## Environment: elevation, rivers and forest cover

The physical environment of the region is by no means uniform, ranging as it does from high mountains to foothills to alluvial river estuaries to coastal plains. There is a general trend from lower to higher elevation going northwards from the coastal plains, with a steep rise to high mountains in northern Yunnan (Figure 3). There are substantial areas of moderate elevation in Viet Nam, Lao PDR, Myanmar and Thailand with smaller elevated areas in western Cambodia. However, only in northern Yunnan does the degree of elevation reach heights where it is difficult for malaria vectors to breed successfully.

In addition to the Mekong itself, which arises in the high mountains of Qinghai Province in central China, flows through all 6 countries in the region and is the dominant waterway, another striking feature of the region is the series of other rivers that flow through valleys between the mountains and foothills to the plains below (Figure 4). These also arise in the high mountains of China or in the foothills and flow south or east to the coast where they form fertile deltas as they enter the sea. Each of the rivers plays an important role in the life and economy of the respective countries through which it flows. Indeed the fertility depends greatly on these rivers, as does water supply for human and agricultural consumption, for transport and in some cases for hydro-power generation. The whole watershed also plays a critical role in the transmission of infectious diseases in the region, especially those carried by mosquito vectors such as malaria, dengue, filariasis and other water-related diseases such schistosomiasis, diarrhea.

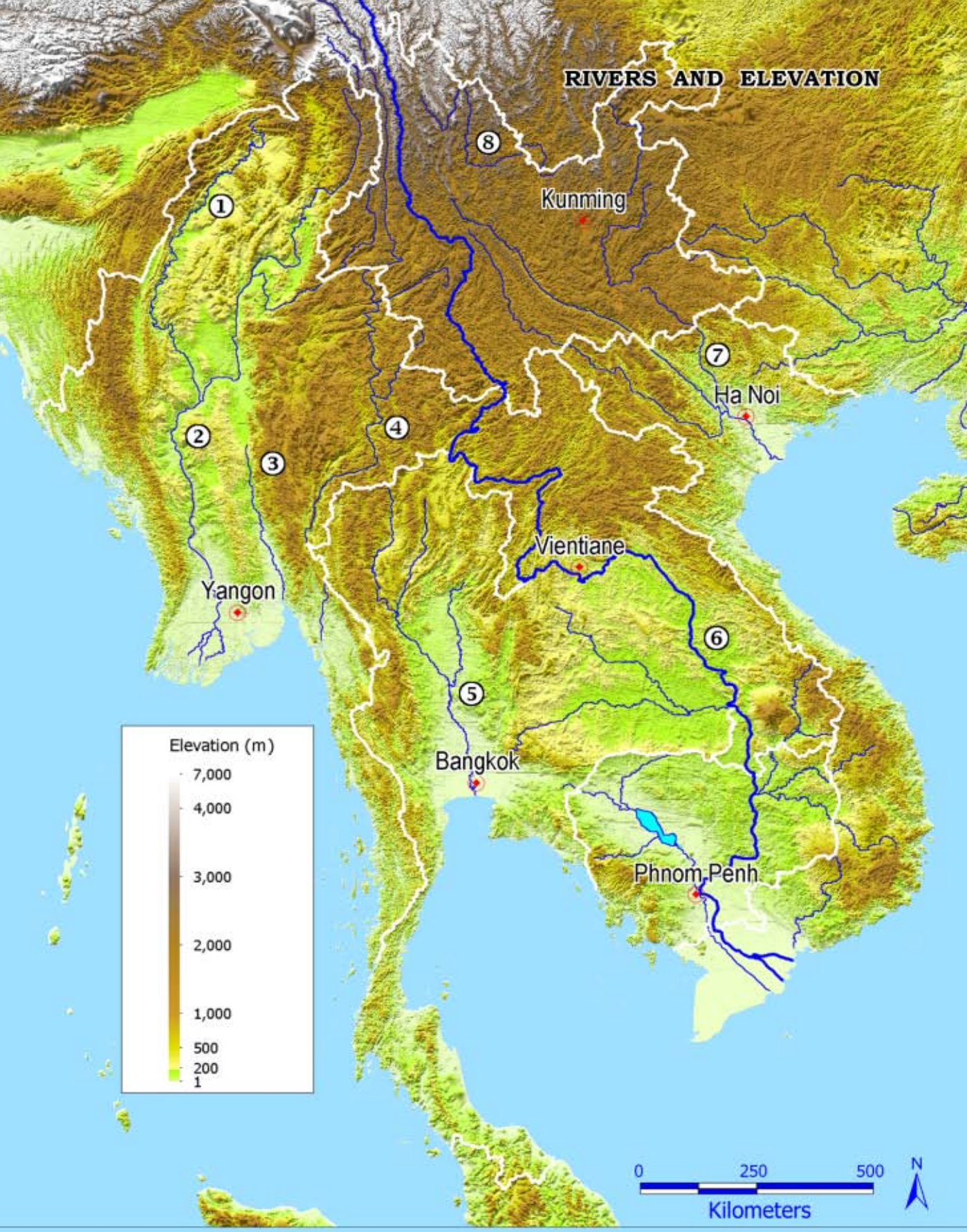
An important role is also played by forests, plantations and the whole spectrum of agricultural activity. In this context satellite imaging is instructive (Figure 4). While the extent of afforestation in some areas is still impressive, deforestation is also marked in some areas, *e.g.*northeastern Thailand. The satellite picture shows also areas of intensive cultivation in what is one of the world's most productive rice growing regions. Forests, plantations and rice fields all play a part in transmission of mosquito-borne diseases, especially malaria, since differing mosquito breeding habitats are encountered in these ecological niches.

Against this environmental background lies the critical element of change over time. The drive towards economic growth is accompanied by major alterations in the environment in the region, in some countries more than others. All have become embroiled in the effects of environmental change. Logging of forests, conversion of logged land to cultivation and to plantations alters the breeding sites of vectors, eliminating some, expanding others. Conversion of rice fields to factories changes both the ecology and types of employment opportunities, hence the population distribution. Construction of highways opens up forest land to cultivation, increases population mobility and the chances of disease spread among the increasingly mobile populations.

Maps shown at macro level such as here provide a cursory overview of environmental change over time, but clearly environmental monitoring and satellite imaging at more local levels can play a part in continuing assessment and prediction of the effects of economic change. Satellite technology from ultra-micro to macro levels is now very sophisticated and can be a powerful tool in environmental monitoring.

Malaria is predominantly a disease of rural areas where mosquito vector habitats are common. The human populations in malaria endemic areas are generally relatively poor, so that accessibility to health care facilities is limited in terms of distance and time. Environmental mapping highlights the logistic difficulties involved in case finding, diagnosis and management in remote areas, with consequences for morbidity and mortality.

***Data sources:*** Elevation data were derived by ACASIAN from United States Geographical Survey global map databases. Forest cover maps were obtained from the Geo-Informatics and Space Technology Development Agency, per the kindness of Dr Darasri Dowreang.




Rivers

① Chindwin River
② Ayeyarwaddy River
③ Sittaung River
④ Thanlwin River
⑤ Chao Phraya River
⑥ Mekong River
⑦ Red River
⑧ Yangzi River system

**Figure 3**

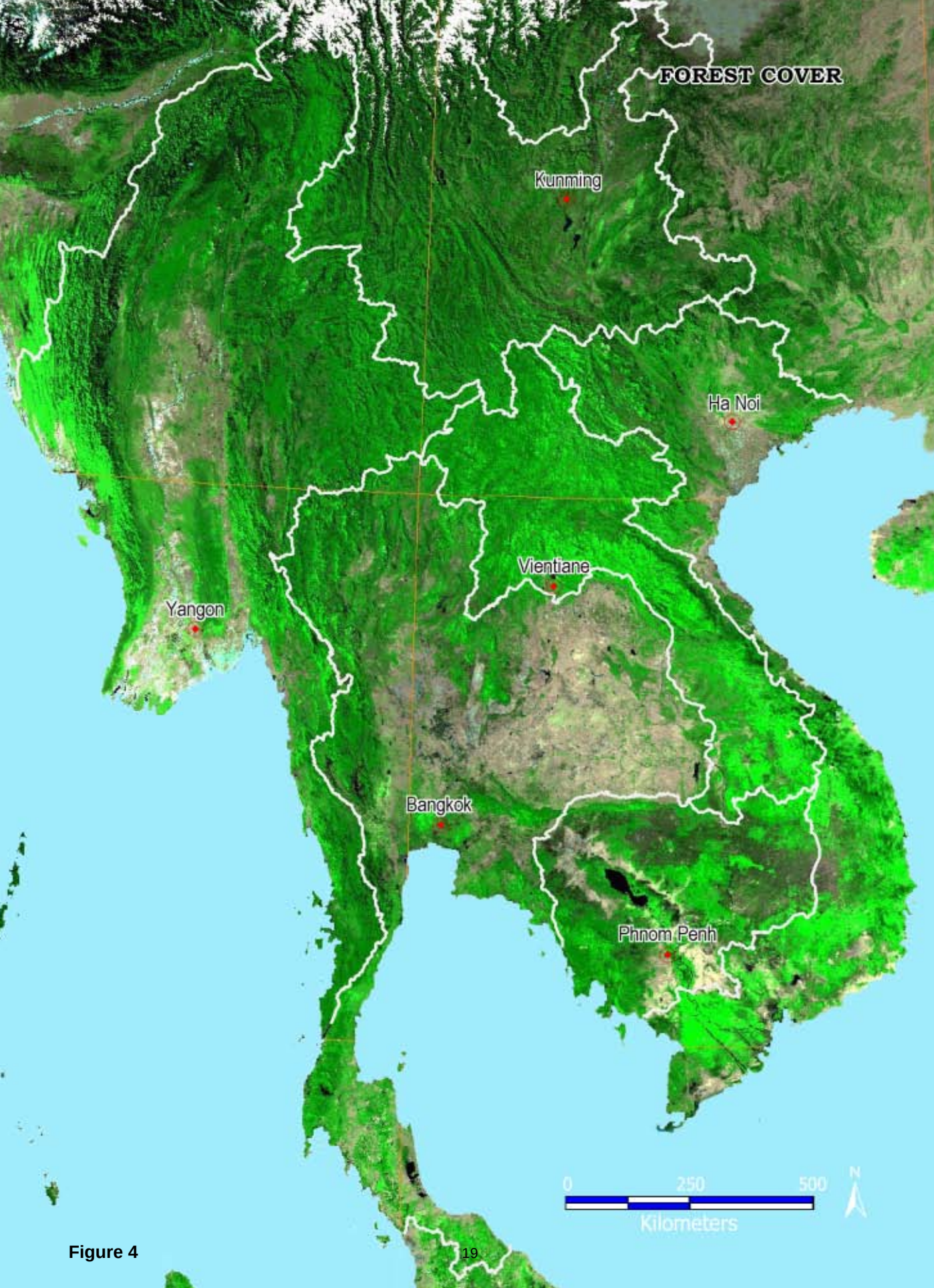

FOREST COVER
Kunming
Ha Noi
Vientiane
Yangon
Bangkok
Phnom Penh
0
250
500
Kilometers
N

**Figure 4**