Part Two

Overview of Bhutan

Country-wide Characteristics

Physical features

Bhutan is a mountainous and landlocked Himalayan country situated between latitude 26°40' and 28°15'N and longitude 88°45' and 92°10'E. It borders the Tibet Autonomous Region of China to the north and the Indian states of Assam, West Bengal, Arunachal Pradesh and Sikkim to the south (Map 1). The country spans about 300 km from east to west and 170 km from north to south with a total land area of 40,973 sq.km* (Source: RNR Census 2000). The terrain is highly rugged and steep with very little flat area for productive agricultural farming. Elevation throughout the country ranges from less than 100 masl (in the south) to above 7000 masl in the north (Map 2).

The country can be divided into three distinct physiographic regions on the basis of altitude and corresponding rainfall and temperature. The southern foothills range in altitude from less than 100m to about 2000 masl and comprise the Siwalik Hills together with a narrow band of flat plains along the Indian border. The inner Himalayas make up the main river valleys and steep hills and rise in elevation from about 2000 to 4000m. The great Himalayas to the north along the Tibetan border consist of snow capped peaks and alpine rangelands above around 4000m (Map 3).

For administrative purposes, Bhutan is divided into twenty districts called dzongkhags, which are further subdivided into 202 sub-districts or blocks called geogs. The district and block boundaries are shown in Map 4.

Climate

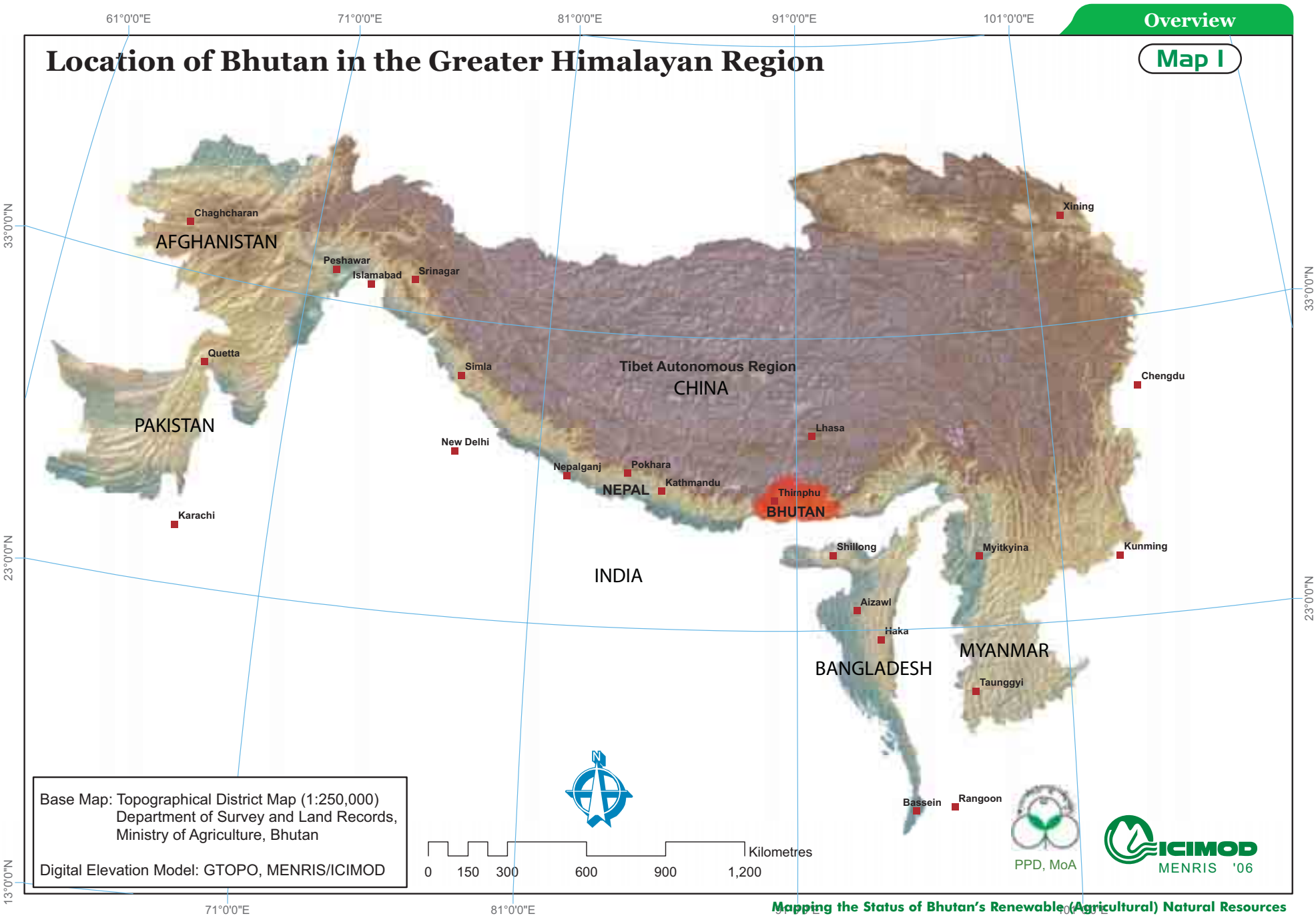
The large variation in elevation gives rise to a wide range of climatic conditions: from hot and humid subtropical in the low-lying south, to tundra with perpetual snow and ice conditions in the great Himalayan zone in the north. This is further modified by latitude, rainfall, slope gradient and exposure to sunlight and wind, to give each valley (and often even opposite facing slopes of a valley) a unique set of weather conditions. The south-west monsoon (which lasts from mid-June to September) is a dominant factor and accounts for 60-90% of the annual precipitation. The annual precipitation varies widely in different parts of the country. The high Himalayan region in the north receives only about forty millimetres of precipitation annually, primarily in the form of snow. The temperate central regions receive a yearly average of about 1,000 millimetres of rain, and in the subtropical south, plentiful precipitation (as much as 7,800 millimetres per year in some areas) gives rise to thick tropical forests.

Average daily temperatures in the sub-tropical foothills range from 15°-30°C. At elevations above about 1500m, the climate is cold and misty for much of the year as clouds move into the inner valleys. In the inner valleys, where the climate is temperate, the seasons are distinct; in Paro (2300m), for example, the temperature varies from 5°C in January to 25°C in July. Above 3500m, there is less recorded data on rainfall and temperature and the commonly used estimate of average daily temperature is 5°C. With increasing altitude the climate becomes more severe and is marked by short cool and wet summers and long cold winters.

* Current official figure (as of 2006) is 38,394 sq.km.

Location of Bhutan in the Greater Himalayan Region

Map I



Overview

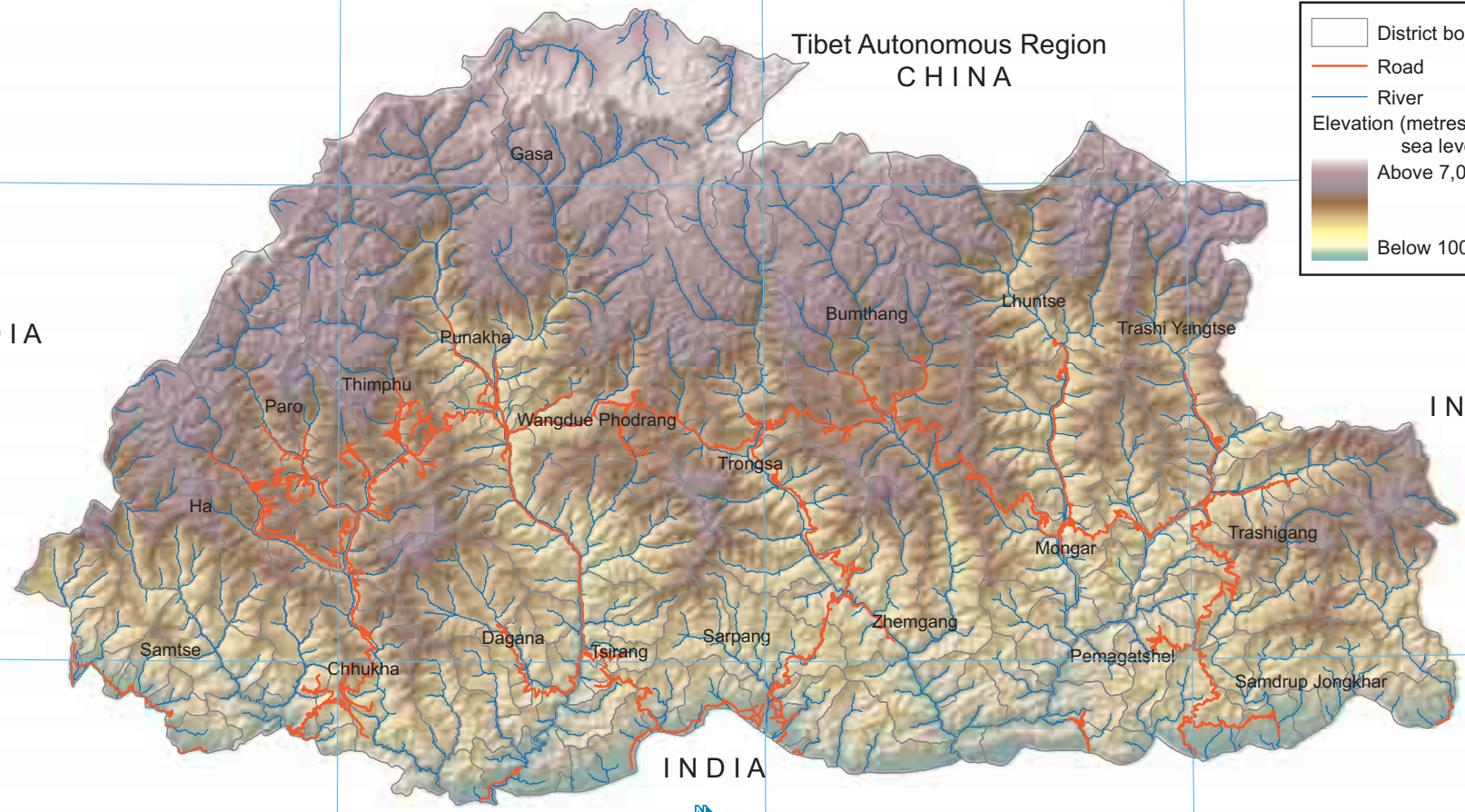
Map 2

Elevation Map of Bhutan

89°0'0"E 90°0'0"E 91°0'0"E 92°0'0"E

28°0'0"N

27°0'0"N



LEGEND

- District boundary
- Road
- River

Elevation (metres above sea level)

Above 7,000

Below 100

Base Map: Topographical District Map (1:250,000)
Department of Survey and Land Records,
Ministry of Agriculture, Bhutan

Digital Elevation Model: SRTM, MENRIS/ICIMOD

N

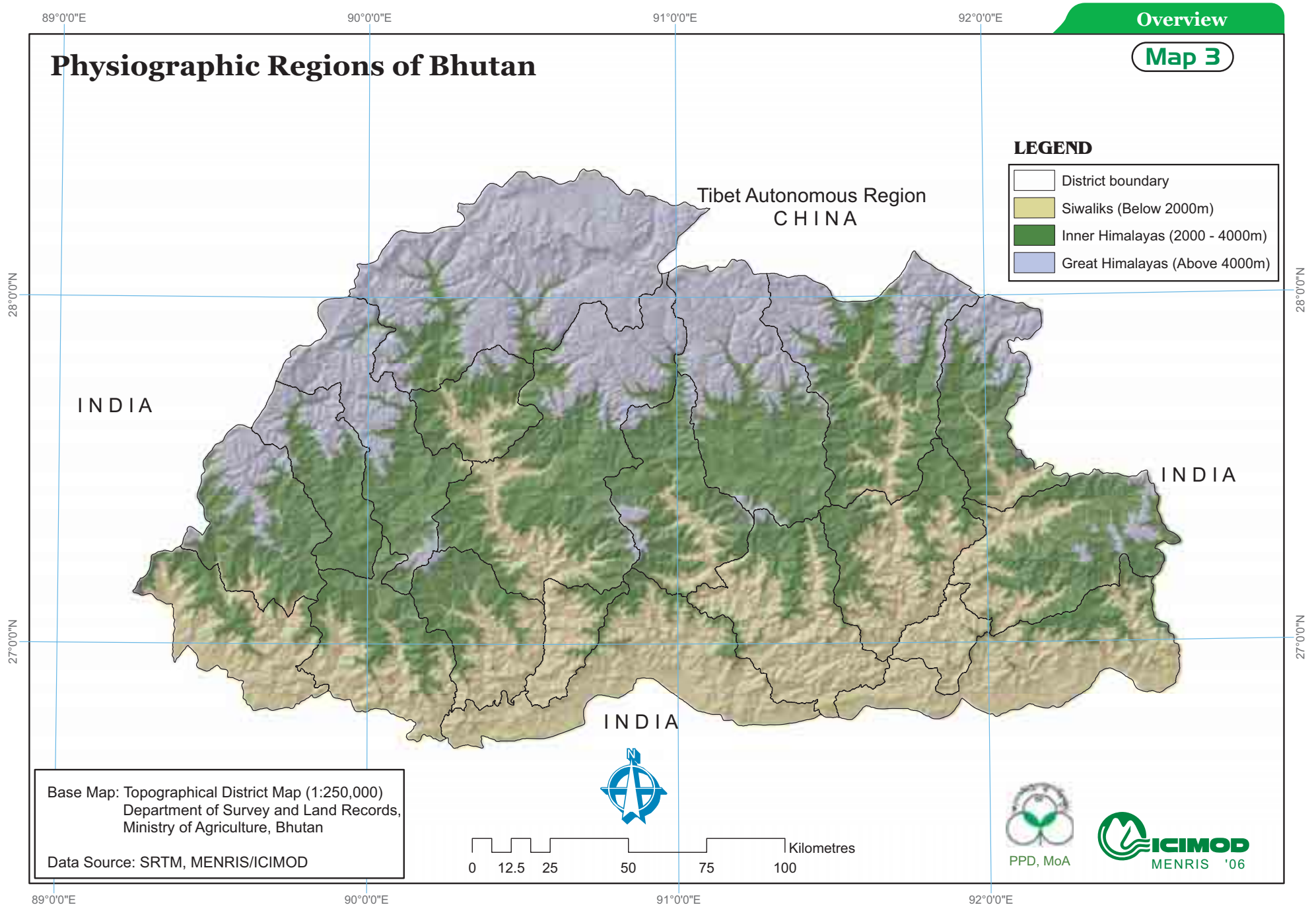
0 12.5 25 50 75 100 Kilometres

PPD, MoA

ICIMOD
MENRIS '06

Physiographic Regions of Bhutan

Map 3



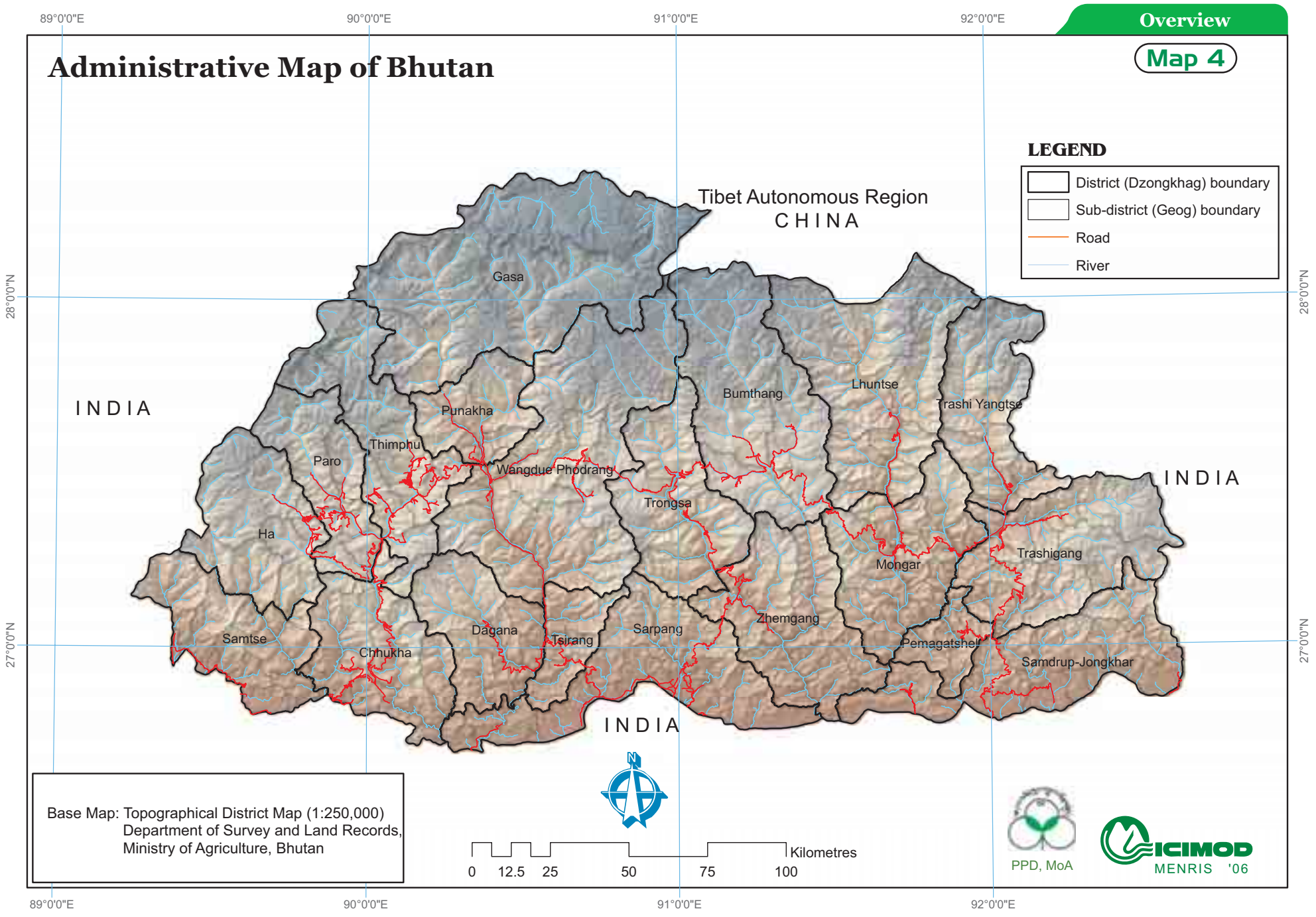
Base Map: Topographical District Map (1:250,000)
Department of Survey and Land Records,
Ministry of Agriculture, Bhutan

Data Source: SRTM, MENRIS/ICIMOD

Overview

Map 4

Administrative Map of Bhutan



Agro-ecological zones

MoA/ISNAR (1992) has proposed dividing Bhutan into six agro-ecological zones (AEZ) based mainly on altitude as shown in Table 2.1 and Map 5. These AEZ divisions are used to define the country's eco-floristic zones and agricultural ecosystems; each zone has a more or less distinct vegetation cover and agricultural practices. The AEZ divisions are alpine, cool temperate, warm temperate, dry sub-tropical, humid sub-tropical and wet sub-tropical. They do not correlate directly with the division into physiographic regions (the Southern Foothills, Inner Himalayas, and High Himalayas) although the division is similar. While such classifications work well in theory there are a number of difficulties in trying to use them in practice. The difficulties arise mainly because the terrain can vary greatly in elevation over very short distances so that it is common to find several agro-ecological zones within a few kilometres of each other in the same district.

Table 2.1: Agro-ecological Zones of Bhutan

Agro-ecological Zone	Altitude Range (masl approx.)	Annual Rainfall (mm approx.)	Air Temperature (°C)		
			Max	Min	Mean
Alpine	3600-4600	< 650	12.0	-0.9	5.5
Cool Temperate	2600-3600	650-850	22.3	0.1	9.9
Warm Temperate	1800-2600	650-850	26.3	0.1	12.5
Dry Sub-tropical	1200-1800	850-1200	28.7	3.1	17.2
Humid Sub-tropical	600 - 1200	1200-2500	33.0	4.6	19.5
Wet Sub-tropical	150-600	2500-5500	34.6	11.6	23.6

Source: MoA/ISNAR 1992

Vegetation

The wide variations in macro and micro-climatic conditions as a result of altitude, the number of hours of sunlight, and levels of precipitation, have resulted in the existence of a great diversity of vegetation within a limited geographic area. The southern foothills are mostly covered by dense forests of deciduous trees while the inner regions enjoy an almost endless variety of plants, flowers and trees. The fertile valleys of these inner regions are home to such varieties as birch, pine, chestnut, oak, apple, peach, and plum. The northern part, which is mostly tundra, can support flora such as coniferous trees and other alpine species such as magnolia, rhododendrons, birch, fir, and spruce (Table 2.2).

Table 2.2: Types of Vegetation

Agro-ecological Zone	Types of Vegetation		Agro-ecological Zone	Types of Vegetation	
	Common Name	Scientific Name		Common Name	Scientific Name
Wet Sub-Tropical	Sisso	*Dalbergia sissoo,*	Warm Temperate	Oaks	*Quercus semicarpifolia, Q. lanata, Q. grifithii*
	Khair	*Acacia catechu*		Blue pine	*Pinus wallichiana*
	Sal	*Shorea robusta*		Spruce	*Picea spinulosa*
	Sua grass	*Pollinia ciliata*		Bamboo	*Bambusa arundiacea*
Humid Sub-Tropical	Alnus	*Alnus nepalensis*		Rhododendron	*Rhododendron arboreum*
	Walnut	*Juglans regia*	Cool Temperate	Fir	*Albies densa*
	Magnolia	*Magnolia campbellii*		Juniper	*Juniperus recurva*
	Maple	*Acer cappadocicum*		Hemlock	*Tsuga dumosa*
	Rhododendron	*Rhododendron arboreum*		Larch	*Larix griffithiana*
				Birch	*Betula utilis, B. alnoides*

Source: Gyamtsho 1996 (citing Grierson and Long 1983, 1994)

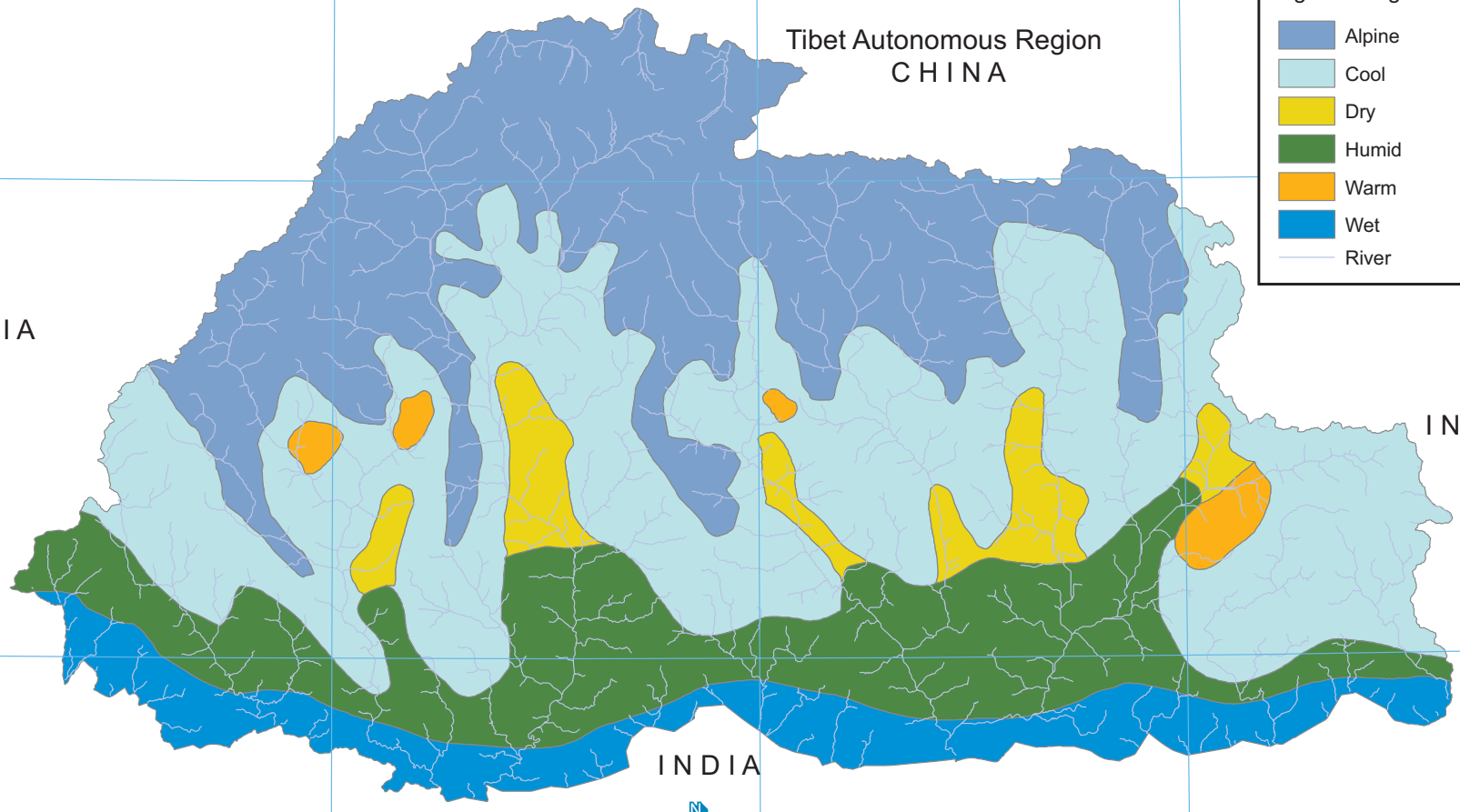
Agro-ecological Zones of Bhutan

Map 5

89°0'0"E 90°0'0"E 91°0'0"E 92°0'0"E

28°0'0"N

27°0'0"N



LEGEND

Agro-ecological Zone

- Alpine
- Cool
- Dry
- Humid
- Warm
- Wet
- River

N

0 12.5 25 50 75 Kilometres

Base Map: Topographical District Map (1:250,000)
Department of Survey and Land Records,
Ministry of Agriculture, Bhutan

Data Source: LUPP 1995

PPD, MoA

ICIMOD
MENRIS '06

Land use and land cover

The last detailed survey of land use and land cover in Bhutan was carried out by the Land Use Planning Project in 1994 and was based on data from satellite images plus field verification (LUPP 1995). This survey showed that about 72% of Bhutan's total land area was forested of which 8% was scrub and the actual tree covered area about 64%. Much of Bhutan's forests are found on steep hillsides where they are relatively inaccessible for commercial exploitation and where there is a danger that tampering with the forest cover can have serious environmental implications. Arable agriculture land accounts for only about 8% of the total land area and this number is probably close to the maximum area suitable for cultivation. About 4% of the land is natural pasture; however, this does not reflect the total areas actually used as pasture since both forests, scrub forests and agricultural fallows are used for grazing at one time or other. The remaining 16% includes permanent snow covered areas, marshland, rocky outcrops, open eroded areas and landslides (Table 2.3 and Map 6).

The agricultural land mainly consists of chushing or wetland (terraced areas which are irrigated to grow crops), kamshing or dryland (sloping agricultural land that has not been modified into terraces where crops are grown mainly without irrigation), orchard, and shifting cultivation land (tseri). Paddy is the main crop cultivated on chushing, while kamshing is used to grow a variety of crops including maize, wheat, barley, buckwheat, millet, and vegetables. Shifting cultivation has decreased considerably during the last few years and is gradually giving way to sedentary cultivation.

Table 2.3: Land Use and Land Cover, 1994

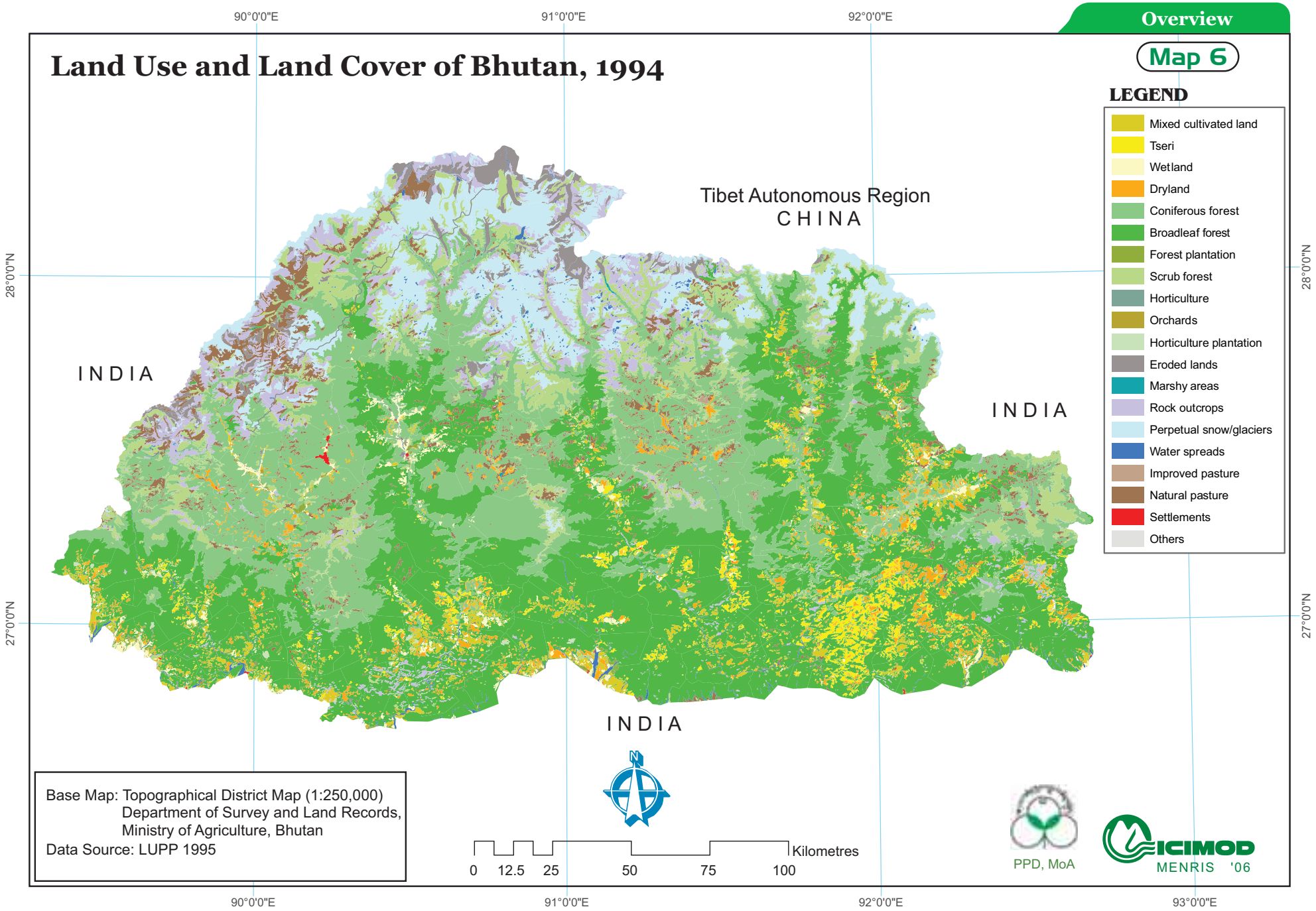
Land Use/Cover	Area (ha)	Percentage	
Total Forest	**2,904,521**		**72.5**
Coniferous forest	1,061,621	26.5	
Broadleaf forest	1,510,661	37.7	
Plantation	6,427	0.2	
Scrub	325,812	8.1	
Total Pasture	**156,441**		**3.9**
Natural pasture	155,346	3.9	
Improved pasture	1,095	0	
Total Agricultural Land	**308,844**		**7.7**
Chushing[a] (irrigated terraces)	38,761	1	
Kamshing (non-irrigated sloping land)	97,724	2.4	
Tseri (shifting cultivation)	88,332	2.2	
Mixed agriculture[b]	84,027	2.1	
Total Orchards	**5,788**		**0.1**
Orchards	2,222	0.1	
Plantations	3,566	0.1	
Settlements	**3,128**		**0.1**
Total Others	**628,949**		**15.7**
Perpetual snow	298,860	7.5	
Rocky outcrop	200,754	5	
Water bodies	30,376	0.8	
Marshland	3,528	0.1	
Landslips/eroded areas	95,431	2.4	
Total Land	**4,007,671[c]**		**100**

Source: LUPP 1995
[a] includes insignificant amount of non-irrigated terraces
[b] a type of land use in which wetland, dryland, orchard, and kitchen garden are adjacent
[c] value differs slightly from official value for land area

Overview

Map 6

Land Use and Land Cover of Bhutan, 1994



Base Map: Topographical District Map (1:250,000)
Department of Survey and Land Records,
Ministry of Agriculture, Bhutan
Data Source: LUPP 1995

PPD, MoA

ICIMOD
MENRIS '06

National protected areas and biological corridors

The RGoB policy is to maintain at least 60% of the total land area of Bhutan under forest cover for the foreseeable future. Accordingly, conservation of the natural environment is given priority over the extraction and utilisation of natural resources for economic gain. However, in a country with a growing population, there is now increased demand on forest areas as the need for agricultural land and settlements increases. The government has responded by adopting policies aimed at protecting representative samples of remaining pristine Himalayan ecosystems, including the establishment of protected areas for the conservation of biodiversity and genetic resources. The national protected area system was established in 1993 and comprises four national parks, four wildlife sanctuaries, and one strict nature reserve (Table 2.4, Map 7). Protected areas now account for about 10,513 km^2 (26.2%) of the country's total land area. In 1999, a further 3804 km^2 was declared to be a 'biological corridor' intended to link the protected areas and to allow the free movement of wildlife between them. While these biological corridors are not strictly protected areas, they are intended to have only low intensity land use such as forest management units, community forests, agricultural land, and riparian corridors.

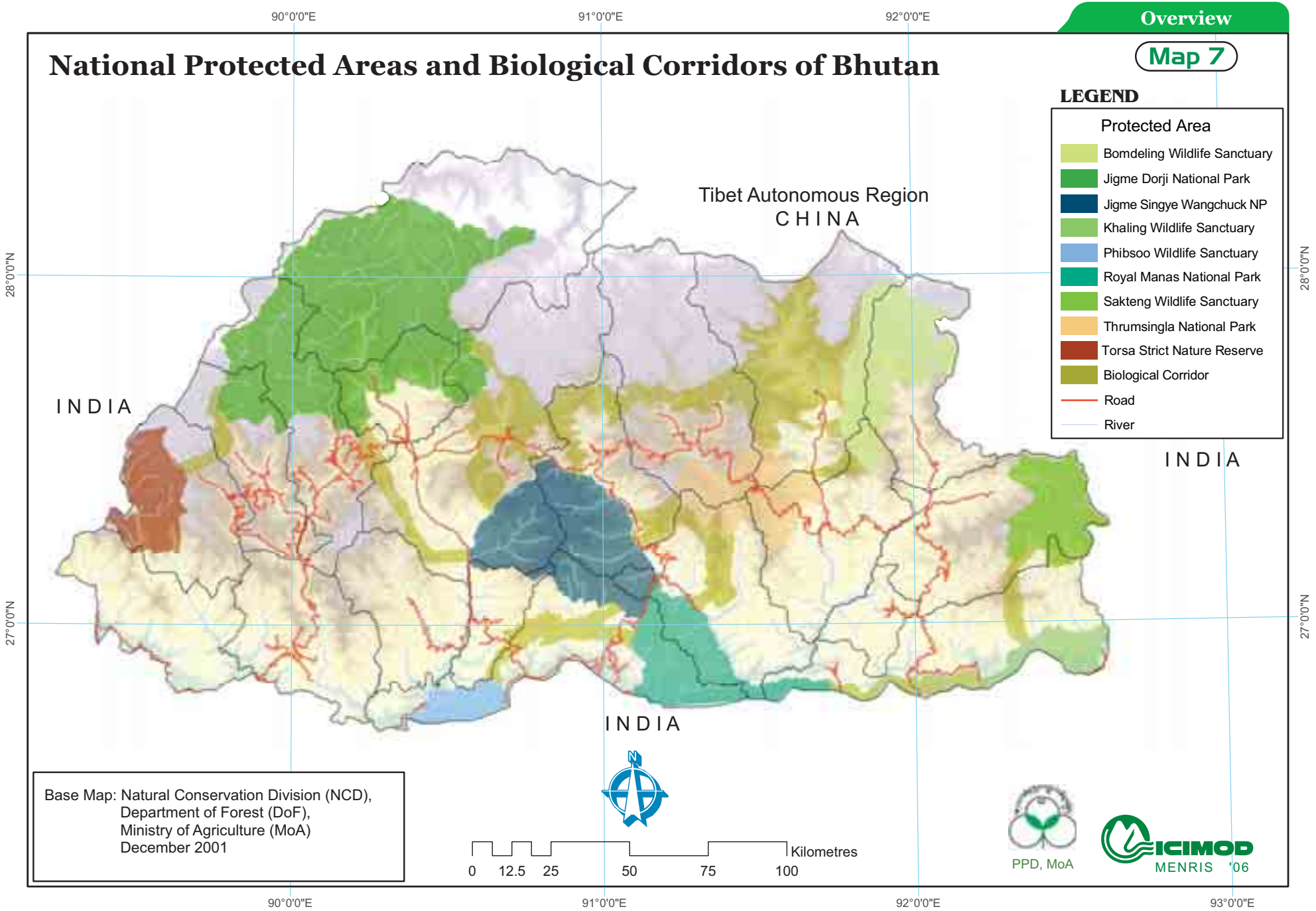
Table 2.4: Protected Areas

Name	Area (km^2)	Ecosystem Represented	Districts	Recorded species of Flora and Fauna	Status
Bomdeling Wildlife Sanctuary	1,300	Upland broadleaf forest, winter roosting area of migratory black-necked cranes	Trashi Yangtse, Lhuntse and Mongar	Mammals: na Birds : >290 Flora : >450	Fully operational
Jigme Dorji National Park	4,200	Habitat for takin, snow leopard, blue sheep, Chinese caterpillar, yarcha gunbu (*Cordyceps sinensis*), and rare alpine plant species	Gasa, Punakha, Thimphu and Paro	Mammals: >30 Birds : 300 Flora : 1400	Fully operational
Jigme Singye Wangchuk National Park	1,400	Pristine upland broadleaf forest, habitat for clouded leopard	Zhemgang, Tsirang, Trongsa, Sarpang and Wangdue	Mammals: >50 Birds : 395 Flora : na	Fully operational
Khaling Wildlife Sanctuary	273	Habitat of the pygmy hog	Samdrup Jongkhar	na	Notified by the RGOB in 1993
Phibsoo Wildlife Sanctuary	278	Country's only natural sal forest and also the habitat of the spotted deer	Sarpang	na	Operational plan under implementation
Royal Manas National Park	1,000	Prime subtropical forest; habitat for elephants, tigers, leopards, and golden langur (endemic)	Zhemgang and Sarpang	Mammals: 45 Birds : 366 Flora : >900 Herpeto-fauna: 28	Fully operational
Sakteng Wildlife Sanctuary	650	Pristine mixed coniferous forest; the highest number of rhododendron species are found here	Trashigang	na	Fully operational
Thrumsingla National Park	768	Old growth fir forest; prime habitat for the red panda, the satyr tragopan, and the monal pheasant	Bumthang, Mongar, Zhemgang and Lhuntse	Mammals: 68 Birds : 341 Flora : 7600	Fully operational
Torsa Strict Nature Reserve	644	Pristine temperate forest	Ha and Samtse	na	Notified by the Royal Government of Bhutan in 1993
Total Area	**10,513**				
Biological Corridors	3,800	Connect all protected areas			
Total Area	**14,313**	**About 35% of the total area of the country**			

Source: DFS 2003; ICS/MoA 2005 na = not available

National Protected Areas and Biological Corridors of Bhutan

Map 7



Base Map: Natural Conservation Division (NCD),
Department of Forest (DoF),
Ministry of Agriculture (MoA)
December 2001

PPD, MoA

ICIMOD
MENRIS '06

The Economy

Agriculture and related activities continue to dominate Bhutan's economy. Current estimates show that about 79% of the population depends on agriculture. In 2003, the agriculture (RNR) sector contributed about 33% of GDP (total value Nu 10,595 million or approximately US$ 225 million) of which, crop production contributed 16%, livestock production 6%, and forestry and logging 11% (Table 2.5). Among the sectors, the contribution of the construction industry to the GDP has increased steadily from about 13% in 2000 to about 20% in 2003, which can be attributed to the government's emphasis on infrastructure development and the demand for housing. Despite the commissioning of new hydropower plants, the proportional contribution of the electricity and gas sector to the GDP has decreased slightly from 11.3% in 2000 to 9.6% in 2003. The GDP real growth rate in 2003 was 6.5%, with an inflation rate of 1.6%. Based on preliminary projections, real GDP is expected to grow by 7 to 9% per annum, and the average annual rate of growth by 8.2%, during the 9th Plan (2002-2007) period. The national currency is the 'ngultrum', which is pegged at par with the Indian rupee. Overall, the Bhutanese economy is closely interlinked with the Indian economy; India is Bhutan's main trading and development partner and provides the major share of its development assistance.

National development vision and policy

Bhutan's Vision 2020 document states that, "in our system of priorities for the future there is one priority that stands above all others: it is the need to ensure the future independence, sovereignty and security of our nation-state".

In keeping with this clear national priority, the important policy objectives include:

- human development – by addressing the need to improve standards of living, quality of life, and levels of well-being;
- welfare, culture, and heritage – promoting awareness and appreciation of the country's rich cultural heritage which is vital to Bhutan's unique identity, and interpreting traditional values in dynamic and development-oriented ways;
- balanced and equitable development – which requires special measures to support disadvantaged and vulnerable groups and ensure that development is regionally balanced;
- governance – for further development of institutions, human resources, and the system of governance; and
- environmentally sustainable development – the need for environmental conservation and environmentally sound development

Table 2.5: Sectoral Contributions to GDP 2003

Sector	% Contribution to GDP	
Renewable natural resources		32.7
Agriculture (crops)	*16.1*	
Livestock production	*6.2*	
Forestry and logging	*10.5*	
Mining and quarrying		1.9
Manufacturing		7.6
Electricity and gas		9.6
Construction		19.9
Trade and commerce		5.5
Transport and communication		8.6
Finance, insurance and real estate		6.5
Community, social and personal services		9.9

Source: NSB 2003

Renewable natural resources (RNR) development in Bhutan

As a result of the high priority placed by the government on the agricultural (RNR) sector, the rural economy has been transformed from a purely subsistence to a vibrant semi-subsistence cash economy. Despite the rapid growth in the hydropower and manufacturing sectors, agriculture (including livestock and forestry) remains the single biggest contributor to GDP, providing 33% of the total (Table 2.5). The proportion of the RNR contribution provided by agricultural crop production, livestock, and forestry over the years is shown in Table 2.6 and Figure 2.1.

People's access to food in terms of both quantity and quality have improved significantly an increase in production and the introduction of new crop varieties and improved farming practices. A small survey showed more than two-thirds of households to be fully self sufficient in rice (Table 2.7). The food basket has expanded to include more varieties of vegetables, fruits, and animal products. The range of options and opportunities available to rural people has increased manifold. The country now grows a wide range of food and cash crops, including maize, potatoes, apples, plums, walnuts, cabbage, tomato, broccoli, and asparagus. With a reduction in fallow lands, cropping intensity has increased significantly. While seasonal shortages of food still occur in some parts of the country, people are now able to manage by purchasing what they require from the market with the income they earn from the sale of cash crops and livestock products.

Export of agricultural products has increased consistently in spite of the constant challenge posed by the difficult climatic conditions, which can lead to both crop damage and the disruption of road transportation. Imports of major cereals have stabilised at around 38,000 tonnes annually. Livestock products such as meat, dairy products, and eggs continue to be imported, mainly for the urban population. The rural population has become mostly self-sufficient in cereal and livestock products, the deficit is mainly in urban areas.

Sale of timber and other forest products is a major source of revenue for the country. The forestry and logging sectors combined contribute 10.5% to the GDP and support some 270 industries, making them one of the country's main sources of employment.

Table 2.6: Trends in Contribution of the RNR Sector to GDP 1999-2003 (million Nu)

	1999	2000	2001	2002	2003
Agriculture (crops)	3,175	3,878	4,214	4,611	5,211
Livestock	1,487	1,637	1,770	1,788	2,002
Forestry	1,968	2,255	2,487	2,972	3,382
Total RNR	**6,630**	**7,772**	**8,471**	**9,371**	**10,595**

Source: NSB 2004

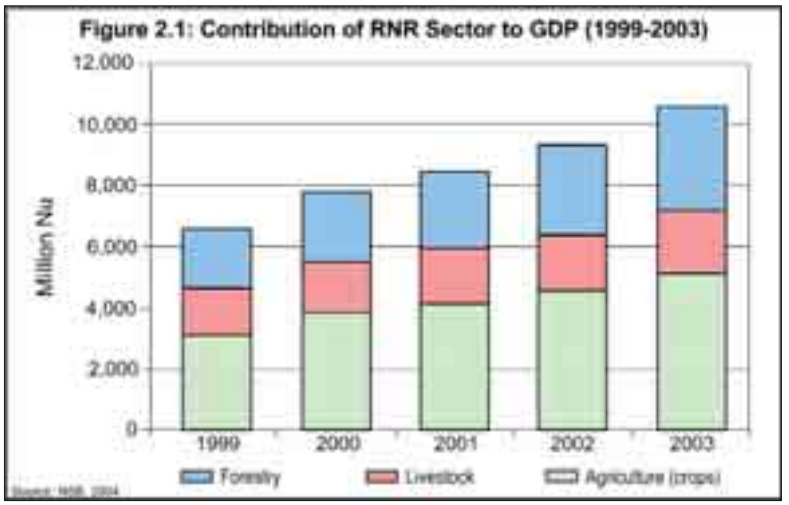


Table 2.7: Household Rice Self-sufficiency Status

Altitude	Total Sample	%HHs Sufficient	%HHs Deficit
High	105	73.3	26.7
Medium	83	71.1	28.9
Low	60	53.3	46.7
Overall	**248**	**67.7**	**32.3**

Source: RNRRC 2003

Over 77.5% of the households in rural Bhutan keep cattle. While the total number of cattle has been maintained at around 320,000, over 20% of these are now improved breeds (mostly cross breeds from Jersey and Brown Swiss stock). The production of milk and milk products has increased considerably as these crossbred cattle produce more than three times as much as the local cattle. The development of horse, sheep, and pig rearing has also been supported, as has the keeping of poultry birds for egg production.

As a direct result of the country's strong conservation policy, over 72% of the land area is now under forest cover – up from around 64% in the 1980s. Over 26% of the country's area is now protected in national parks and wildlife sanctuaries which are linked by a network of biological corridors occupying an additional 9% of the land area. Bhutan has gained international recognition for its conservation efforts; it is listed as one of the 10 global 'hot spots' of biodiversity. The recorded biodiversity includes 5400 species of vascular plants, 770 species of birds, and 178 species of mammals. Conservation has come hand in hand with a realisation of the need to balance both the social and commercial benefits from forests. Timber, firewood, and other forest products continue to be used by rural people to support their livelihoods. The commercial harvesting of timber is carried out in areas where it is feasible to do so but in accordance with a strict code of harvesting and post-harvesting management practices that conform to environmental principles.

Over the past few decades, the government has invested heavily in human resource and infrastructure development in the RNR Sector. As a result the Ministry of Agriculture now enjoys one of the best staffed ministries and employs professionals in nearly every area of its operation. The Ministry also has an elaborate network of field offices spread throughout the country; they include research and training centres, extension centres, livestock and seed production farms, veterinary hospitals, divisional forest offices, range and beat offices, soil and plant analysis laboratories, plant protection centres, and quarantine facilities.

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