island	14	30,996	3,931	12.7
10	Changbai Mountains	2	118,927	8,789	7.4
11	SE China Mountains	2	123,445	8,180	6.6
12	Qilian Mts.	2	97,429	6,664	6.8
13	Helan Ningxia	2	92,718	11,758	12.7
14	Daba-Qingling Mts.	3	120,402	10,588	8.8
15	Hokkaido Mountains	2	19,898	4,530	22.8
16	C. Honshu Mountains	2	30,575	8,610	28.2
17	Sado-Nigita	3	4,733	489	10.3
18	Tsushima Islands	2	640	228	35.6
19	Ryukyu Island Chain	10	2,972	801	27.0
20	Ogasawara-Bonin	2	49	49	100.0

Figure 19: Endemic Mammal Area Distribution by Extent of Protection in East Asia



4.6 Threatened Species

Analysis of specific species ranges reveals some gaps in species protection. For example, PA cover was overlaid on the geographical ranges of 93 species of threatened and endangered birds. The results of the analysis (Tables 27 and 28, and Figure 20) reveal that for the 93 threatened bird species included in the analysis 60% have greater than 10% PA cover within their gross geographical ranges, whilst about 30% have between 5-10% PA cover. Only nine species appear to face gaps in the PA system, listed on Table 28 with notes and comments on the individual species.

Table 27: Protected Area Coverage and Range of Selected Threatened and Endangered Bird Species

Species	Range (km²)	Range in PA (km²)	% Range Protected
Aceros nipalensis	6,573	1,747	26.6
Acrocephalus tangorum	315,861	52,352	16.6
Alcippe variegaticeps	155,234	15,982	10.3
Anas formosa	2,900,445	209,903	7.2
Anser cygnoides	2,220,165	193,095	8.7
Aquila clanga	408,077	28,272	6.9
Aquila heliaca	1,941,004	188,826	9.7
Arborophila ardens	13,200	1,584	12.0
Arborophila gingica	396,420	23,291	5.9
Arborophila mandellii	794	95	12.0
Arborophila rufipectus	7,706	307	4.0
Aythya baeri	3,060,452	298,171	9.7
Aythya nyroca	1,128,523	469,778	41.6

Species	Range (km²)	Range in PA (km²)	% Range Protected
Brachypteryx hyperythra	1,530	0	0.0
Caprimulgus centralasicus	60,414	4,799	7.9
Catreus wallichi	52	51	98.4
Certhia tianquanensis	19,670	5,643	28.7
Ciconia boyciana	2,372,125	193,512	8.2
Columba eversmanni	1,009,384	120,562	11.9
Columba punicea	3,127	0	0.0
Coturnicops exquisitus	789,502	80,824	10.2
Crex crex	93,447	14,681	15.7
Crossoptilon mantchuricum	188,620	12,168	6.5
Egretta eulophotes	145,070	17,197	11.9
Emberiza jankowskii	207,451	25,043	12.1
Emberiza sulphurata	254,175	41,587	16.4
Eurochelidon sirintarae	184,644	16,018	8.7
Falco naumanni	2,371,348	378,443	16.0
Gallinago nemoricola	242,993	25,658	10.6
Gallirallus okinawae	594	177	29.9
Garrulax bieti	23,396	2,555	10.9
Garrulax sukatschewi	28,519	4,625	16.2
Garrulus lidthi	1,064	157	14.8
Gorsachius goisagi	493,417	51,836	10.5
Gorsachius magnificus	608,528	41,339	6.8
Grus japonensis	435,357	41,669	9.6
Grus leucogeranus	29,435	3,524	12.0
Grus monacha	118,872	14,871	12.5
Grus nigricollis	872,191	358,228	41.1
Grus vipio	646,247	102,819	15.9
Gyps bengalensis	6,642	1,304	19.6
Haliaeetus leucoryphus	4,683,374	1,241,792	26.5
Haliaeetus pelagicus	79,427	11,915	15.0
Ketupa blakistoni	87,826	11,794	13.4
Larus relictus	1,256,117	168,796	13.4
Larus saundersi	341,225	35,330	10.4
Liocichla omeiensis	8,196	307	3.8
Locustella pleskei	5,029	1,268	25.2
Lophophorus lhuysii	175,683	60,806	34.6
Lophophorus sclateri	29,765	10,879	36.6
Luscinia obscura	59,292	12,605	21.3
Luscinia ruficeps	46,542	7,358	15.8
Megalurus pryeri	268,655	33,309	12.4
Mergus squamatus	2,491,202	168,291	6.8
Nipponia nippon	2,837	38	1.3
Numenius madagascariensis	544,797	65,280	12.0
Oceanodroma matsudairae	577	81	14.1
Oriolus mellianus	154,925	15,982	10.3
Otis tarda	853,486	87,696	10.3
Paradoxornis przewalskii	32,728	4,736	14.5

Species	Range (km²)	Range in PA (km²)	% Range Protected
Paradoxornis zappeyi	41,012	2,718	6.6
Pavo muticus	181,330	16,305	9.0
Pelecanus crispus	91,989	11,043	12.0
Perisoreus internigrans	143,346	53,385	37.2
Phylloscopus hainanus	13,200	1,584	12.0
Phylloscopus ijimae	54,114	7,594	14.0
Pitta nympha	1,165,671	91,100	7.8
Platalea minor	110,675	9,950	9.0
Polysticta stelleri	11	0	0.0
Pterodroma cervicalis	566	74	13.2
Pycnonotus taivanus	7,275	1,035	14.2
Rhinomyias brunneata	595,329	39,755	6.7
Rostratula benghalensis	1,205,526	99,734	8.3
Sapheopipo noguchii	585	172	29.3
Saxicola insignis	228,549	24,304	10.6
Scolopax mira	2,284	560	24.5
Sitta formosa	167,399	14,387	8.6
Sitta magna	270,666	21,140	7.8
Sitta yunnanensis	169,402	10,117	6.0
Spelaeornis badeigularis	1,360	0	0.00
Sterna acuticauda	13,270	1,993	15.0
Sterna bernsteini	3	0	0.0
Synthliboramphus wumizusume	2,198	1,395	63.5
Syrmaticus ellioti	440,267	29,964	6.8
Syrmaticus humiae	247,694	19,776	8.0
Syrmaticus reevesii	894,580	69,032	7.7
Tadorna cristata	1	0	0.0
Terpsiphone atrocaudata	267,260	40,530	15.2
Tragopan blythii	6,042	3,394	56.2
Tragopan caboti	396,420	23,291	5.9
Turdus celaenops	884	539	61.0
Turdus feae	188,620	12,168	6.5
Zoothera major	809	64	7.9

Figure 20: Bird Species Distribution by Extent of Protection

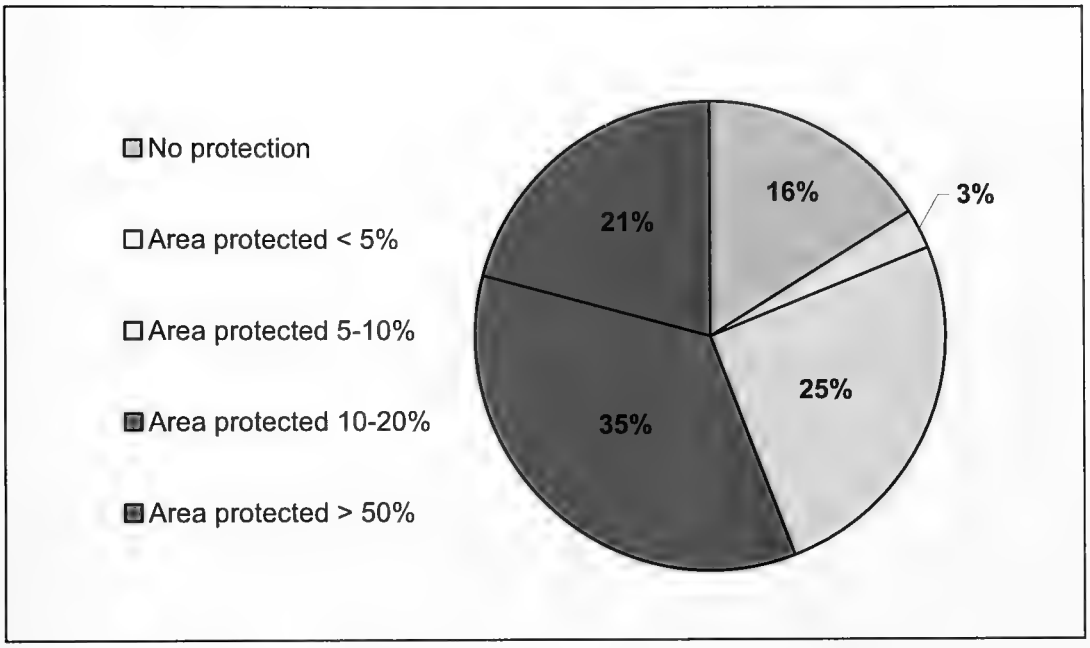


Table 28: Threatened and Endangered Bird Species without Adequate Protection

Species	% PA Cover	Red Data Category	Comments
Brachypteryx hyperythra	0	Vulnerable	Occurs in NE India. Will be protected in Nujiang PA in marginal Chinese range
Columba punicea	0	Vulnerable	Himalayan species protected in neighbouring Nepal PAs.
Nipponia nippon	1.33	Critically Endangered	Extirpated from most of former range. Last wild breeding colony is within PA. Captive breeding and release programme in place.
Polysticta stellata	0	Vulnerable	Winter visitor only. Breeding range is in Russia.
Sterna bernsteini	0	Critically Endangered	Almost extinct. No breeding colonies known.
Tadorna cristata	0	Critically Endangered	Possibly extinct. No wild populations known in Russia, Korea, China junction region.
Arborophila rufipectus	3.98	Critically Endangered	Protected in Mabian Dafending PA. Recommendations for additional sites have been made by SSC.
Liocichla omeiensis	3.75	Near Threatened	Well protected in Mt. Emei PA but more forest could be protected.
Spelaeornis badeigularis	0	Vulnerable	Never recorded in China but probably occurs on north side of Mishmi Hills. Protected in Indian administered territory.

A similar analysis has been undertaken with the distribution of all Chinese endemic mammals (see Table 29 and Figure 21). Endemic mammals whose ranges do not appear to be covered by any PA are *Soriculus fumidus*, *Soriculus sodalis*, *Rhinolophus osgoodi*, *Plecotus taivanus* and *Murina puta*. These are two shrews and three bats. However, it is likely that in fact these

much over-looked species would be found in existing PAs if their full ranges were better known.

Species with only limited PA cover totalling less than 5% include: *Eospalax fontanierii*, *Eothenomys proditor*, *Ochotona iliensis*, *Sorex cansulus* and *Myotis pequinius*. Two of these are small overlooked mammals but certainly the pika *Ochotona iliensis* appears to be very restricted and the Rabbit and Pica Specialist Group of IUCN's Species Survival Commission are proposing additional PAs for its protection. *Eospalax fontanierii* is both widespread and well reported but happens to occur in the loess plateau region of China which is one of the poorest protected regions in terms of PA cover.

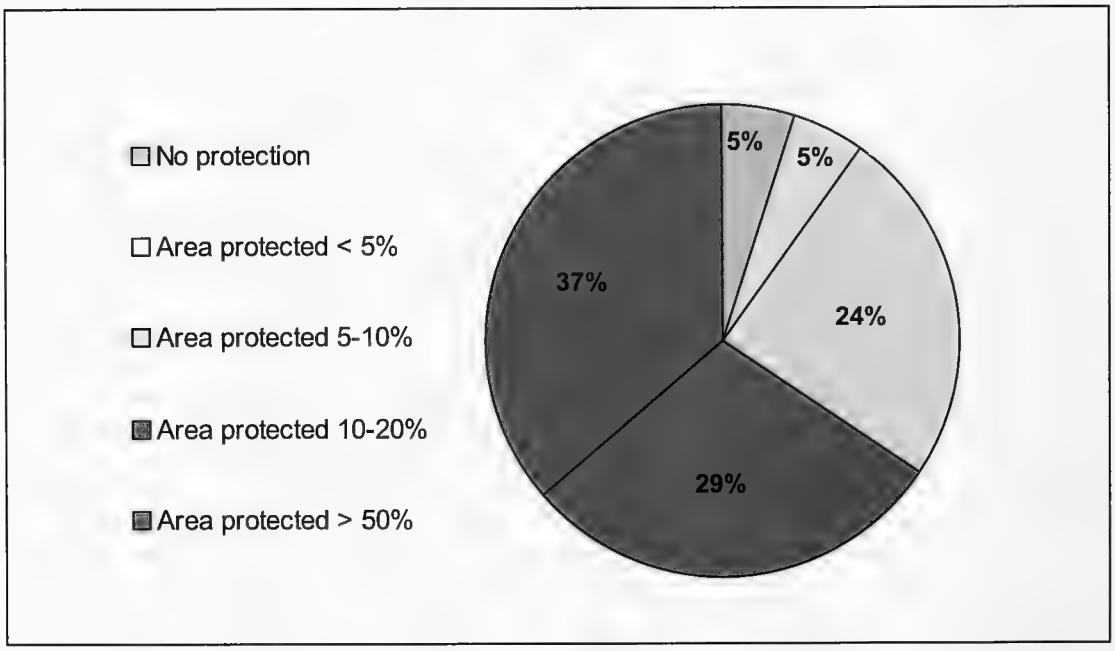
Table 29: PA Coverage and Range of Chinese Endemic Mammal Species

Species code	Distribution (km²)	Area in PA (km²)	Genus	Species	% PA Cover
A008	19,644	3,392	*Macaca*	*cyclopis*	17.3
A011	1,318,834	135,796	*Macaca*	*thibetana*	10.3
A012	35,018	6,655	*Rhinopithecus*	*bieti*	19.0
A013	20,111	3,722	*Rhinopithecus*	*brelichi*	18.5
A014	148,137	34,716	*Rhinopithecus*	*roxellana*	23.4
A018	4,841	659	*Trachypithecus*	*poliocephalus*	13.6
A026	139,724	22,747	*Aeretes*	*melanopterus*	16.3
A036	596,876	120,038	*Petaurista*	*xanthotis*	20.1
A039	1,828,505	238,029	*Trogopterus*	*xanthipes*	13.0
A045	13,017	2,176	*Callosciurus*	*quinquestriatus*	16.7
A059	1,697,021	154,098	*Sciurotamias*	*davidianus*	9.1
A060	284,232	21,388	*Sciurotamias*	*forresti*	7.5
A061	299,438	19,196	*Spermophilus*	*alashanicus*	6.4
A068	2,967	1,195	*Chaetocauda*	*sichuanensis*	40.3
A088	599,128	181,523	*Eozapus*	*setchuanus*	30.3
A090	468,171	20,971	*Eospalax*	*fontanierii*	4.5
A091	171,133	14,411	*Eospalax*	*rothschildi*	8.4
A092	100,886	9,166	*Eospalax*	*smithii*	9.1
A106	283,123	34,340	*Caryomys*	*eva*	12.1
A107	450,775	33,453	*Caryomys*	*inez*	7.4
A112	8,057	1,663	*Eothenomys*	*chinensis*	20.6
A113	65,403	4,687	*Eothenomys*	*custos*	7.2
A116	125,612	7,122	*Eothenomys*	*olitor*	5.7
A117	36,018	1,028	*Eothenomys*	*proditor*	2.9
A118	70,165	4,377	*Eothenomys*	*wardi*	6.2
A121	52,278	52,018	*Lasiopodomys*	*fuscus*	99.5
A129	2,213	788	*Microtus*	*kikuchii*	35.6
A130	633,051	202,094	*Microtus*	*limnophilus*	31.9
A138	409,378	32,730	*Myodes*	*shanseius*	8.0
A141	635,175	184,405	*Neodon*	*irene*	29.0
A145	3,101	426	*Proedromys*	*bedfordi*	13.8
A146	7,034	3,049	*Volemys*	*millicens*	43.4
A150	163,527	10,206	*Cansumys*	*canus*	6.2
A164	55,680	12,445	*Meriones*	*chengi*	22.4
A171	810,575	76,214	*Apodemus*	*chevrieri*	9.4
A176	9,374	881	*Apodemus*	*semotus*	9.4
A181	1,088	154	*Berylmys*	*mackenziei*	14.2
A186	756	337	*Hadromys*	*yunnanensis*	44.7

Species code	Distribution (km²)	Area in PA (km²)	Genus	Species	% PA Cover
A199	4,329	785	*Niviventer*	*coninga*	18.1
A200	218	66	*Niviventer*	*culturatus*	30.1
A202	48,323	6,910	*Niviventer*	*excelsior*	14.3
A218	189	14	*Ochotona*	*argentata*	7.5
A219	467,860	102,633	*Ochotona*	*cansus*	21.9
A222	513,624	139,108	*Ochotona*	*erythrotis*	27.1
A224	5,915	1,902	*Ochotona*	*gaoligongensis*	32.2
A225	204,283	75,967	*Ochotona*	*gloveri*	37.2
A226	31,902	11,007	*Ochotona*	*himalayana*	34.5
A227	170,431	20,583	*Ochotona*	*huangensis*	12.1
A229	86,064	4,207	*Ochotona*	*iliensis*	4.9
A230	159,254	48,807	*Ochotona*	*koslowi*	30.7
A233	385	76	*Ochotona*	*muliensis*	19.8
A234	582	229	*Ochotona*	*nigritia*	39.3
A240	230,569	113,295	*Ochotona*	*thomasi*	49.1
A243	5,000	684	*Lepus*	*hainanus*	13.7
A250	488,510	36,483	*Lepus*	*yarkandensis*	7.5
A257	266,339	23,170	*Mesechinus*	*hughi*	8.7
A271	6,924	1,735	*Blarinella*	*quadraticauda*	25.1
A280	4,464	155	*Sorex*	*cansulus*	3.5
A281	262,563	43,284	*Sorex*	*cylindricauda*	16.5
A290	64,872	18,805	*Sorex*	*sinalis*	29.0
A291	94,611	38,778	*Sorex*	*thibetanus*	41.0
A294	639	0	*Soriculus*	*fumidus*	0.0
A295	424,160	55,723	*Soriculus*	*hypsibius*	13.1
A296	217,408	23,184	*Soriculus*	*lamula*	10.7
A301	6,713	2,816	*Soriculus*	*salenskii*	42.0
A302	29,311	5,598	*Soriculus*	*smithii*	19.1
A303	17	0	*Soriculus*	*sodalis*	0.0
A306	720,677	73,898	*Euroscaptor*	*longirostris*	10.3
A309	479,770	37,342	*Mogera*	*insularis*	7.8
A312	188,265	22,413	*Scapanulus*	*oweni*	11.9
A313	990,289	52,190	*Scaptochirus*	*moschatus*	5.3
A315	1,717	422	*Uropsilus*	*andersoni*	24.6
A317	517	224	*Uropsilus*	*investigator*	43.2
A318	113,605	21,338	*Uropsilus*	*soricipes*	18.8
A333	7,422	1,569	*Rhinolophus*	*formosae*	21.1
A336	2,635	495	*Rhinolophus*	*monoceros*	18.8
A337	188	0	*Rhinolophus*	*osgoodi*	0.0
A341	25,210	4,934	*Rhinolophus*	*rex*	19.6
A367	2,810	771	*Arielulus*	*torquatus*	27.5
A393	189	0	*Plecotus*	*taivanus*	0.0
A410	142,927	17,728	*Myotis*	*fimbriatus*	12.4
A411	227,094	15,322	*Myotis*	*formosus*	6.8
A422	6,240	308	*Myotis*	*pequinius*	4.9
A423	353,489	24,169	*Myotis*	*ricketti*	6.8
A435	150	0	*Murina*	*puta*	0.0
A471	86,788	24,001	*Ailuropoda*	*melanoleuca*	27.7
A485	633	52	*Meles*	*leucurus*	8.2
A502	2,558	848	*Moschus*	*anhuiensis*	33.2
A516	93,174	7,069	*Muntiacus*	*crinifrons*	7.6

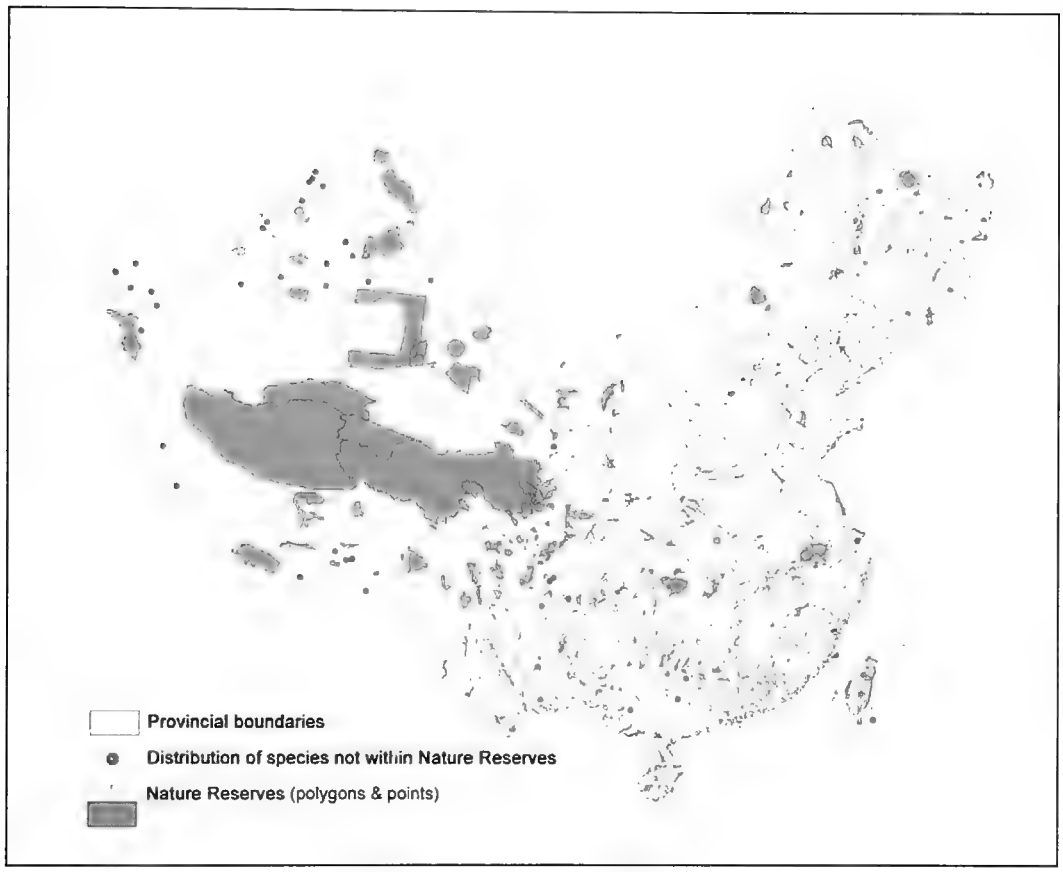
Species code	Distribution (km²)	Area in PA (km²)	Genus	Species	% PA Cover
A517	2,117	948	*Muntiacus*	*gongshanensis*	44.8
A519	1,610,197	125,646	*Muntiacus*	*reevesi*	7.8
A520	665,062	264,510	*Przewalskium*	*albirostris*	39.8
A522	8,011	963	*Ruservus*	*eldii*	12.0
A527	118,376	29,128	*Procapra*	*przewalskii*	24.6
A533	2,248,810	266,172	*Capricornis*	*milneedwardsii*	11.8
A534	127	101	*Capricornis*	*swinhoei*	79.5
A537	556,705	52,202	*Naemorhedus*	*caudatus*	9.4
A543	14,929	4,441	*Pseudois*	*schaeferi*	29.8
A571	38,394	4,454	*Lipotes*	*vexillifer*	11.6

Figure 21: Endemic Mammals of China (including Taiwan) Distribution by Extent of Protection



Xie Yan and Lishu Li (2004) have also tested the PA coverage for all mammals, reptiles, amphibia totalling 1,138 vertbrates. Forty-eight species or 4% of these appear to have no overlap with the PA system in China. Figure 22 shows all known localities of these 48 species. These are mostly in northwest China and southeast Xizang. Xie Yan and Lishu Lu also point out that the number would likely be higher if plants and invertebrates were included in the analysis as these species have typically more restricted ranges than vertebrates within China.

Figure 22: Distribution of Species not covered by Protected Areas in China
(Source: Xie Yan *et al.* 2004)



BirdLife International have been compiling a directory of Important Bird Areas (IBAs) - sites where the occurrence together of several Red Listed birds are known to occur. We were able to use a point GIS cover of the East Asian IBAs. Using circles to represent their known sizes, as well as information in the name of IBAs which also sometimes refer directly to protected areas, a rough analysis was undertaken of how many of these sites fall within the PA system. The following results emerge:

Table 30: Relationship of IBAs to PAs in East Asia

Relation IBA to PA	Numbers	Total (km²)	% Number	% Area
Far outside PA (relatively to size or 10 km for IBA with unknown size)	319	130,304	40.8	11.9
Centre within PA	233	619,722	29.8	56.6
Within 10 km from PA	74	28,966	9.5	2.6
Large area relatively close to PA	23	221,481	2.9	20.2
Centre further than 10 km from PA	133	94,153	17.0	8.6
Total	**782**	**1,094,626**		

The results show that although most of the area of IBAs lie inside or close to existing PAs there remain many important areas outside of the PA system. Clearly some sites may prove to be duplicates of protected sites or have no scope for PA development but when the full details of these sites are published they should be individually assessed to determine which sites merit supporting as new PAs.

5. Conclusion and Recommendations

It is clear that collectively the countries of East Asia have made and continue to make tremendous strides in the development of a wide-ranging and diverse protected areas system. It is hard to find significant gaps in terms of habitat or species cover. However, there is a bias towards commercially less valuable lands that are also of less value to biodiversity, in particular agriculturally less or unproductive mountains and deserts. They have great wilderness value and may be important as water catchments, but they tend to have low biodiversity value. Thus, there is a need to conserve representative areas of lower altitude and lowland ecosystems.

Protected areas in highly populated or better developed regions tend to be much smaller than those in areas where land is under less competition. The small size of these reserves may undermine their ecological sustainability and island biogeographical effects may result in high levels of local extinction even within well- protected sites. For small protected areas to be effective very efficient planning and implementation of buffers and corridors is required to allow as much dispersal of key species between protected areas or with natural or semi-natural habitats. For example, it may be impossible to link two nearby nature reserves with other protected areas but it may be possible to have a corridor or plantations and parkland rather than crops and urban sprawl, which would serve as a corridor for many woodland species.

The review identifies some gaps where more PAs may need to be established, enlarged or linked via corridors of natural or semi-natural habitats. These are presented in the recommendations below. While not the prime focus of this review, the authors observe that, as stressed in IUCN's *A Regional Action Plan for Protected Areas in East Asia*, the development of marine PAs (MPAs) still lags far behind the terrestrial. This is, of course, part of the global issue of inadequate conservation of marine ecosystems. In Asia, given the increasing threats from heavy marine pollution and sedimentation, mining of coral, over-fishing and use of destructive fishing practices, excessive harvesting of sharks, turtles and pressures to re-open whaling, it is clear that this should be addressed as a matter of urgency.

We cannot emphasise enough the need for effective management of protected areas. The establishment of a large protected area does not in itself guarantee protection of component species. Quite low levels of human hunting can completely decimate slow breeding species. Despite the very large number and area of protected areas in East Asia, most specialist group reports and national studies indicate ever growing lists of threatened species and continuing damage and degradation to important sites. The problem facing East Asia's threatened wildlife is not, in general, a lack of PAs but weakness in management and protection within existing reserves.

Ironically, the vast expanses of the Tibetan Plateau and Gobi desert within the East Asian region have some huge protected areas and yet Wild Yak, Snow Leopard, Wolf, Chiru Przewalskii's Gazelle and wild camels are all desperately endangered as a result of human pressures. Within China there has been historically great attention paid to 'precious' or economically valuable species. Many protected areas were established for the protection of single species, on the basis that their protection constitutes an economic investment. This approach has given rise to some imbalance in PA distribution. Some species end up with

almost their entire range protected (for example, the Giant Panda) while other species, not so well regarded, such as some of the endemic Pikas, are not only not protected in reserves but actively persecuted as agricultural pests.

5.1 General Recommendations

i) There is a need to make a greater effort to achieve full representation of the richer and lower altitude habitats, many of which are already highly threatened and reduced by human development. It is certainly not easy to acquire valuable development land for conservation. One way countries can encourage this is through comprehensive regional planning and zoning, including the designation of PAs.

ii) While management capacity varies across the region, generally there is a need to raise management standards, which will require:

- fund raising;
- establishment of monitoring systems;
- strengthening legal systems and law enforcement;
- training of staff and capacity building;
- increasing international co-operation;
- improving public awareness and involving local people.

iii) Ecosystem restoration should be considered in many cases. It is difficult to restore some complex tropical forest systems but not so difficult in wetlands, grasslands and temperate forests.

iv) Selection of protected areas on the basis of species needs or habitat cover fails to win alliance with other strong agencies that can help support PA establishment. PA selection should pay much more attention to the ecological services, economic and social benefits that habitat protection or restoration can achieve in the local development context.

v) Governments are urged to pay greater attention to the involvement of local communities in the establishment and management of protected areas. Government can no longer dictate to rural communities. Whether a protected area succeeds or fails will depend on whether it is accepted and actively supported by local communities.

vi) More attention must be paid to the development of marine protected areas or marine protection measures (quotas, agreements on fishing areas, agreements on equipment allowed), and so on. In this regard it is important to reach international agreement about resource use within disputed waters. Countries may not agree who owns an area of sea but if all agree that in any case it should be protected, there can be the basis for cooperative research and protection activities.

vii) Many PAs are too small to retain their original complement of species. They will lose species as a result of island biogeographic principles (the number of species that can be supported is proportional to the area occupied). But this process can be minimized if

connectivity can be maintained or recreated, if distances to other similar habitats are not too great or habitat islands are available to act as stepping stones to provide links. Corridors may need to be established between PAs to allow migration and genetic exchange between otherwise isolated and inbred populations – building ecological networks. PA effectiveness can be greatly enhanced if some level of connectivity can be established between them, or artificial movement of organisms is employed to maintain breeding between otherwise isolated populations. In some cases where *in-situ* conservation alone seems doomed to fail, higher levels of management intervention or *ex-situ* conservation actions may also be required.

viii) New threats such as invasive alien species are becoming more important issues. These must be tackled at frontiers and by other agencies that by the management staff of protected areas when species have already arrived there.

5.2 Country and Territory-Specific Recommendations

China

Although China has made great progress in the establishment of a national system of protected areas in terms of numbers of sites, area, completeness of coverage, staffing, budget allocations, studies and projects, there remain many weaknesses throughout the system ranging from systemic to very specific. Unless these matters are urgently addressed the great investments of land and funds will be largely wasted. Biodiversity losses will continue and reduced ecological services provided by PAs (climate regulation, watershed protection, erosion control, biodiversity and genetic resources protection and potential tourism earnings) will cost China many billions of US$ of lost revenue and social benefits.

In 2003 and 2004 a special Protected Areas Task Force was established under the auspices of the China Council for International Cooperation in Environment and Development (CCICED). The task force was asked to examine and comment on the effectiveness of the protected areas system within China. Many weaknesses were pointed out in the report of the task force. It is worth listing seven of these, which remain very relevant to the present review:

i) The law needs strengthening and needs more flexibility to apply a wider range of operational options such as those offered by the six IUCN categories rather than the one existing category under current Chinese law.

ii) Funding should be provided for the management of each PA, rather than expect managers to fraise their own funding through the introduction of a wide range of economic ventures that usually contradict the conservation objectives of sites.

iii) Greater screening of the biological justification and operational and financial capability of the management agency before new PAs should be accepted for declaration.

iv) Adoption of a series of competency standards should be adopted to promote higher skills and calibre of management staff at all levels.

v) Greater emphasis should be put on creating linkage and corridors between sites, including transfrontier arrangements where appropriate.

vi) Greater coordination in planning, pooling of data and experience should be realised at both central and provincial levels and a core of supporting ministries – agriculture,

water resources etc. should be mobilised to give greater support for ecological protection and restoration activities.

vii) Greater efforts need to be made to involve local communities in a positive way, through allowing them employment and ecotourism opportunities and compensation schemes for lost opportunities.

viii) China needs more flexibility in protected areas management, and so there is a need for new and revised categories for the PA system. Table 31 proposes new categories, based on IUCN recommendations and adapted to China's conditions.

Table 31: Recommended Categories for China's Protected Area System

Title	IUCN Management Category Equivalent	Objectives	Examples
Strict Nature Reserve	I	Preserve natural habitat of representative ecosystems or species for conservation and scientific study	Dinghushan, Foping
National/ Provincial Park	II	Provide public access for recreation and education to attractive natural areas. Ecotourism encouraged, but core area protected.	Juzhaigou, Huanglong, Wolong, Xishuangbanna
Wildlife Sanctuary	IV	Protect important habitats or species through active habitat management. Visitor use permitted.	Datian, Dafeng Milu reserve, Wanglang
Ecological Reserve	VI	Protect or restore natural habitat to serve connectivity or ecological function needs. This could be a seasonal overlay on normal farm practices.	Panda corridors, Dongzaigang, Xingkaihu
Scenic Site	III	Protect small scenic sites for cultural and recreational purposes	Xiangshan, Lushan

ix) China should also adopt a set of competence standards that list the various professional skills and knowledge (competencies) for different positions and levels within a protected area management organisation. The use of such standards has many advantages including:

- Staff know what roles they are expected to perform.
- Clear terms of reference can be drawn up for each job on the basis of these standards.
- Hiring of staff can be guided by whether the applicant has the necessary skills. Training can be individually tailored to bring staff up to standard to fulfil their own roles.
- Training courses can be redesigned to ensure that they deliver the exact skills needed by the profession.
- Staff can plan their own training to achieve upgrading.
- Projects with funds for staff training purposes can ensure that these are spent on courses that are compliant with the standards adopted for the trainees needs.

- Expertise requirements for special jobs can be very precisely defined in terms of standardised skills.

- Professional societies can emerge based on recognised qualifications.

x) A major gap in Chinese legislation is the lack of a national legislation on protected areas. Current legislation is seen to be very inflexible and ill-matched to the real situation of most PAs in China. To fill this gap and tackle current inadequacies, new legislation is recommended. In fact, it is understood that a team is already engaged in preparation of a new law for nature reserves. Existing regulations for establishment of Scenic Areas may also need revision.

Hong Kong

i) Continue to allow habitat restoration and actively seek suitable native species from nearby Guangdong Province in China for forest enrichment and restoration. Tai Po Kau has potential for re-establishment of a close to original forest type, but plantations of exotic timbers should be phased out.

ii) Mai Po Marshes has become an important wetland bird sanctuary but the habitat is almost entirely artificially created from acquired fish ponds. Care should be taken to re-establish natural mangrove areas. Attention to species, in relation to zones, should be followed in any seedling planting. The interface between mangroves and beach forest is absent. Suitable species could be acquired in Hainan for this restoration.

iii) Continue to strengthen marine reserves.

Taiwan

i) Continue to maintain high standards of research, monitoring and management.

ii) Improve relations with relevant ministries in China so that it can share its experiences and expertise and assist China in its own PA programme.

iii) Establish a PA to protect the endemic flora of Lanyu Island.

Mongolia

i) Complete the establishment of additional reserves proposed under the Biodiversity Conservation Action Plan especially in the southeast of the country, Altai Mountains and Great Lakes area.

ii) Establish greater control of hunting and wildlife trade.

iii) Develop transfrontier relationships with PAs in China (Altai Mountains, Gobi Desert and eastern Mongolia) and with Russia (Khovsgol Lake, Khan Khenti and Mongol Dagurian).

DPR Korea

It is heartening to see that North Korean authorities so isolated and independent in many other areas of development are increasingly showing concern for environmental protection, conservation and the establishment of a system of protected areas. It is hoped that this system

can be further extended and strengthened and we strongly recommend that international support is provided to DPR Korea as soon as possible.

Republic of Korea

i) Increase PA cover to at least 10%.

ii) Try to establish better protection in the evergreen forests of the south of the country, especially at lower altitudes.

iii) Continue efforts to develop transfrontier reserve with DPR Korea in the DMZ.

Japan

i) Continue to restore degraded habitat.

ii) Maintain the high standards in existing PAs.

iii) Assist other countries in the region through JICA programmes in areas of environmental conservation and PA management.

5.3 Site-Specific Recommendations

i) The number of specific sites already protected or in need of survey and possible addition to the PA system is too long for individual treatment in this review. However, the various analyses presented here do reveal some areas and sites that appear to be under represented in the PA system. These should form the basis for surveys, feasibility studies and selection of additional sites needed to fill gaps. Some examples include:

- Tian Shan, Jinji Mountains., eastern border of Qinghai Province, southeast Yunnan-Guizhou Plateau, Hengduan Mountains, Huagtu Plateau, Ordos Plateau, northern Guangxi, downstream of Huaihe and Yellow Rivers ion China;
- Altai Mountains, Great Lakes Plain and southeast corner of Mongolia;
- southern tip of the peninsula in the Republic of Korea;
- west-central lowland forest , Lanyu Island and marine areas generally in Taiwan.

ii) The approach used by BirdLife International to identify specific sites of importance to threatened birds should be extended to other taxa. It is clear that plants and invertebrates have narrower distributional ranges and will require additional sites. As sites become identified, they need to be presented to national authorities with a justification based more than just species needs. The boundaries and zoning of sites must be integrated into the regional ecology and development context. Most of the countries are facing water shortages, desertification, floods or pollution. Sites must fulfill strong ecological functions in mitigating these phenomena to warrant priority attention for establishment.

5.4 Species-Related Recommendations

i) Despite the extensive PA system developed in Mongolia, populations of large ungulates are under threat. They are reduced as a result of official harvesting, combined with increased poaching. Recommendations of the SSC Antelopes Specialist Group (Mallon & Kingswood, 2001) include better control of poaching, achieving sustainable quotas

for species such as Mongolian gazelle *Procapra gutturosa* that are still legally hunted, captive breeding and relocation projects (for example,Saiga *Saiga tatarica* and Przewalski's Horse *Equus ferus przewalskii*) where necessary, implementing outstanding PA proposals and regulating water resources.

ii) Even in such a huge PA as the Chang Tang Reserve in Xizang where human density is only 1 person per 10 km^2 there are major problems facing wildlife. Approximately 1.5 million head of domestic stock are grazed within the reserve, hunting is increasing, long-established seasonal grazing patterns are being modified by fencing of winter pasture and areas that formerly could only be reached by months on horseback can now be reached in a few days by vehicle (Miller & Schaller, 1997; Moehlman, 2002). Populations of Kiang *Equus kiang*, Chiru *Pantholops hodgsonii*, other ungulates and carnivores are in decline.

iii) Halt the rodent and pika spraying programmes in northern China. These are counter-productive and may also contribute to drying up of water resources by reducing the permeability of grasslands caused by rodent and pika burrows. One of the keystone species in the great grasslands of northern and western China and Mongolia are the Pikas *Ochotona* spp. These animals live in burrows in colonies and feed on leaves, roots and seeds of various herbs and grasses. They are an essential part of a healthy grassland ecosystem. They feed on many plants that are toxic to domestic stock, maintaining a low dense turf of mutually compatible plant species, cycling nutrients, providing aeration and drainage to the turf, allowing melting snow to drain into the land rather than be lost in spring run off. Moreover, the burrows of Pikas are secondarily used by a great number of other grassland fauna such as snakes, owls, other birds and reptiles. Pikas do eat some fodder species of cattle or sheep but on the whole their presence is ecologically enriching, even essential for maintaining healthy grasslands. Yet Chinese agriculturalists have identified these animals as great pests and have mobilised vast poisoning programmes whereby poison is sprayed from planes over thousands of square kilometers of grassland at a time. This spraying kills not only Pikas but a great variety of other harmless or even beneficial fauna. Other problems in grasslands include the enclosure of grazing areas, these exclude wide areas of the best winter pasture both from the herds of pastoralists as well as wild grazers such as antelope, yaks and horses.

iv) Various recommendations have been proposed by SSC specialist groups:

- Antelopes require stricter enforcement of the Wildlife Protection Law, strengthening of anti-poaching measures in Chang Tang and Arjin Shan reserves, creation of new PAs in the Tarim Basin and Quaidam Basin, establishment of a PA to protect Przewalskii's Gazelle *Procapra przewalskii* in the Hudong-Ketu area east of Qinghai Lake, establishment of PAs in Xinbaragyouqi and Dongwuqi on the Mongolian border to save the Chinese populations of Mongolian Gazelle *Procapra gutturosa*, reintroduction of Saiga in the Altai region of northwest China, and wider measures to control the *shahtoosh* trade of chiru wool (Mallon and Kingswood 2001).

- Improve knowledge of distribution of free ranging Sika Deer races *Cervus nippon*, Chinese Water Deer *Hydropotes inermis* and endangered Musk Deer *Moschus* spp (including control of the musk trade) and strengthen protection for the rare Black Muntjac *Muntiacus crinifrons* in southeast China (Wemmer 1998).

- Establish a network of four protected areas, including an extension of the Mabian Dafengding Nature Reserve for protection of the rare endemic Sichuan Hill-partridge *Arborophila rufipectus* (Fuller *et al.* 2000).

- Identify areas outside the range of the Giant Panda where the Red Panda *Ailurus fulgens* needs protection in China (Glaston 1994).

- Enlarge or link PAs as much as possible to protect wild cat species and tighten control of trade in cat furs (Nowell and Jackson 1996).

- Strengthen hunting controls in the forests of northern China to protect rare grouse species (Storch 2000) and Moose *Alces alces* (Wemmer 1998).

- Strengthen protection of several sites identified by the Crane Specialist group important for breeding or wintering crane populations (Meine and Archibald 1996).

- Improve the knowledge base on distribution of wild canids and strengthen PAs where necessary (Sillero-Zubiri *et al.* 2004).

- Status surveys are needed for poorly known weasel populations and strengthening of PAs as appropriate for Tsushima marten *Martes tsuensis*, wolverine *Gulo gulo*, Taiwan yellow-throated marten *Martes flavigula chrysospila*, spotted linsang *Prionodon pardicolor*, and Owston's palm civet *Chrotogale owstoni* (Schreiber *et al.* 1989).

- Identify, and add to the protected areas of Hainan, suitable habitat for the endemic Hainan Hill Partridge *Arborophila ardens* (Fuller *et al.* 2000).

5.5 Transfrontier Recommendations

i) Much more can be achieved by strengthening the links between managers of adjacent PAs that straddle national or internal borders. IUCN's excellent guidelines on this subject should be followed (see Sandwith *et al.* 2001). Annex: Map VI identifies a number of specific opportunities by showing the location of protected areas on or very close to the border of the region. These should be explored for possibilities for international cooperation. Specific opportunities exist within the region along the Mongolia-China border, on the China-DPR Korea border and at the DMZ between DPR Korea and Republic of Korea.

ii) A special effort is needed to establish protection of important island and source reef communities in the South China Sea. This is a politically sensitive area of overlapping claims, but in the present atmosphere of not knowing who is in charge, these reefs are under tremendous destructive abuse.

iii) International relations with Taiwan prevent Taiwan from participating as fully and contributing as much to regional and international programmes as it might. Perhaps the only way forward is for Taiwan to improve levels of cooperation with China in the area of biodiversity conservation, so that it can participate in such programmes with China's approval and collaboration.

6. References and Consulted Bibliography

Abe, N., Uchida, Y., and Fujimura, H. (1987). Studies of the cranes in Izumi, Kagoshima, Japan: 3, the observations of ringed cranes (1). *Reports of the Inst. for Nature Study* 18:33-40. [In Japanese].

Achuff, P.L. and Petocz, R. (1988). *Preliminary resource inventory of the Arjin Mountains Nature Reserve, Xinjiang, People's Republic of China.* Unpubl. Project report, WWF, Gland, Switzerland.

Ades, G. (1990). *The bats of Hong Kong.* WWF, Hong Kong.

Akai, I. (1990). Protected area management and community development in Japan. *Regional expert consultation on management of protected areas in the Asia-Pacific Region.* FAO Regional Office for Asia and the Pacific, 10-14 December 1990, Bangkok, Thailand.

Akai, I. (1991). Protected area management and community development in Japan. *Tiger Paper.* April-June, 1991. pp 11-14.

Archibald, G. W. (1981). Cranes wintering in the Republic of Korea. *Crane Research Around the World:* 66-69.

Archibald, K. (1987). The conservation status of the breeding ground of the Red-crowned Crane in Hokkaido, Japan. *Proc. 1983 Intl. Crane Workshop:* 63-86.

Aniruddah, D.P. et al (1989). *History of wildlife conservation in Taiwan.* COA Forestry Series No. 20

Anonymous (1988). *Master plan of the Great Gobi National Park.* 2 vols. UN Environmental Programme, Ulaanbaatar, Mongolia 334pp.

Anonymous (1991). *Red data book of Japan.* Two volumes: Vertebrates and invertebrates. Japanese Wildlife Research Centre.

Anonymous (1994). *The report of a feasibility study of the Mongolian gazelles' natural reserve.* Grassland Environment Monitoring Station of Inner Mongolia Autonomous Region and Environment Protection Monitoring Station of Inner Mongolia Autonomous Region (in Chinese)

Aomori Prefecture (1990). *Status report of Japanese black bears in Aomori.* 55pp (In Japanese)

Asoshina, T. (1994). Status and management of the Japanese black bear. *Bull. Wildl. Admin.* 6: 7-9 (In Japanese)

Azuma, S. and Torii, H (1980). Impact of Human Activities on survival of the Japanese black bear. *Int. Conf. Bear Res. And Manage.* 4: 71-91

Bannikov, A. (1954). *Mammals of the Mongolian People's Republic.* Academy of Sciences, Moscow (In Russian)

Bold, A., Tseveenmayadag, N., and Zvonov, B. M. (1995). Cranes of Mongolia. *Cranes and Storks of the Amur Basin:*42-47.

Chen, C.S. (1956). *Vertebrate fauna in Taiwan.* Kaiming Press Taipei.

Cheng Taso-hsin (1987). *A synopsis of the avifauna of China* Paul Parey Sceintific Publications, Hamburg and Berlin

Chiba, S. and Abe, N. (1990). *Studies of the Cranes in Izumi, Kogishima, Japan. Basic Research on the Conservation and Management of Hooded and White-naped Cranes.* Institute for Nature Study, National Science Museum, Tokyo, Japan.

Chong, J. R. (1987). *Endangered Bird Species in the Korean Peninsula.* Korea Nature Museum, Korea University (Tokyo), Tokyo. [In Japanese].

Chong, J.-R., Higuchi, H., and U-il, P. (1994). The migration routes and important rest-sites of cranes on the Korean Peninsula. *The Future of Cranes and Wetlands:* 41-50.

Chongqi, L. (1991). Nature reserves in China. *Tiger Paper* 18: 2-25.

City of Kushiro (1993). *A Report on the Protection of Tancho, A Special Natural Monument.*

Construction and Planning Administration, Ministry of the Interior, Taiwan (1985). *The Taiwan Nature Conservation Strategy.*

Council of Agriculture (2001) *National Biodiversity Action Plan,* Taipei: Council of Agriculture.

Dai B., Dowell, S.D. and Martins, R.P. and Williams R.S.R. (1998). Conservation status of the Sichuan hill-partridge *Arborophila rufipectus* in China. *Bird Conservation International* 8: 349-359.

Department of Edition in North-West University (1987). Special symposium on the researchers of nature reserves in China. *Journal of North-West University* 17: 1-158 (In Chinese, with English summary).

Department of Nature Conservation in National Environmental Protection Bureau (1989). *List of Protected Areas in China.* China Environment Science Press (In Chinese and English).

Dwyer, N. C., Bishop, M. A., Harkness, J. S., and Zhang Yao Zong. (1992). Black-necked Cranes nesting in Tibet Autonomous Region, China. *Proc. Sixth N. Am. Crane Workshop:* 75-80.

Eguchi, K., Nagata, H., Takeishi, M., Henmi, Y., and Takatsuka, M. (1991). Foraging and time budget of the Hooded Cranes in a wintering area at Yashiro, Japan. *Proc. 1987 Intl. Crane Workshop:*305-310.

Eguchi, K., Takeishi, M., and Nagata, H. (1993). Conservation of wintering Hooded Cranes in Yashiro, Japan. *J. Yamashina Inst. Ornitho.* 25:157-165.

Environment Agency (1983). *The Birds and Terrestrial Mammals in Japan.* Tokyo. Environmental Agency of Japan (1991). *The Japanese red data book* (in Japanese).

Fan, Z. and Song, L. (1997). Current status and conservation of bears in China and Chinese bear farms. Pp 5-19 in Gaski, A.l. and Williamson, D.F. (eds) *Proc. 2nd Int. Symp. On the Trade of Bear Parts*, Seattle, Washington. Traffic USA/WWF.

Fan Zhongmin, Liang Yu, Zhang Yaowen, and Jin Liankui. (1994). Distribution and conservation of cranes and wetlands in Jilin and Liaoning Provinces, Northeast China. *The Future of Cranes and Wetlands:* 136-140.

Fujita, G., Harris, J., Bold, A., Tveenmayadag, N., and Chuluunbatar, S. (1994). Habitat preference of Demoiselle and White-naped Cranes, *Anthropoides virgo* and *Grus vipio*, breeding in Mongolia. *The Future of Cranes and Wetlands:* 93-96.

Fuller, R.A., Carroll, J.P., and McGowan, P.J.K. (eds.) (2000). *Partridges, Quails, Francolins, Snowcocks, Guineafowl, and Turkeys. Status Survey and Conservation Action Plan 2000-2004.* WPA/BirdLife/SSC Partridge, Quail and Francolin Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK, and the World Pheasant Association, Reading, UK.

Gao Yu-ren (1998). Conservation status of endemic Galliformes on Hainan Island, China. *Bird Conservation International* 8: 411-416.

Geisler, C. and Hisayoshi, M. (1992). Imperiled Parks and Imperiled People: Lessons from Japan's Shiretoko National Park. *Environmental History review* 16: 23-39.

Glatston, A.R. (ed.) (1994) *The Red Panada, Olingos, Coatis, Racoons and their relatives: status survey and conservation action plan for Procyonides and Ailurids* . IUCN/SSC, Gland, Switzerland.

Government of China. (1994). *Proposal to register the first commercial captive-breeding operation for Siberian tiger.* Proposal submitted to the CITES Secretariat, Lausanne, Switzerland.

Groves, C.P. (1980). The Chinese mountain cat (Felis bieti). *Carnivore* 3(3): 35-41.

Gui Xiao Jie. (1995). Protection and habitat management for wintering cranes at Dongting Lake of the Yangtze River, China. *Cranes and Storks of the Amur River:*163-167.

Halvorson, C. and Kaliher, F. (1995). A current assessment of cranes wintering in South Korea, January-March, 1992: needs and opportunities. *Cranes and Storks of the Amur Basin:* 81-85.

Hanai, M. (1990). The status of the Japanese black bear and a few problems with its management. *Proc First E. Asiatic Bear Conf.*

Harris, J. (1992). Managing nature reserves for cranes in China. *Proc. Sixth N. Am. Crane Workshop:*1-11.

Hazumi, T. (1992). Current status and management of the Asian black bear in Japan. *WWFJ Scientific Rept.* 1: 293-333

Henwood, W.D., (1998). An overview of Protected Areas in the Temperate Grassland Biome, *Parks* 8 (no.3), 3-8.

Hong, D-G (2002). *Protected Area Conservation Policies of the Republic of Korea.* Proceedings of IUCN/WCPA – EA-4 Taipei Conference March 18-23, 2002 Taipei, Taiwan. pp 57-65.

IUCN (1993). *Nature reserves of the Himalaya and mountains of Central Asia.* IUCN, Gland, Switzerland and Cambridge, UK.

IUCN CNPPA EA (1996). *A Regional Action Plan for Protected Areas in East Asia.*

IUCN (2002). *Biodiversity Planning in Asia.* ed. J. Carew-Reid. IUCN Regional Biodiversity Programme, Asia, Colombo.

Japan Environmental Agency (1991) *Red data book of Japan: vertebrates.* Japan Wildlife Research Center, Tokyo. 331pp (in Japanese).

Jiang, Z. (1989). Nature conservation in China. *Journal of Applied Ecology* 29: 825-833.

Jo, G-H. (1997). Harmonising Development and Preservation of the Natural Parks. *Journal of the Korean Geographical Society* 32: 299-310.

Johnson, K.A and T.K. Fuller. (1992). *The leopard cat (Felis bengalensis) in China: ecology and management,for sustainable utilization.* Unpubl. project proposal.

Johnson, K.A, Yu, J.-P., Wang, Y.-X., Wang, S. and T.K. Fuller. (1993). *The leopard cat (Felis bengalensis) in China: ecology and management for sustainable utilization.* Unpubl.

King, B. (1989) Birds observed at Huang Nian Shan Mabian County, southern Sichuan, China. *Forktail* 4:63-68.

Kaliher, F. (1993). A peace park and nature reserve for Korea's DMZ? *The ICF Bugle* 19(4):3, 8.

King, B. and Liao, W. (1989). Hainan Island bird notes. *Hong Kong Bird Report* 1988: 88-101.

Kyu, K. H. and Oesting, M. R. (1981). Cranes in Korea. *Crane Research Around the World:*57-60.

Li Dehao, Zhou Zhijun, Wu Zhikang, Wang Youhui, and Li Zhumei. (1988). Studies on wintering areas and population of Black-necked Crane in China. *Acta Biologicia Plateau Sinica* 8(12):41-48. [In Chinese. English translation available through ICF].

Li Peixun, Li Fangman, and Yu Xuefeng. (1991). Selection of nesting sites and territories by White-naped Cranes in Lindian County, China. *Proc. 1987 Intl. Crane Workshop:*59-60.

Lin, X. (1990). Development of the pastoral areas of Chifeng City Prefecture. In The wool industry in China: some Chinese perspectives, ed. J. Longworth, pp. 74-92. Inkata Press, Melbourne. 52 *Seminar on the Protection and Conservation of Grasslands in East Asia.*

Li Xiangtao (1996). *The gamebirds of China: Their distribution and status.* International Academic Publishers, Beijing.

Longworth, J. and G. Williamson. (1993). China's pastoral region: sheep and wool, minority nationalities, rangeland degradation and sustainable development. CAB International, UK.

Lu Houji. (1987). Habitat availability and prospects for tigers in China. in R.L. Tilson and U.S. Seal, eds. Tigers qf the world: the biology, biopolitics, management and conservation of an endangered species. Noyes, Park Ridge, New Jersey, pp. 7l-74.

Lu Houji. and Sheng Helin. (1986). Distribution and status of the Chinese tiger. In S.D. Miller and D.D. Everett, eds. Cats of the world: biology, conservation, and management. National Wildlife Federation, Washington, D.C., pp. 5 l-58.

Lushchekina, A. A., Dulamtseren, S. Amgalan, L. and Neronov, V.M. (1999). The status and prospects for conservation of the Mongolian saiga *Saiga tatarica mongolica. Oryx* 33: 21-30

MacKinnon, J. (1989). *National conservation management plan for the giant panda and its habitat.* China Alliance Press, Hong Kong..

MacKinnon, J. (1989). *The selection of nature reserves in China.* Paper prepared for Beijing Pheasant Symposium.

MacKinnon, J., Meng S., Cheung, C., Carey, G., Zhu X. and Melville, D. (1996). *A Biodiversity Review of China.* WWF International China Programme, Hong Kong.

MacKinnon, J. and Phillipps, K. (2000). *A Field Guide to the Birds of China.* Oxford University Press, Oxford.

McGowan, P. Ding Chang-qing and Kaul, R. (1999). Protected areas and the conservation of grouse, partridges and pheasants in East Asia. *Animal Conservation* 2: 93-102

McHenry, T.J.P. (1984). *National Park Planning in Taiwan* National Park Department, Construction and Planning Administration, Ministry of Interior, Taiwan.

McNeely, J.A., Harrison, J., Dingwall, P., Eds. (1994). *Protecting Nature: regional reviews of protected areas.* IUCN, Gland Switzerland and Cambridge, UK.

Ma Y. (1991). Status and conservation of cranes in China. *Proc. 1987 Intl. Crane Workshop:* 27-33.

Mallon, D. (1985) The mammals of the Mongolian People's Republic. *Mamm. Rev* 15: 71-102

Mallon, D.P., Bold, A., Dulamtseren, S., Reading, R.P. and Amgalanbaatar, S. (1997). Mongolia In *Wild sheep and goats and their relatives. Status survey and conservation action plan for Caprinae.* IUCN, Gland, Switzerland and Cambridge, UK, pp 193-201.

Mallon, D.P. and Kingswood, S.C. (compilers) (2001). *Antelopes. Part 4: north Africa, the Middle East, and Asia. Global Survey and Regional Action Plans.* SSC Antelope Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.

Meine, Curt D. and George W. Archibald (Eds). (1996). *The cranes: - Status survey and conservation action plan.* IUCN, Gland, Switzerland, and Cambridge, U.K. 294pp. Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/distr/birds/cranes/cranes.htm.

Ministry of Culture and Sports (1995). *Mt. Soraksan Nature Reserve.* Government of Republic of Korea.

Ministry of Forestry (MoF) (1992). *National conservation project for the giant panda and its habitat.* (Synopsis in English) Ministry of Forestry Beijing, China.

Ministry for Nature and the Environment of Mongolia, (1996). *Mongolia's Wild Heritage.* MNEM/UNDP-GEF/WWF, Ulaan Baator, 42.pp.

Ministry for Nature and the Environment of Mongolia, (1998). *Biological Diversity in Mongolia.* MNEM/UNDP/Regional Bureau for Asia and the Pacific, Ulaan Baatar, 106pp.

Moehlman, P.D. (ed.) (2002). *Equids: Zebras, Asses and Horses. Status Survey and Conservation Action Plan.* IUCN/SSC Equid Specialist Group. IUCN, Gland Switzerland and Cambridge, UK.

Molloy, L. F., (2000). *Future Directions for Natural World Heritage sites in East & Southeast Asia,* pp. 33-56 in, "Regional Workshop on Nature and Biodiversity as World Heritage", Tokyo & Yakushima, Japan. Environment Agency of Japan/UNESCO/IUCN. 43 *Seminar on the Protection and Conservation of Grasslands in East Asia*

Mongolian Ministry for Nature and the Environment / World Wide Fund for Nature, (1996). *The Natural Heritage of Mongolia: the Protected Areas of Mongolia's Eastern Steppe.* Ulaan Baatar, (brochure).

Mongolia Ministry for Nature and the Environment, UNDP and WWF (1996). *Mongolia's Wild Heritage.* Avery Press, Hong Kong.

Nature Conservation Bureau (The Environment Agency) (1995). *Nature Conservation in Japan* (4th edition).

Nowell, K and Jackson, P. (compliers) (1996). *Wild Cats: status survey and conservation action plan.* IUCN, Gland, Switzerland, and Cambridge, U.K

Protected Areas Task Force/CCICED (2004). Using Protected Areas to Extend Economic Benefits to Rural China -- Evaluation of the Protected Area System of China and Policy

Recommendations for Rationlizing the System. In: XIE Yan, WANG Sung and Peter Schei (eds.) *China's Protected Areas*. Tsinghua University Press. Beijing, China, pp 271-312.

Pyong-Oh, W. (1981). *Red data book of the Republic of Korea*. Korean Association for Conservation of Nature, Republic of Korea.

Rabinowitz, A. and Lee, L.L. (1990). *A management and conservation strategy for the Tawu Mountain Nature Reserve, Taiwan, ROC* Council of Agriculture COA Forestry Series No 30.

Reading, R., Mix, H.M., Lhagvasureb, B., Feh, C., Kane, D.P., Dulamtseren, S. and Enkhbold, S. (2001). Status and distribution of Khulan (*Equus hemionus*) in Mongolia *J. Zoo. Lond.* 254: 381-389.

Reid, D. G., Hu Jinchu & Huang Yan. (1991). Ecology of the red panda, *Ailurus fulgens,* in the Wolong Reserve, China. *J. 2002. Lond.*, 225,347-364.

Saito, N. (2002). *State of Protected Areas in Japan, Challenges Faced and Current Initiatives*. Proceedings of IUCN/WCPA – EA-4 Taipei Conference March 18-23 2002 Taipei, Taiwan, pp 67-73.

Sandwith, T., Shine, C., Hamilton, L. and Sheppard D. (2001). *Transboundary Protected Areas for Peace and Cooperation*. IUCN, Gland, Switzerland and Cambridge UK.

Sang Hwe, L. (1996). Emphasis on Policies and Future Strategies for the Management of the National Parks System in Korea, in *Proceedings of the Second Conference on National Parks and Protected Areas in East Asia: Mobilising Community Support for National Parks and Protected Areas in East Asia.* Japan pp 64-76.

Schreider, A., Wirth, R., Riffel, M. and Van Rompaey H. (eds.) (1989). *Weasels, Civets, Mongooses and their Relatives: An action plan for the conservation of Mustelids and Viverrids*. IUCN, Gland, Switzerland, and Cambridge, U.K

Secretariat of the Convention on Biological Diversity (SCBD) (2004). Decisions adopted by the Conference of the Parties to the Convention on Biological Diversity at its Seventh Meeting. UNEP/CBD/COP/7/21, SCBD Montreal.

Servheen, C., Herrero, S. and Peyton, B. (compilers) (1999). *Bears. Status Survey and Conservation Action Plan.* IUCN/SSC Bear and Polar Bear Specialist Groups. IUCN, Gland, Switzerland and Cambridge, UK.

Shagdarsuren, O. (editor) (1987). *Red book of the Mongolian People's Republic.* Academy of Sciences, Ulaanbaatar (in Mongolian).

Shah, N.V. and Huibin, Z. (2000). *Status of Kiang (*Equus kiang*) in East Arjin Mountain Nature Reserve, Xinjiang Province, People's Republic of China*. Report (Dec 1999-Jan 2000), China Exploration and Research Society, Hong Kong

Sillero-Zubiri, C., Hoffmann, M. and Macdonald, D.W. (eds). (2004). *Canids: Foxes, Wolves, Jackals and Dogs. Status Survey and Conservation Action Plan*. IUCN/SSC Canid Specialist Group. Gland, Switzerland and Cambridge, UK.

Simpson, S., Tsai, H-M and Chen, C-J (1992). *Island of Diversity – Nature Conservation in Taiwan.* Council of Agriculture and Department of National Parks (Construction and Planning Administration)

Sneath, D., (1998). State Policy and Pasture Degradation in Inner Asia. *Science 281,*1147-8.

Stattersfield, A.J., Crosby, M.J., Long, A.J. and Wege, D.C. (1998). *Endemic Bird Areas of the World: Priorities for biodiversity conservation.* BirdLife Conservation Series, BirdLife International, Cambridge.

Storch, I. (compiler) (2000). *Grouse: Staus Survey and Conservation Action Plan 2000-2004.* WPA/BirdLife/IUCN SSC Grouse Specialist Group, Gland , Switzerland and Cambridge, UK.

Taiwan Forestry Bureau (1996). *Nature Reserve of National Forest.*

The Environment Agency, The Forest Agency and The Agency for Cultural Affairs (1995). *Shirakami-sanchi World Heritage Area Management Plan.*

Udvardy, M. D. F., (1984). A Biogeographical Classification System of Terrestrial Environments, in J. A. McNeely and K. R. Miller, Eds., "*National Parks, Conservation and Development*", Washington D.C., Smithsonian Institute Press.

Wang, S. (2002). *The Development and Management of Taiwan's Protected Areas.* Proceedings of IUCN/WCPA – EA-4 Taipei Conference March 18-23 2002 Taipei, Taiwan. pp 133-143.

Wemmer, C. (compiler) (1998). *Deer: status survey and conservation action plan.* IUCN/SSC Deer Specialist Group, Gland Switzerland and Cambridge, UK.

Wenhua, L. and Xianying Z. (1989). *China's nature reserves*. Foreign Languages Press, Beijing. Pp 11-16.

Xianpu, W. Huen-pu, W. (1980). Nature Conservation in China: the present situation. *Parks* 5: 1-10.

Xianpu, X. (1989). *Theory and practice of protected areas.* China Environmental Science Press (in Chinese).

Xianpu, W. (1991). *Review report on the course of protected areas in China.* Document prepared for the Palaearctic Asia Regional Review presented at the Congress on the World Parks and Protected Areas at Caracas, Venezuela, February 1992.

XIE, Yan & LI Lishu. (2004). Gap Analysis on Nature Reserve System. In: XIE Yan, WANG Sung and Peter Schei (eds.) China's Protected Areas. Tsinghua University Press. Beijing, China, pp 203-208.

Xie Yan, John MacKinnon and Li Dianmo. (2004). Study on Bio-Geographical Divisions of China, Biodiversity and Conservation, Vol.13 (7): 1391-1417.

Xuezhi, X. (1987). *Wildlife management in China.* Paper presented at International Conference on Wildlife Conservation in China, 14-19 July, Beijing, pp 153-161.

Wang, S. (1998). *China Red Data Book of Endangered Animals: Mammalia.* Science Press, Beijing.

Wang, S., Gu, J., Hu, D., Ning, L., Zhang, Y., Wang, Z., Yang, R., and Cai, G. (1997). China In D.M. Shackleton. (editor) *Wild sheep and goats and their relatives. Status survey and conservation action plan for Caprinae.* IUCN, Gland, Switzerland and Cambridge, UK, pp 148-172.

Wang, Y. (1990). The current status and distribution of the black bear in Taiwan. *Int. Conf. Bear Res. And Manage.* 8: 1-4.

Woo, B-M (1990). *Status and Management of the Protected Areas in the Republic of Korea.* FAO Regional Office for Asia and the Pacific.

Wong, F. (2002). *Report on Protected Area: Hong Kong Special Administrative Region, China* Proceedings of IUCN/WCPA – EA-4 Taipei Conference March 18-23 2002 Taipei, Taiwan, pp 17-34.

Yonzon, P. B. & Hunter, M. L. (1989). Ecology of the red panda in the Nepal-Himalaya. in *Red Panda Biology* (Ed. A. R. Glatston) SPB Academic Press, The Hague, pp. 1-7.

Yonzon, P. B. & Hunter, M. L. (1991). Conservation of the red panda, *Ailurisfulgens. Biol Conserv. 57,* 1- 11.

Yuging, W. (1987). Natural conservation regions in China. *Ambio* 16: 326-331

Zhang Fuyun. (1994). Conservation of wetlands and cranes in China. *The Future of Cranes and Wetlands in China*:130-135.

Zhang Yongzu (1997). *Distribution of mammalian species in China.* China Forestry Publishing House, Beijing.

Zheng Guangmei and Wang Qishan (1998). *China Red Data Book of Endangered Animals: Aves.* Science Press, Beijing.

Zhao Songqiao (1986). *Physical Geography of China.* Science Press

Zheng, S. (1994). *Rare and endangered animals in northwestern China.* Forestry Publishing House, Beijing (in Chinese)

Zhirnov, L. and Ilyinski, V. (1986). *The Great Gobi National Park: a refuge for rare animals of the Central Asian deserts.* Centre for Int Projects, GKNT, Moscow

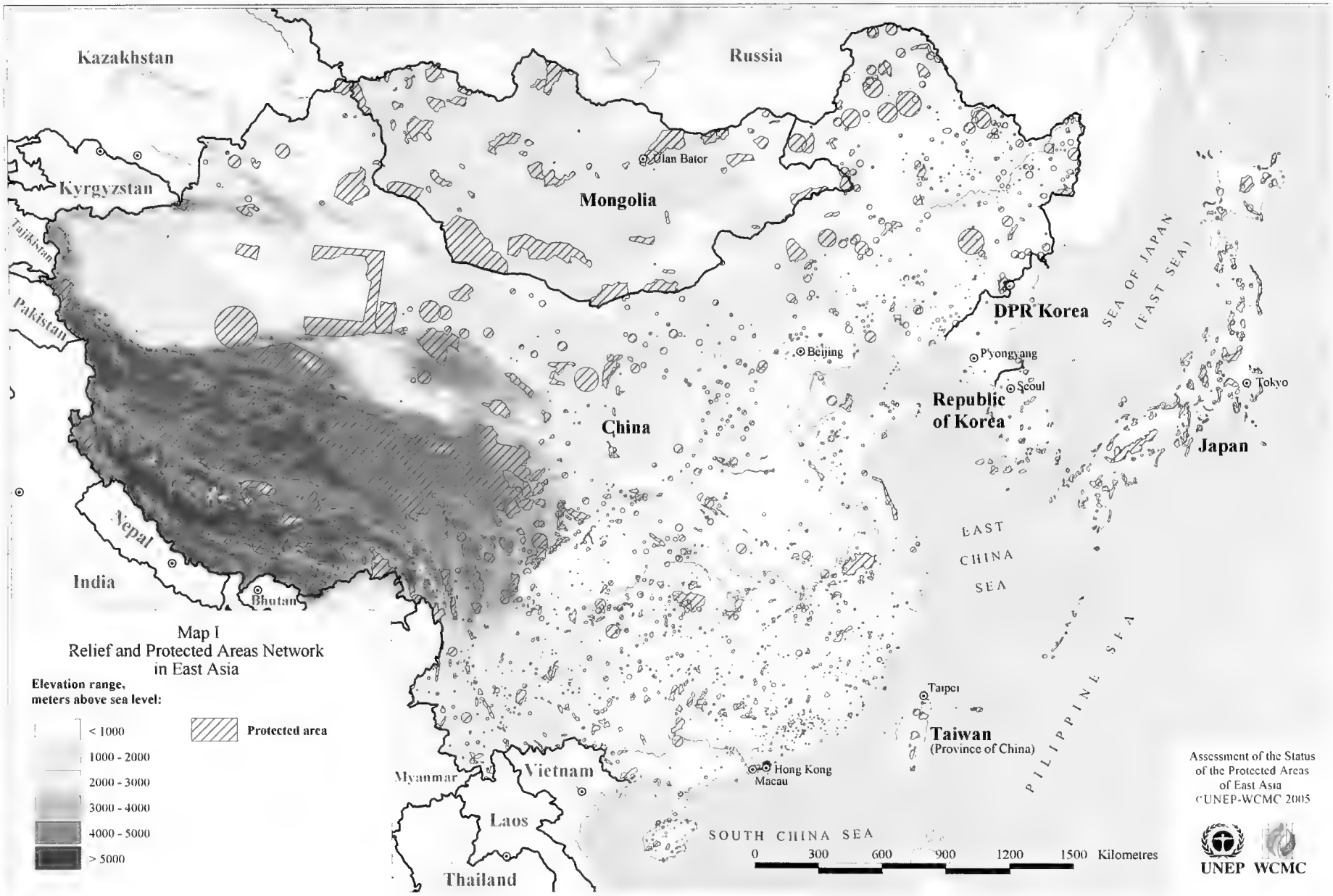
Zhou, L. (1990). Economic development in China's pastoral regions: problems and solutions. In *The wool industry in China: some Chinese perspectives*, ed. J. Longworth, pp. 43-56. Inkata Press, Melbourne. Li, Y., Y. Yan, S. Yong, and Z. Chen. 1995. Xilingol Grassland Reserve: role of scientific research in linking nature conservation with local development.

China's Biosphere Reserves - special English issue. Chinese National Committee for Man and the Biosphere Program, Beijing.

Zhu Jing (1989). Nature conservation in China. *Journal of Applied Ecology* 26: 325-333.S

Zhu Jiang et al (1985). Programme for establishing a nature reserves network in China. *Proceedings of the Symposium on Nature Reserves in China*, China Forestry Press, Beijing, pp 7-39 (in Chinese).

Annex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Seoul
Republic of Korea
Tokyo
China
Japan
Nepal
India
Bhutan
EAST CHINA SEA
PHILIPPINE SEA
Taipei
Taiwan (Province of China)
Hong Kong
Macau
Myanmar
Vietnam
Laos
Thailand
SOUTH CHINA SEA
0 300 600 900 1200 1500 Kilometres
Map I
Relief and Protected Areas Network in East Asia
Elevation range, meters above sea level:
< 1000
1000 - 2000
2000 - 3000
3000 - 4000
4000 - 5000
> 5000
Protected area
Assessment of the Status of the Protected Areas of East Asia ©UNEP-WCMC 2005
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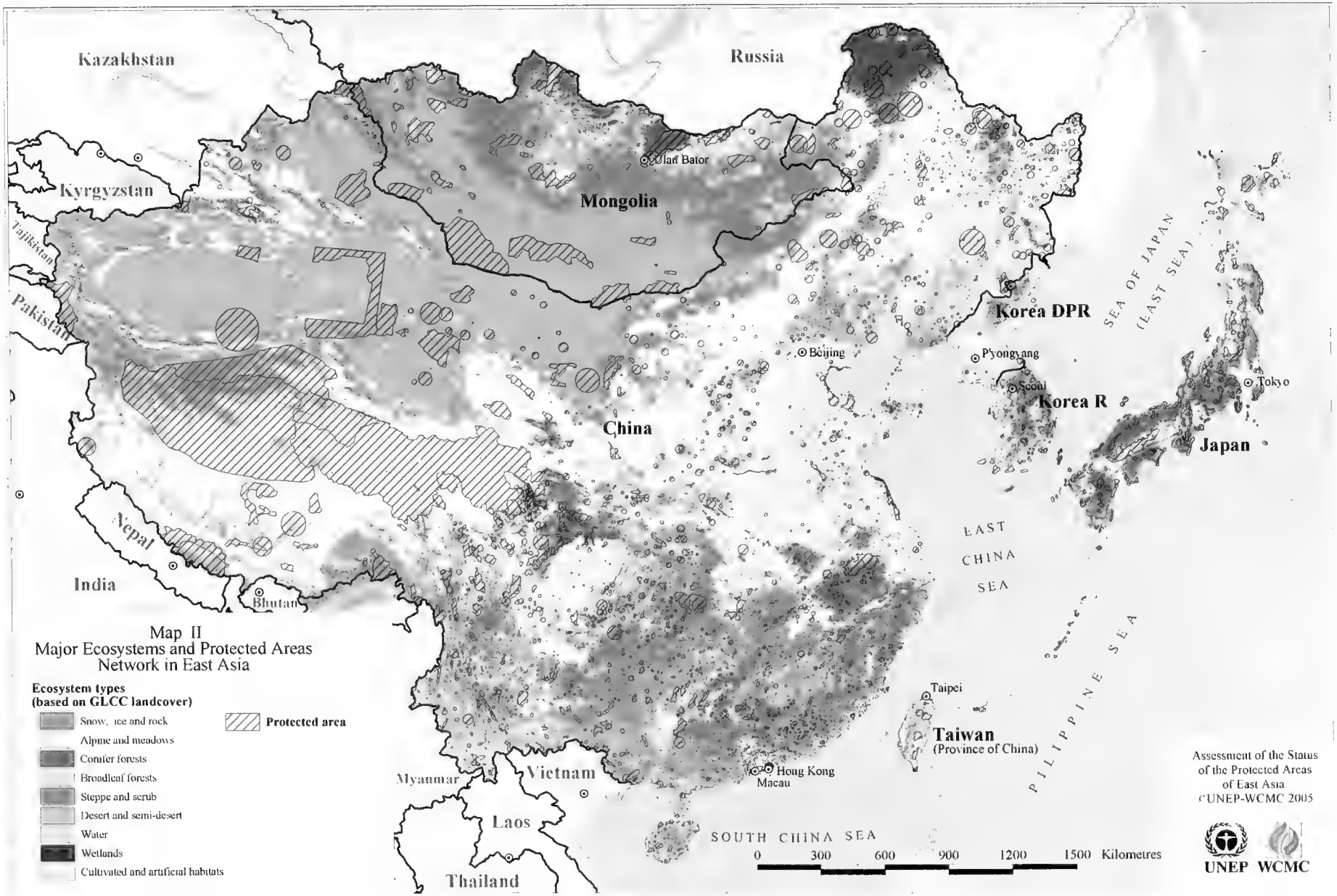
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Japan
Nepal
India
Bhutan
EAST CHINA SEA
Taipei
Taiwan
(Province of China)
PHILIPPINE SEA
Myanmar
Vietnam
Hong Kong
Macau
Laos
Thailand
SOUTH CHINA SEA
0 300 600 900 1200 1500 Kilometres
Map II
Major Ecosystems and Protected Areas Network in East Asia
Ecosystem types
(based on GLCC landcover)
Snow, ice and rock
Alpine and meadows
Conifer forests
Broadleaf forests
Steppe and scrub
Desert and semi-desert
Water
Wetlands
Cultivated and artificial habitats
Protected area
Assessment of the Status of the Protected Areas of East Asia
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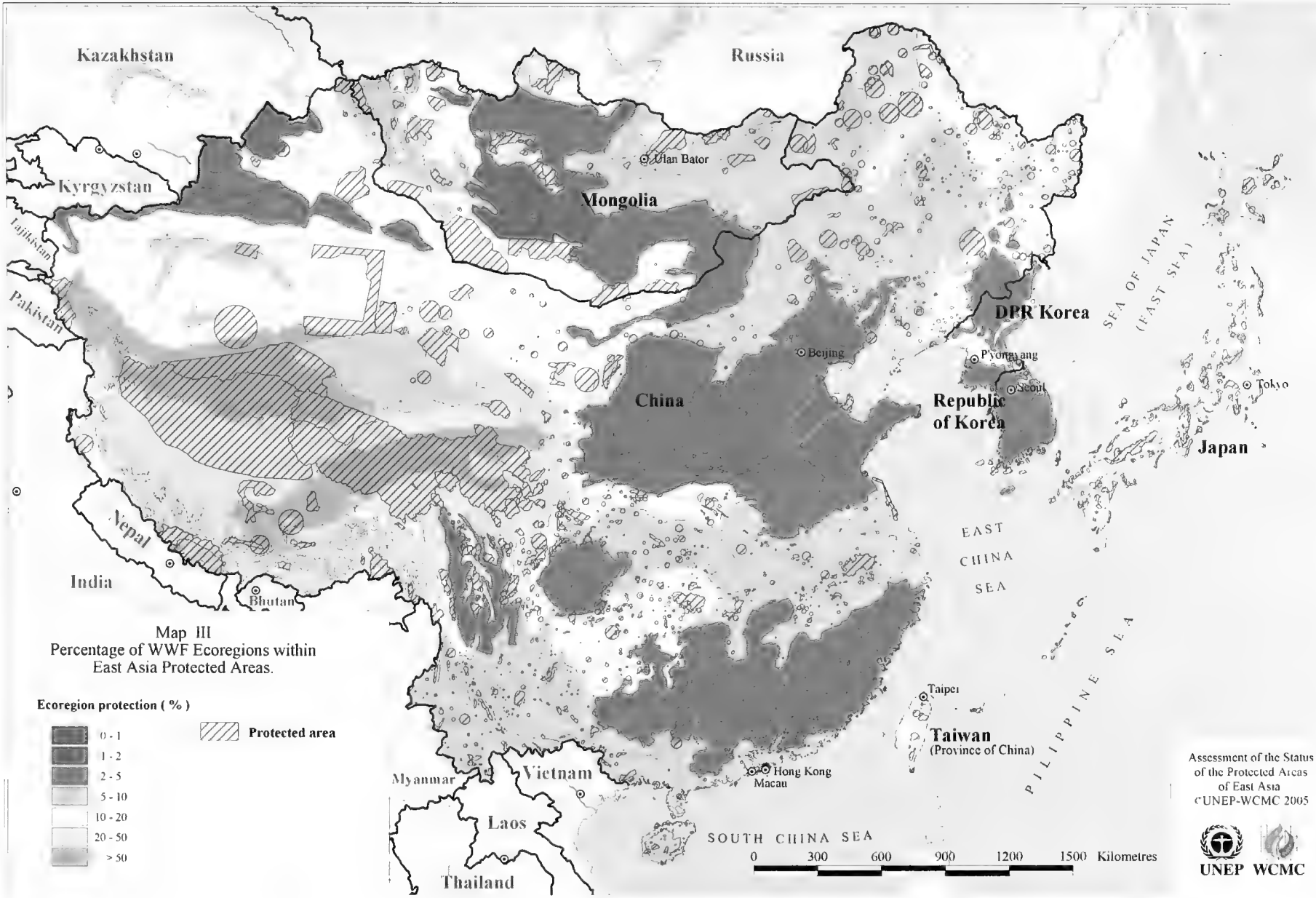
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Russia
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SEA OF JAPAN (EAST SEA)
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Seoul
Tokyo
China
Republic of Korea
Japan
Nepal
India
Bhutan
EAST CHINA SEA
PHILIPPINE SEA
Taipei
Taiwan
(Province of China)
Hong Kong
Macau
Myanmar
Vietnam
Laos
Thailand
SOUTH CHINA SEA
0 300 600 900 1200 1500 Kilometres
Map III
Percentage of WWF Ecoregions within
East Asia Protected Areas.
Ecoregion protection (%)
0 - 1
1 - 2
2 - 5
5 - 10
10 - 20
20 - 50
> 50
Protected area
Assessment of the Status
of the Protected Areas
of East Asia
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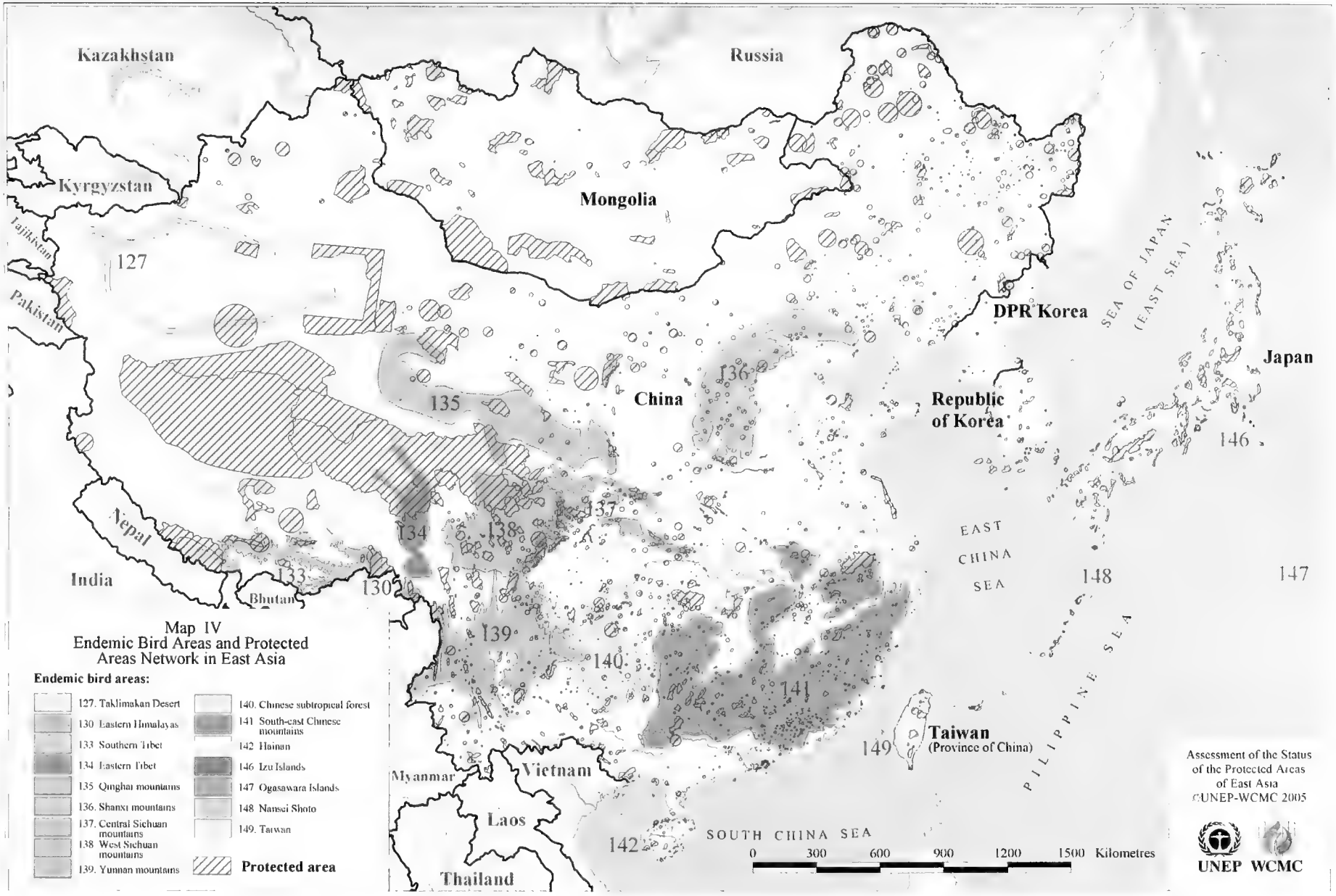
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Russia
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Mongolia
Tajikistan
Pakistan
127
DPR Korea
SEA OF JAPAN (EAST SEA)
Japan
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Republic of Korea
146
Nepal
India
134
138
137
EAST CHINA SEA
148
147
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Bhutan
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140
141
Taiwan
(Province of China)
149
PHILIPPINE SEA
Myanmar
Vietnam
Laos
142
SOUTH CHINA SEA
Thailand
0 300 600 900 1200 1500 Kilometres
Map IV
Endemic Bird Areas and Protected Areas Network in East Asia
Endemic bird areas:
127. Taklimakan Desert
130 Eastern Himalayas
133 Southern Tibet
134 Eastern Tibet
135 Qinghai mountains
136. Shanxi mountains
137. Central Sichuan mountains
138 West Sichuan mountains
139. Yunnan mountains
140. Chinese subtropical forest
141 South-east Chinese mountains
142 Hainan
146 Izu Islands
147 Ogasawara Islands
148 Nansei Shoto
149. Taiwan
Protected area
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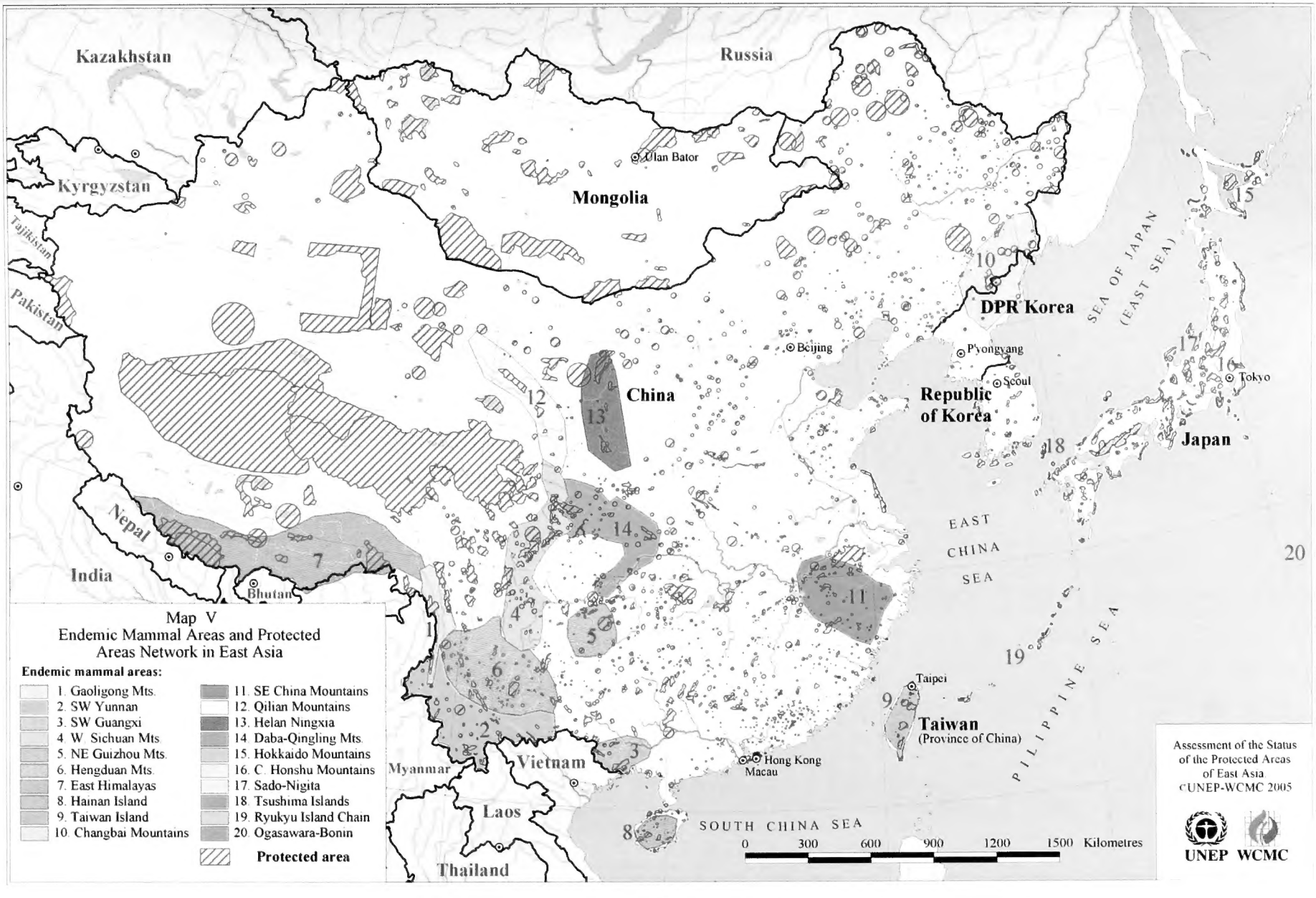
Kazakhstan
Russia
Kyrgyzstan
Mongolia
Ulan Bator
Tajikistan
Pakistan
Beijing
DPR Korea
Pyongyang
SEA OF JAPAN (EAST SEA)
Seoul
Republic of Korea
China
Tokyo
Japan
Nepal
India
Bhutan
EAST CHINA SEA
Taipei
Taiwan (Province of China)
PHILIPPINE SEA
Hong Kong
Macau
Myanmar
Vietnam
Laos
Thailand
SOUTH CHINA SEA
0 300 600 900 1200 1500 Kilometres
Map V
Endemic Mammal Areas and Protected Areas Network in East Asia
Endemic mammal areas:
1. Gaoligong Mts.
2. SW Yunnan
3. SW Guangxi
4. W. Sichuan Mts.
5. NE Guizhou Mts.
6. Hengduan Mts.
7. East Himalayas
8. Hainan Island
9. Taiwan Island
10. Changbai Mountains
11. SE China Mountains
12. Qilian Mountains
13. Helan Ningxia
14. Daba-Qingling Mts.
15. Hokkaido Mountains
16. C. Honshu Mountains
17. Sado-Nigita
18. Tsushima Islands
19. Ryukyu Island Chain
20. Ogasawara-Bonin
Protected area
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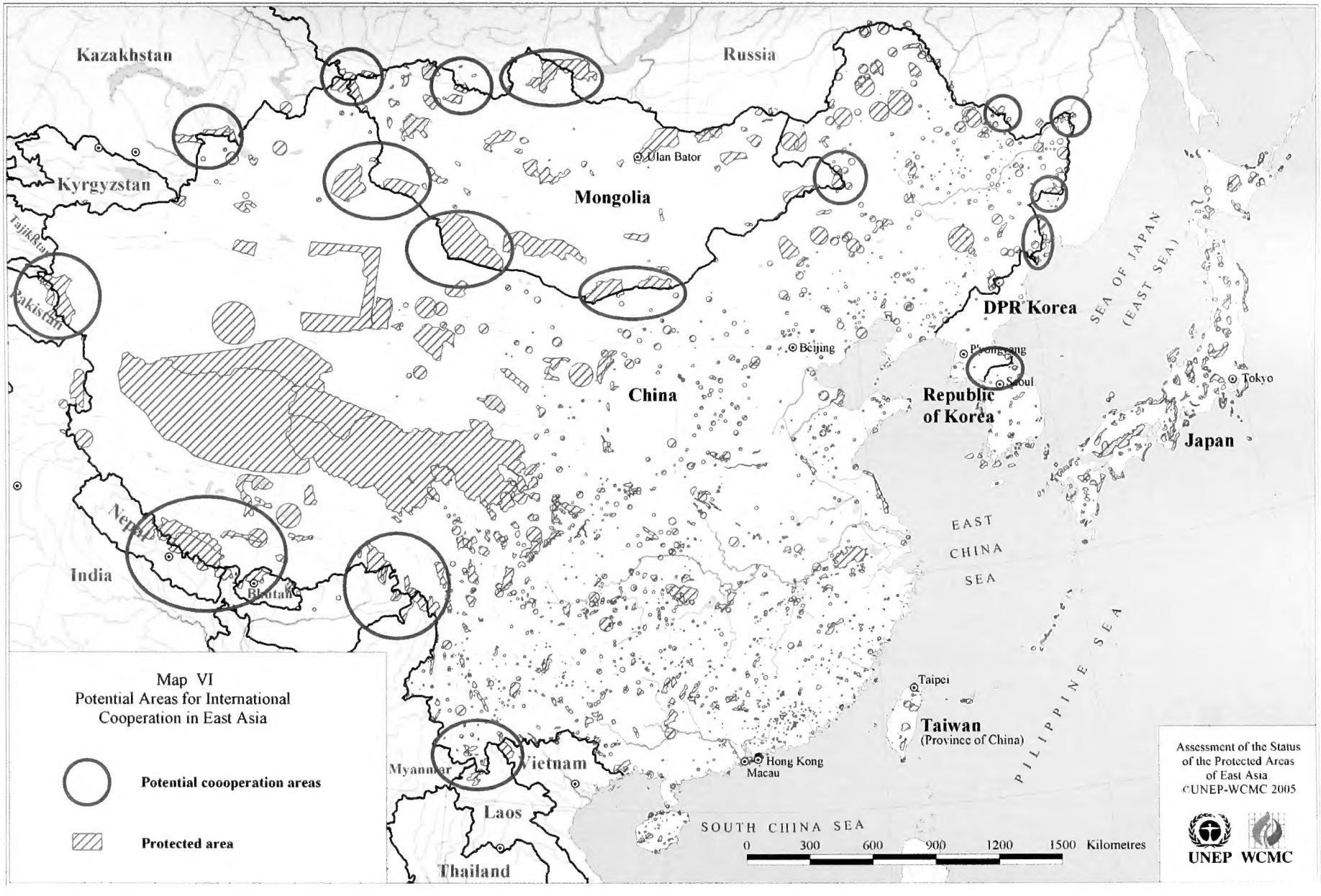
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(Province of China)
PHILIPPINE SEA
Myanmar
Vietnam
Hong Kong
Macau
Laos
SOUTH CHINA SEA
Thailand
0 300 600 900 1200 1500 Kilometres
Map VI
Potential Areas for International Cooperation in East Asia
Potential coooperation areas
Protected area
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