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Population distribution across Asia

Christophe Z. Guilmoto and Sébastien Oliveau

This chapter aims at providing an overview of population distribution in Asia at various scales. Asia is taken here in the usual United Nations definition, and comprises the 51 countries and territories forming a triangle with the Bosphorus to the West, Japan to the Northeast, and Indonesia to the Southeast, as the three corners.¹ It includes China and India, which are the two most populated nations in the world. With the addition of Indonesia, Pakistan, Bangladesh and Japan, six out of the ten largest populations are in Asia. While there are a few Asian countries with less than a million inhabitants, such as the Maldives in the Indian Ocean and Bhutan in the Himalayas, Asia is made up mostly of nations with large populations, and 24 among them have more than 20 million inhabitants. This chapter will examine the main features of the spatial distribution of population in Asia, by stressing the geographical and demographic variations observed across the continent, and by presenting some of the main factors that have influenced the settlement patterns observed today. The spatial distribution of Asia's population is particularly skewed in comparison with that of other continents. We will also review the recent population dynamics and see how they are likely to alter the population distribution within Asia.

The changing share of Asia's population in the world

With a total population estimated at 1.4 billion in 1950, Asia already represented no less than 55.4 per cent of the world's population.² Yet its formidable demographic increase over the

following decades, of close to 2.0 per cent per year, brought Asia's population total to 3.7 billion at the beginning of the 21st century and its share climbed to more than 60.7 per cent of the world's total. Asia is expected to cross the 5-billion threshold by 2036. This preeminence stems primarily from the presence of the two demographic giants that are China and India. With more than 1.2 billion inhabitants, each represents a larger population than any other continent and they jointly correspond to more than 36 per cent of the world's total. The third largest country by population size (United States) is only about a quarter of that for China or India. It may also be pointed out that Asia includes several other countries such as Indonesia, Pakistan, Bangladesh and Japan that are ranked 4th, 6th, 8th and 10th respectively by population size.

Yet in spite of the continuing demographic growth anticipated until the middle of the 21st century, the beginning of the millennium has marked an historical downturn in Asia's population surge; it is exactly at this juncture that its relative share in the world has started to level off. It is now expected to decline at a sustained pace in the near future, falling back to 55 per cent of the world's total by 2050 and perhaps close to 45 per cent at the end of the current century, following recent population forecasts by the United Nations Population Division. As these trends suggest, this turnaround is related directly to Asia's declining population growth rate vis-à-vis the rest of the world's growth rate. Estimates provided in Figure 15.1 demonstrate that Asia's annual population increase will be consistently below the world's average during the 21st century, and that the gap may reach 0.5 per cent per year by 2070. This downturn, associated with a net population decrease anticipated in Asia after 2050, is of course closely linked to its rapid fertility decline. However, it also highlights the importance of the first couple of decades of the 21st century in shaping Asia's relative

demographic share of global population. This chapter should therefore be read as a description of Asian population at its apex, on the eve of an irreversible demographic decline.

[Figure 15.1 is about here]

The rest of this section will review recent demographic differentials across the continent, with a special emphasis on the variations in growth rates observed within Asia due to their implications for the relative distribution of population within Asia. Because Eastern Asia will experience the lowest growth rates, and in contrast Western Asia the highest, we highlight a comparison between those two regions in this section. Before that, however, we consider a longer-term perspective based on available population estimates for more ancient periods. In view of the lack of reliable population figures in several Asian countries before 1950,³ these estimates obviously need to be taken with caution, but they offer an illuminating overview of population trends. The most reliable source stems from the HYDE project that has compiled and revised all previous available demographic estimates for the last 300 years, with more speculative figures referring to the entire Holocene period starting about 11,760 years ago.⁴

According to these estimates, people were already living in Asia in very early human history, and population in the continent had already reached more than 100 million at the beginning of the Christian era. Even though Europe was already densely populated, Asia's population density was also close to 5 persons per sq. km and comparable to that of Europe. This level was three times higher than in the rest of the world. The annual demographic growth rate was estimated at 0.7 per 1000 and the gap between Asia and the rest of the world was almost imperceptible, but its cumulative impact over more than ten centuries was significant. In fact, the share of Asia in the global population gradually increased and reached a peak in 1800 at

66.4 per cent. At that time, Asia had a density close to 17 persons per sq. km, a level that the rest of the world would only reach one and a half centuries later.

The ensuing period was, however, characterized by a relative decline in Asia's population in contrast with the spectacular demographic evolution of Latin and North America as well as the steady population growth observed in Europe and Russia. This growth was linked firstly to agricultural expansion by settlers in the Americas and in Russia, and also to industrialization and urbanization processes in most of Europe. Asia did not benefit from any increase in croplands nor from industrial economic development, during the 19th and first half of the 20th century. In addition to the colonial predicament of the region, China was affected by a succession of major internal and international conflicts and subsistence crises, while India also suffered from epidemics and famines until 1950. In spite of Asia's subsequent record growth during the last fifty years, the continent as a whole has never recovered from the relative demographic stagnation observed through 1800-1950 (Goldewijk 2005).

[Table 15.1 is about here]

Starting from 1950, we have more detailed demographic estimates at both national and sub-national levels based on census results. We will also use population forecasts till 2050. These figures show how the distribution of population within Asia has been subject to significant changes during the last six decades and the extent of growth differentials in the future.

Beyond the mere effect of demographic forces such as steady mortality decline, the 20th century finally witnessed a formidable agricultural expansion in most Asian countries – such as Indonesia, India, Viet Nam and the Philippines – which combined with the Green

Revolution after 1960 to reverse the Malthusian pressure on rural areas (Goldewijk and Ramankutty 2004; Hazell 2009).

Asia's relative size in the world population has not increased uniformly since 1950, nor is the forecast until 2050 and beyond parallel for all 51 countries and territories.⁵ As Figure 15.1 demonstrates (see also Table 15.2), population growth has been notably faster in Western Asia since the 1950s. The number of inhabitants in this mostly arid subregion rose by a factor of 4.5 in the 60 years until 2010. The progression was even more spectacular in the Arabian Peninsula where the populations of small Gulf countries such as Qatar, Kuwait, Bahrain, and the United Arab Emirates have increased more than tenfold from 1950 to 2010. Although by far the least populous of Asia's subregions, Western Asia is likely to witness a similar record population growth over the coming decades. Demographic forecasts predict faster (by more than 0.5 per cent) annual population growth in Western Asia than in the rest of the continent, until 2050. Rapid natural increase in most of these countries, coupled with a considerable inflow of immigrants to the oil-producing countries, account for one of the fastest paces of demographic growth ever observed. To this specific subregion, we should add the case of individual countries such as Afghanistan and Timor-Leste, where delayed fertility decline will cause a near threefold demographic increase during the next four decades. If we restrict the focus here to larger countries, then it is in Pakistan and the Philippines that growth over the 1950-2050 period will be the most remarkable; the population is estimated to increase by a factor of seven during these hundred years, or double the average Asian increase.

On the other hand, growth has been rather modest, and will continue being so, in more developed areas of Asia. A net demographic decline is forecast from 2010 to 2050 in countries such as Japan and South Korea, and as a result the share of Eastern Asia in Asia's

population will shrink. Eastern Asia's lower population growth is the direct product of its dramatic fertility decline. However, the evolution of the growth rate in this region has been complex: the first decades after 1950 witnessed a succession of demographic ups and downs, such as the great Chinese famine of 1958-61, followed by a spectacular recovery and subsequent demographic 'echoes', but the overall trend became steadier after 1980, highlighting a gradual slowing down in population growth. Eastern Asia's annual demographic growth has decreased steadily since then, reaching 1 per cent in 1990 and 0.5 per cent today. Within 15 years, it is likely to become negative. As in Eastern Asia, the smaller countries of Armenia and Georgia that are part of the Western Asia subregion, are also poised to record a population loss in the future as a consequence of persistent below-replacement fertility levels, with the additional effect of massive emigration from the Caucasus region.

[Table 15.2 is about here]

The overall impact of these country-specific differentials in demographic growth is a gradual redistribution of Asia's population. Thus, Western Asia's share in Asia has grown from 4 per cent in 1950 to 6 per cent today, and it is expected to reach 8 per cent by mid-century. Similarly, the share of Southern Asia has risen from 35 per cent in 1950 to 41 per cent today and should reach 47 per cent in 2050, owing to the rapid growth forecast for Pakistan and Afghanistan, and the sustained growth observed in India where the fertility decline has been slower than anticipated. The fastest decline in birth rates has negatively affected the demographic share of Eastern Asian countries, which used to account for almost 50 per cent of Asia's population in 1950, as compared to the forecast of about 29 per cent by 2050 and even lower values in the following decades. Japan, once the third-largest country in Asia after

China and India, will be surpassed by Indonesia, Pakistan, Bangladesh and the Philippines by the middle of the century.

Population densities

Table 15.2 provides an overview of some key demographic characteristics of the 51 Asian countries and territories, starting with population estimates in 1950, 2010 and 2050, and the current rates of demographic increase. We have added data on population densities as well as on urbanization levels, as a first indication of the major variations in the distribution of population across the continent. As our further analysis will show, national averages tend to conceal significant variations in density levels within countries.

Interestingly, Asia as a whole – with more than 130 inhabitants per sq. km – appears to be five times more densely inhabited than Africa, America or Europe, which have an average density of 26.4. Contrary to what its high density would intuitively suggest, Asia is less urbanized than other continents, an apparent paradox that can be explained by its especially dense rural settlements patterns. Within Asia, there is in fact no significant positive or negative correlation between the overall density and urbanization; some of the low-density countries such as Kazakhstan and Mongolia also happen to be highly urbanized, while others such as Bangladesh display both extremely high density levels and moderate urbanization. The disaggregated spatial analysis discussed below will also show that some rural areas display elevated density levels.

Population density varies strikingly across countries. If we leave aside the specific case of small islands – from Bahrain to Singapore and Hong-Kong – that are highly or totally urbanized, we observe that population density levels range from 2 persons per sq. km in Mongolia to 1050 persons in Bangladesh. A different way to illustrate these regional disparities across Asian nations is by considering Kyrgyzstan, Sri Lanka and Bangladesh, three countries with roughly similar land surfaces, yet with populations as varied as 5, 21 and 149 million inhabitants respectively, in 2010.

Comparing densities at the national level fails, however, to give a fair idea of population distribution within Asia, since populations within most countries tend to both concentrate in specific areas such as river basins and avoid other areas such as arid tracts (Small and Cohen, 2004), though India is somewhat an exception with a few cities in arid zones (Balk et al., 2009). Sparsely inhabited lands that are almost entirely unpopulated lie next to subregions of extreme density levels in many countries, from Iran to China and Indonesia. Rescaling our analysis from Asia as a whole to sub-national units, we observe that density has an obviously fractal dimension in the sense that the heterogeneity in population density between countries is hardly greater than that observed within individual countries and even within individual subregions.⁶

We will therefore rely on another set of disaggregated data for Asia, derived from the ‘Gridded Population of the World: Future Estimates’, for our analysis of population dispersion and concentration in Asia.⁷ This source provides sub-national figures for all Asian countries based on census results. The number of administrative units in this database is close to 100,000 for Asia alone, compared to the 51 countries and territories for which the United Nations Population Division provides demographic estimates. It has been used here to draw a

detailed map of estimated density levels across Asia in 2015. We have added on Map 15.1 the 2015 estimated populations for the 323 largest Asian cities, drawn from the United Nations database of cities with population larger than 750,000 inhabitants (United Nations 2012). Note that extremely high density areas typical of metropolitan conurbations are largely indiscernible on a map drawn at the all-Asia scale.⁸

[Map 15.1 is about here]

Map 15.1 reveals a multifaceted picture of human settlements across Asia, ranging from desert areas to some of the densest population concentrations in the world. Three large high-density macro-regions emerge across Asia. The first block is located in Western Asia and includes in particular Turkey and Western Iran, as well as the Caucasus, the Mediterranean coast and the former Mesopotamia. It obviously corresponds to a northern extension of the Fertile Crescent associated with the Neolithic Revolution, towards the Anatolian Plateau and the Turkish littorals. The second block encompasses the entire Indian Subcontinent, enclosed by the Baluchistan desert to the west, the Himalayas to the north, mountainous forested areas to the east, and the Indian Ocean to the south. The third major block is made of East China (roughly Imperial China at the time of the Han Dynasty), broadened to Korea and Japan. In comparison to these three macro-regions, the remaining territories of South-Eastern Asia, Central Asia and the Arabian Peninsula present a far more fragmented picture, with several isolated population concentrations surrounded by sparsely inhabited tracts. Incidentally, these three macro demographic regions correspond to what are perceived as the world's major cradles of civilization, with distinct linguistic, ethnic and religious features that clearly delineate population groups up to today.

A closer geographical examination leads to the identification of more distinct and homogeneous areas, sharing typical demographic features. We will use high and low density to single out some of the most prominent regions, in terms of land area and population concentration. If we start our review with the most populated areas, two compact regions distinctly emerge with density levels above 500 or even 1000 persons per sq. km: the Ganges Plains in India and Bangladesh, and the Central Plains (Zhongyuan) along the Yellow River (Huang He) in East China. These two lowland areas enjoy, at different periods of the year, both annual monsoon rains and runoff from mountains located in a different climatic region (the Tibetan Plateau). The former area is the larger and more populated of the two, with more than 500 million inhabitants living in this basin. It includes the world's most important deltaic region, in which the Ganges joins the Brahmaputra before flowing into the Indian Ocean. Geographically, it is part of the Indo-Gangetic Plains that also encompasses the Indus valley in Pakistan and the Punjab, where density is also often above 1000 inhabitants per sq. km. By comparison, the Yellow River Plain and especially its densest lower reaches centred on Henan are of somewhat smaller size, but the entire basin supports no less than 400 million people. Geographically speaking, however, the Yellow River basin tends to blend with the lower Yangtze region. In fact, the Yellow River used to flow southward until the 19th century and the limits of its alluvial basin are blurred. These areas in China and India constitute a unique profile of massive concentrations of rural population not found anywhere else in world. China's case is even more striking, as 91 per cent of the population lives east of the Heihe-Tengchong line (or the Hu line), in a group of provinces that includes the Northern plains and Southeast China.⁹

Seven other regions with high population densities appear on our map, starting with Java in Indonesia where local human density is consistently above 500 inhabitants per sq. km, with

higher figures observed in the western and central parts of the island. Compared to Java's 133 million inhabitants, the next population concentration in Asia in the Sichuan basin, covering most parts of the current provinces of Sichuan and Chongqing along the Yangtze River (Chang Jiang) and its tributaries, is hardly less populated with almost 110 million inhabitants. The Sichuan region stands out as a somewhat unique example of a remarkable population concentration located far away from a sea coast (Shanghai is 2,500 km downstream from Chongqing), set against the sparsely populated Tibetan Plateau that lies to the west and from where the Yangtze pours down. In fact, another high-density area in China lies further downstream, centred on Wuhan in Hubei province and extending towards Nanjing, Shanghai and the coast. Three additional, narrower regions with exceptional human density are also distinguishable on our map. The first is the Red River (Song Hong) Delta region in North Viet Nam that represents the cradle of Vietnamese civilization. While the region includes the cities of Hanoi and Haiphong, it is however, a mostly rural area with a long agricultural rice-growing tradition. In several of its constituting provinces, population density in the Red River Delta exceeds 1000 persons per sq. km. The second region is the state of Kerala in southwestern India, whose average population density (860 inhabitants per sq. km) is nearly three times higher than in the rest of the country and exceeds 1500 in some coastal districts. The Philippines and Japan constitute the last high-density zones, with national averages above 300 inhabitants per sq. km and limited variation across administrative regions.

The demographic concentration along the major river basins represents the first basic principle of the population distribution across Asia.¹⁰ We have stressed the role of the Indus, Ganges, Brahmaputra, Yellow River, Yangtze, and their tributaries in Asia's population geography. This logic is also replicated at a smaller scale and we easily identify smaller population concentrations on the map: along the Tigris and Euphrates in the Middle East;

along the Narmada, Kaveri, Godavari and Krishna in Peninsular India; along the Irrawaddy in Myanmar; and along the Chao Phraya and Mekong in continental South-Eastern Asia. The close resemblance between the maps of population density and local hydrography is no coincidence. The availability of permanent water provided by these major waterways is the key to irrigation and cereal cultivation, and is especially essential for growing rice. Along with appropriate terrain and climatic conditions, permanent access to water makes multiple cropping possible, with both demand for intensive labour and exceptionally high yield per hectare, compared to rain-fed and other agricultural systems.¹¹ These rich agricultural regions have long been able to sustain high population densities, including ancient commercial towns and royal cities.

The urban structure is, however, not the mere outgrowth of population concentrations across Asia.¹² While many historical capitals such as Baghdad, Hanoi, Delhi, Nanjing, Beijing and Xi'an are indeed located in Asia's main water basins, the urban system is far more diverse, and many metropolises have emerged over the last two centuries. As a matter of fact, the distribution of cities on our map points to a second guiding principle of population settlement in Asia along the sea coast. Coastal cities include some of Asia's large metropolises, from Istanbul, Karachi and Mumbai to Shanghai, Tianjin and Tokyo. Of the ten largest urban agglomerations in Asia, only two (Delhi and Beijing) are located away from the sea. High density in littoral areas proceeds partly from favourable climatic conditions such as higher rainfall and fertile delta zones, but the distinct role of urbanization in the process of population concentration is also significant. New port cities have appeared over the last two hundred years under the influence of colonial powers, and the development of many coastal metropolises of today, such as Ho Chi Minh City, Karachi, Mumbai, Kolkata, and Shanghai, started during the late 19th century. Yet the extraordinary expansion of coastal cities over the

last thirty years is, of course, linked to Asia's rapid economic development and its export-oriented growth. Many of these Asian conurbations are located in low-elevation areas and are therefore especially prone to the future effects of climate change. In fact, Asia contains eight of the ten largest fragile countries in terms of population, with about half of the population of Viet Nam and Bangladesh residing in vulnerable coastal areas. According to one count, in 2000, 466 million people lived in these exposed low-elevation coastal zones.¹³ The overall health risks of climate change for Asian cities, however, go beyond rising seas and represent a major challenge for future urban concentration (Kovats and Akhtar 2008).

A third type of high-density area is a typical Asian settlement pattern described as *desakota*, a word derived from Indonesian meaning 'countryside-town' and used by geographer McGee to describe mixed rural-urban regions.¹⁴ *Desakota* areas are rural areas characterized primarily by high human density (above 200 people per sq. km), but also by close access to cities and intense population mobility.¹⁵ Agriculture remains a significant part of the local economy, but its role has gradually faded due to the development of industries and services. *Desakota* resist a simple classification as rural or as urban because of their composite nature. These settlements are not really towns nor part of the urban sprawl in terms of their morphology and historical development, nor can they be confused with the countryside from an economic and demographic viewpoint. The concept of *desakota* therefore captures a typically Asian settlement pattern, lying in-between villages and towns. In most cases, these areas were dominated by rice cultivation, but today they are characterized by mixed land use combining agriculture, industry, commerce and residential areas, and by a parallel blend of diversified activities such as trade, transport and industry, apart from residual agriculture. Intense demographic mobility and trade intimately link *desakota* areas to urban centres.

While this notion was initially developed to describe situations in Indonesian Java, it was found applicable to many other high-density areas in Asia that were neither primarily urban nor agricultural. Examples of *desakota* regions abound in China, India, Pakistan and the Philippines. Almost the entire state of Kerala in India (barring mountainous areas) can fall in this category; its few cities and towns are immersed into a continuous ‘rural’ space with few large village centres, but a continuous high-density settlement with more than 500 inhabitants per sq. km. Agriculture (rice and coconut) has not disappeared, but represents only a secondary source of employment and income to the local population. Kerala is a rather singular area for such an exceptional population density since it is not associated with any major river basin. This is true also for the island of Java and other *desakota* areas in China, where local handicraft, industry and more recently, services, have long supplanted the economic role of agriculture in sustaining high population densities. Provinces around Shanghai, from Jiangsu to Zhejiang, provide further illustrations of former rich agricultural regions that have witnessed a continuous change in land use and decrease in cultivated areas under the influence of gradual industrialization. While still lacking a formal urban morphology, these rural areas have acquired most social and economic characteristics of urban areas, such as access to modern sanitation and communication, and are characterized by density levels usually higher than 500 people per sq. km.

In contrast, our map of population densities also points to the presence of large areas which appear almost uninhabited. As elsewhere, these areas tend to be landlocked and located far away from the coastline. In Asia, in spite of high-density pockets such as Sichuan in China or the smaller Fergana Valley in Central Asia, population tends to decrease with increasing distance from the sea coast. This rule is even stronger when extended to distance from the coastline and from all waterways. The two largest blocks of barren lands, with densities that

are on average below one inhabitant per sq. km, are found in Central and Eastern Asia. The first one covers more than half of Kazakhstan and extends to neighbouring Uzbekistan and Kyrgyzstan. The second block is even larger, and centres on the Taklimakan desert (Tarim basin) in West China and on the Gobi desert along the China-Mongolia border. The Taklimakan is a 1,000 km long depression, with barely any vegetation and very few oases. This inhospitable dry terrain stretches to the south towards the Tibetan Plateau and the Himalayas. While it is a sparsely populated mountainous area, it represents Asia's water tower, providing water to the Brahmaputra, Indus, Ganges, Mekong, Yangtze, and Yellow Rivers, thus irrigating Southern, Eastern and South-Eastern Asia. The Gobi desert to the north is even longer (1600 km), and much larger than the Taklimakan desert. It is also reported to be expanding continuously through a rapid process of desertification, linked to the reduction of grasslands on its edges, at a rate of about 2000 sq. km per year in China (Yang et al. 2005). Taken together, the Gobi and Taklimakan deserts occupy more than 1.5 million sq. km. Other low-density areas found in the Arabian Peninsula, in Iran and in Indonesia, are rather small in comparison. Even smaller population concentrations are also visible in more arid parts of Central and Eastern Asia, such as along the Syr Darya River in Uzbekistan and along the historical northern Silk Road in China. The lack of access to water and arable land has given rise to a very uneven settlement pattern, in which towns and cities predominate and villages are few and far between. Urban settlements can become the focal points for demographic growth, as the large cities of Urumqi in China and Tashkent in Uzbekistan illustrate.

Deserts are, however, never completely empty and Asian deserts are no exception to the rule. Western China is a good example. Even if densities are very low away from cities and agricultural areas, traces of settlements dating back to the Neolithic period are found across Xinjiang and adjacent provinces in West China. Permanent human settlements and villages

have tended to centre on oases, and to rely on elaborate water management systems (*karez*). Turpan in Xinjiang provides a typical example of such a settlement, with hundreds of wells, tunnels and canals, which have long sustained large populations. In addition, population-based maps do not accurately reflect the presence of nomadic groups, and this is especially the case for the Kazakh steppes and Mongolia. In the latter country, pastoralism has long been a dominant force and is based on the constant mobility of a large part of the population, making it as much an economic base as a way of life (Barfield 2011). Nomads occupy extensive territories of seasonal steppes and mountain pastures, through complex migratory movements with their herds that can be vertical (up and down the mountains) as well as horizontal (across the steppes). The Deccan Plateau in India, a vast semi-arid region where agriculture is mostly rain-fed, provides another illustration of the complexity of settlement patterns, since it is characterized by relatively high population densities and the presence of cities with millions of people such as Hyderabad and Nagpur.

In some countries like Turkey, India and the Philippines, populations are on the whole more uniformly distributed than in the rest of Asia where extreme density differentials often prevail. This spatial demographic heterogeneity is illustrated by the contrast between empty West China and the high density levels observed in East China. These imbalances have fuelled specific migration streams from the densest rural areas towards less populated regions. An extreme case is provided by the oil-producing countries of the Middle East, which have attracted millions of temporary migrants to expand their workforces. While the departure to the Gulf region of migrants from Pakistan, India, and the Philippines has had a tremendous impact on the local economies of their regions of origin, it has proved too modest to affect the overall demographic growth in these countries, especially as it is based on short-term moves.

In contrast, the permanent resettlement of internal migrants within given countries has had a more visible demographic impact.¹⁶ It has boosted the growth in some peripheral frontier areas in West China, Malaysia, Thailand, Central Viet Nam, and some Indonesian islands. Contrary to the effects of urbanization, these internal migrations have mostly been rural-rural and have been linked to land development or reclamation. Many governments across Asia have supported voluntary colonization programs as a solution to rural saturation.¹⁷ The Indonesian transmigration project is probably the best-known example and was directed toward less populated islands such as Sumatra, Kalimantan, Sulawesi and Papua, with Java providing most out-migrants. These programs were based on selective incentives for relocation, such as support during migration and access to land and employment, but there was also a significant spontaneous component to these internal migrations fuelled by new economic opportunities. An additional illustration stems from westward migrations observed within China since the 20th century, across the Hu line mentioned earlier. This has resulted in a more rapid demographic progression in West China (Yu et al. 2003). These policies may not have had a visible impact on the areas of origin such as Java or the alluvial plains of China and Viet Nam, but they have often displaced the population composition of the target, that were as a rule less populated and occupied by ethnic and religious minorities with limited political power. Indigenous populations of these destination regions often find themselves now in a minority in urban areas and at times in their entire ancestral regions, a situation that carries significant political risks as recent cases of tension and civil unrest in China attest. The demographic absorption capacity of the last rural frontiers in Asia appears nowadays limited, compared to the lure of more urbanized, densely populated regions.

The distribution of population across Asia

The mapping of population densities across Asia suggests extreme variations between uninhabited steppic regions and major world conurbations. Excluding countries with the smallest territories, we find indeed in Asia, the world's lowest density in Mongolia and the highest in Bangladesh. However, to examine more formally the geographical dispersal and concentration of Asia's inhabitants across its extent, we have used a Lorenz curve to compare the spatial and demographic distributions. In the graph shown below, the areas of countries and sub-country units are arranged by cumulative area on the X-axis, while cumulative population itself is represented on the Y-axis. The curvature of the function provides a graphical representation of the inequality in population distribution within Asia and reflects the degree of spatial concentration. Thus, if Asian populations were equally spread from Turkey to Japan, the Lorenz curve would be close to a straight equality line. The difference between the observed Lorenz curve and the equity line is in fact proportional to the Gini coefficient.

The computation has been done at country level, based on 2010 population estimates from the United Nations. Yet, in the case of Asia, this procedure based on country totals is distorted by the fact that two single units, China and India, account for more than 61 percent of Asia's total. As noted earlier, each of these two countries has a total population larger than that of any other continent. In addition, these countries are at the same time characterized by high levels of subregional heterogeneity in density, with regional densities ranging from less than 20 inhabitants per sq. km in Qinghai (China) and in Arunachal Pradesh (India), to more than 750 in Jiangsu (China) and in Bihar (India). We have, therefore, disaggregated Asia's three most populated countries into subregional units. We have used here China's provinces,

India's states and Indonesia's provinces in our computations, now based on a total of 48 countries and 99 subregions, instead of the 51 countries and territories for which we have statistics. The subregional partition was not necessary for countries such as Japan and Bangladesh where density variations are less pronounced and populations smaller. We could not disaggregate the figures for Pakistan – whose inhabitants tend to concentrate along the Indus River and are rather scarce in desert and mountainous regions – for lack of recent regional census figures.

The resulting graph (Figure 15.2) summarizes the extremely skewed population distribution in Asia. The first empty quarter of Asia – which includes in particular Mongolia, Kazakhstan, Tibet and Indonesia's Papuan provinces – accounts for no more than 1 per cent of its population.¹⁸ This curve further demonstrates that half of the continent's surface – including, in addition to these, large territories such as Iran and Saudi Arabia in the near-East, China's Xinjiang, Gansu and Inner Mongolia provinces in Eastern Asia, and most northern Indonesian islands in South-Eastern Asia – shelters a mere 6 per cent of the population, amounting to less than 14 million inhabitants (less than Delhi's population). It takes, in fact, 87 per cent of Asia's less populated regions to reach half of Asia population, and the remaining 13 per cent of its surface carries the second half.

[Figure 15.2 is about here]

The remarkable demographic concentration in high density areas is also visible on the Lorenz curve, since the last quarter of the population inhabits about 4 per cent of the continent's surface. This quarter includes as expected, all metropolitan areas in our dataset from Singapore to Beijing municipality. It includes for instance, Jakarta province, an Indonesia

metropolitan region of 9.6 million inhabitants squeezed on 664 sq. km, which is part of a larger Jabodetabek conurbation of 28 million people extending to Banten and West Java provinces. Population density in Jakarta nears 15,000 inhabitants per sq. km. Yet the most populated quarter of Asia's population also comprises a significant number of still predominantly rural regions such as the entire country of Bangladesh, India's Uttar Pradesh state, Indonesia's Javanese provinces and China's Shandong province.

Compared to other continents displayed in Figure 15.2, population distributions shown on the respective Lorenz curves demonstrate that Asia's demography appears far more spatially skewed than that of the rest of the world.¹⁹ While Europe (without Russia) emerges as the most evenly populated continent due to the absence of semi-arid, steppe and densely-forested areas, Africa and the Americas also appear to have less skewed population distributions than Asia, in spite of the vast and largely uninhabited parts found in the Sahel, North Canada, and inland Brazil. Half of the continental surface accounts for 23 per cent of Europe's population, 20 per cent of America's, and 15 per cent of Africa's, as against a mere 6 per cent of Asia's population total. In other words, Asia is characterized by the most extreme forms of population distributions found in the world.

These findings raise new questions for future research. One relates to the long-term evolution of this spatial distribution, for which we have limited evidence in view of the almost complete absence of disaggregated demographic estimates before the beginning of the 20th century. Over the last decades, there has been a complex interplay between higher natural growth in inland regions that are both less developed and less densely inhabited, and migration towards more urbanized growth poles often located closer to coastal areas. It remains difficult to predict how these contradictory trends will evolve once fertility has reached low levels, i.e. when spatial mobility becomes a far more decisive factor of

demographic growth than the natural increase.²⁰ A further question relates to the linkages between economic growth and population concentration (World Bank 2009). Agricultural expansion tends to deconcentrate population by directing migrants towards less densely populated pioneer areas. The process is still at work in some Indonesian islands east and north of Java, and in large swathes of West China. Yet, population density has also been associated with Asia's rapid economic growth during the last three decades, especially along the coast which happens to be ecologically most vulnerable, while sparsely populated inland regions have not developed at the same pace (Bloom et al. 1999).

Conclusion

This chapter has reviewed the spatial distribution of Asia's population at its demographic apex – when the share of Asia in the world peaked at 61 per cent at the turn of the 21st century. This dominance is both a product of its dense settlement patterns inherited from the past and of its record population growth during the 20th century, to which China and India have contributed to a considerable extent. Owing in large part to an average population density five times higher than in other world regions, with high growth rates over the past six decades, Asia is by far the most populated continent with its 4.2 billion inhabitants in 2010, and it will remain so even as it enters an era of irreversible decline over the current century.

Closer examination of the population distribution within Asia and within its countries has, however, demonstrated the substantial uneven distributions in population across regions. These variations follow some of the basic physiographic principles of population geography: densities are often highest along the coastline and rivers, and diminish with altitude.

Interestingly, no simple climatic principle emerges linking population distribution with rainfall or average temperature, except for the avoidance of the most arid climate observed in land-locked regions. At the same time, desert areas have progressed and central Asia now represents the greatest concentration of dryland degradation in the world due to erosion, physical deterioration, and decrease in vegetation cover (Lepers et al. 2005). This mechanism is illustrated by the slow colonization of West China by Han settlers and the encroachment on grasslands (McNeill 2006). Elsewhere in Asia, dense forests that used to check the progression of human settlements – as illustrated by the population distribution of South-Eastern Asia – have shrunk rapidly during the last century (Basnyat 2009). The process of deforestation started earlier in China, but has been especially dramatic in South-Eastern Asia over the last 60 years and linked closely to the advance of modern agriculture. In fact, large-scale deforestation is also associated with a rapid increase in cropped areas through most of South-Eastern Asia.

The concentration of population along the coastline – which current modes of export-oriented development are only reinforcing – is a well-known source of environmental risk in many Asian countries such as Japan, India and Viet Nam.²¹ Unequal development is now the main driver of population redistribution, and agricultural systems are therefore bound to play a lesser role in determining future demographic trends (Huang and Bocchi 2009). Economic density (output per sq. km), which tends to attract migration, has been shifting increasingly towards urban and peri-urban areas over the recent decades.

At a higher scale, variations in population both across and within Asian countries are a product of the past, and point to the cradle of major Asian civilizations. These formidable population concentrations have been made historically possible by the combination of

extremely rich agricultural systems and sophisticated water management technologies that have sustained rural population densities higher than in Europe, with the additional contribution of monsoon rains in most Asian countries. The rapid population increase during the previous century has only accentuated Asia's demographic dominance, and within it, the weight of China and India that represent more than 35 per cent of the world's population. Population redistribution within Asia has been directed mostly towards urban areas, and its present moderate level of urbanization suggests that this process of rural-urban migration, along with more migration between towns and cities, will continue unabated during the current century. This will lead to a faster decline of population growth in the countryside, accompanied by population stabilization in most parts of rural Asia.

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Table 15.1 Various population estimates for Asia during the Holocene

Year	Population (in)		Density		Annual growth rates		
	Asia	% of world's population	Asia	World	Period	Asia (%)	World (%)
-10000	0.7	30.4	0.03	0.02			
0 AD	106.7	56.7	4.9	1.4	10000 BC- 0	0.05	0.04
1700	366.4	60.7	7.7	2.2	0- 1700	0.07	0.07
1800	656.8	66.4	16.8	4.5	1700-1800	0.59	0.50
1900	902.2	54.5	41.5	12.3	1800-1900	0.32	0.52
1950	1335.7	52.5	61.4	19.0	1900-1950	0.79	0.86
2000	3419.0	55.6	157.2	45.8	1950-2000	1.90	1.78

Sources: HYDE 3.1 database (Goldewijk et al. 2010).

Note: Figures differ from other estimates quoted in this paper because Asia's definition in the HYDE database excludes the Middle-East and the former Soviet Union.

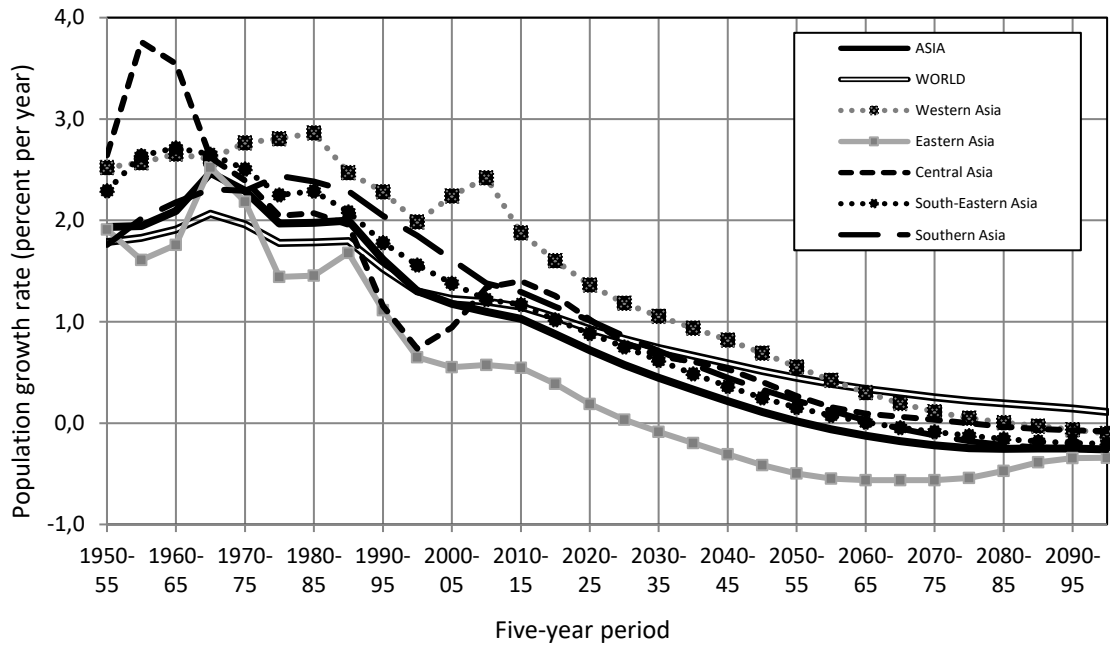
Table 15.2 Population, urbanization, growth rates and density: Asian countries

	Population ('000)			Urban (%)	Annual Growth rates	Density (Inhabitant /sq. km)
	1950	2010	2050	2010	2010-50	2010
WORLD	2 525 779	6 916 183	9 550 945	51.6	1.15	50.6
ASIA	1 395 749	4 165 440	5 164 061	44.4	1.03	130.5
Central Asia	17 499	61 694	86 154	40.7	1.4	15.4
Southern Asia	492 799	1 681 407	2 312 026	32.2	1.29	247.7
Eastern Asia	666 249	1 593 571	1 605 341	54.4	0.55	135.1
South-Eastern Asia	167 986	597 097	787 535	44.1	1.17	132.8
Western Asia	51 216	231 671	373 006	67.4	1.88	48.0
Afghanistan	7 451	28 398	56 551	23.2	2.39	43.5
Armenia	1 354	2 963	2 782	64.1	0.18	99.4
Azerbaijan	2 896	9 095	10 492	53.4	1.11	105.0
Bahrain	116	1 252	1 835	88.6	1.66	1 803.3
Bangladesh	37 895	151 125	201 948	27.9	1.19	1 049.5
Bhutan	177	717	980	34.8	1.60	15.3
Brunei Darussalam	48	401	546	75.6	1.35	69.5
Cambodia	4 433	14 365	22 569	19.8	1.75	79.3
China	543 776	1 359 821	1 384 977	49.2	0.61	141.7
China, Hong Kong SAR	1 974	7 050	8 004	100.0	0.74	6 414.5
China, Macao SAR	196	535	797	100.0	1.78	20 562.5
Cyprus	494	1 104	1 356	70.3	1.08	119.3
Dem. People's Republic of Korea	10 549	24 501	27 076	60.2	0.53	203.3
Georgia	3 527	4 389	3 563	52.7	-0.39	63.0
India	376 325	1 205 625	1 620 051	30.9	1.24	366.8
Indonesia	72 592	240 676	321 377	49.9	1.21	126.4
Iran (Islamic Republic of)	17 119	74 462	100 598	68.9	1.30	45.2
Iraq	5 719	30 962	71 336	66.5	2.89	70.6
Israel	1 258	7 420	11 843	91.8	1.30	335.1
Japan	82 199	127 353	108 329	90.5	-0.08	337.0
Jordan	449	6 455	11 510	82.5	3.50	72.2
Kazakhstan	6 703	15 921	20 186	53.7	1.04	5.8
Kuwait	152	2 992	6 342	98.2	3.61	167.9
Kyrgyzstan	1 740	5 334	7 976	35.3	1.35	26.7
Lao People's Democratic Republic	1 683	6 396	10 579	33.1	1.86	27.0
Lebanon	1 335	4 341	5 316	87.1	3.04	417.4
Malaysia	6 110	28 276	42 113	72.0	1.61	85.7
Maldives	74	326	504	40.0	1.89	1 092.9
Mongolia	780	2 713	3 753	67.6	1.49	1.7
Myanmar	17 527	51 931	58 645	32.1	0.84	76.8
Nepal	8 140	26 846	36 479	16.7	1.15	182.4
Occupied Palestinian Territory	932	4 013	8 906	74.1	2.51	666.6
Oman	456	2 803	5 065	73.2	7.89	9.1
Pakistan	37 542	173 149	271 082	35.9	1.66	217.5
Philippines	18 580	93 444	157 118	48.6	1.71	311.5

Qatar	25	1 750	2 985	98.7	5.90	159.1
Republic of Korea	19 211	48 454	51 034	82.9	0.53	486.8
Saudi Arabia	3 121	27 258	40 388	82.1	1.85	12.7
Singapore	1 022	5 079	7 065	100.0	2.02	7 436.3
Sri Lanka	8 076	20 759	23 834	15.0	0.81	316.4
Syrian Arab Republic	3 413	21 533	36 706	55.7	0.67	116.3
Taiwan	7 562	23 146	21 371	72.8	0.24	639.5
Tajikistan	1 532	7 627	15 093	26.5	2.43	53.3
Thailand	20 607	66 402	61 740	33.7	0.30	129.4
Timor-Leste	433	1 079	2 087	28.0	1.66	72.6
Turkey	21 238	72 138	94 606	70.5	1.22	92.1
Turkmenistan	1 211	5 042	6 570	48.4	1.27	10.3
United Arab Emirates	70	8 442	15 479	84.0	2.52	101.0
Uzbekistan	6 314	27 769	36 330	36.2	1.35	62.1
Viet Nam	24 949	89 047	103 697	30.4	0.95	268.5
Yemen	4 661	22 763	42 497	31.7	2.30	43.1

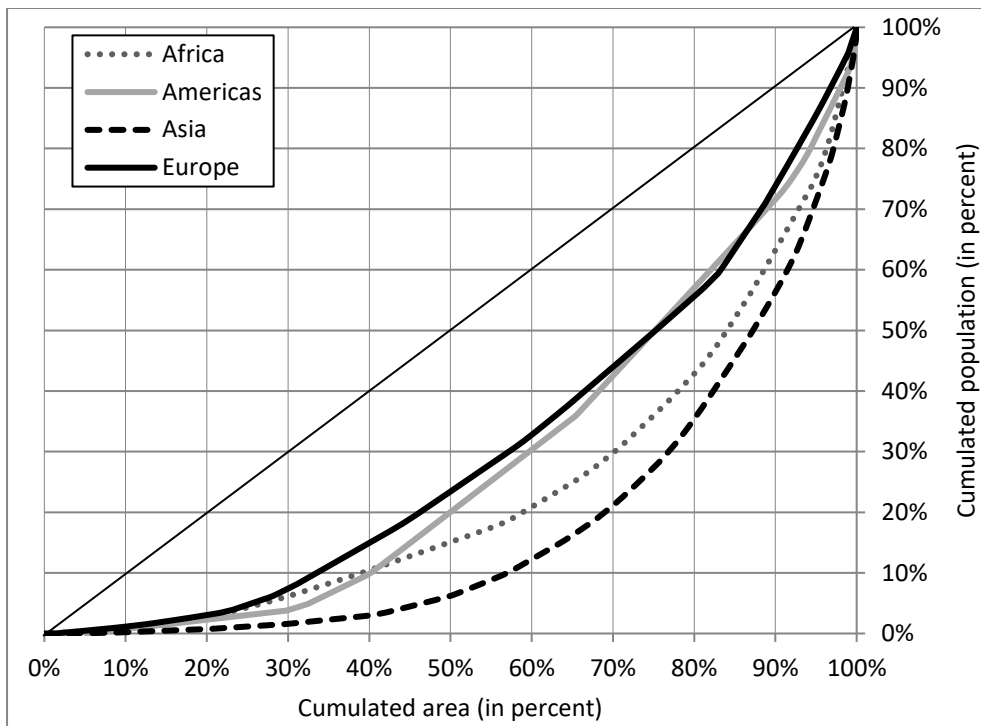
Sources: Population and density: *World Population Prospects: The 2012 Revision*; Urbanization: *World Urbanization Prospects: The 2011 Revision*.

Figure 15.1 Annual population growth per region, 1950-2100



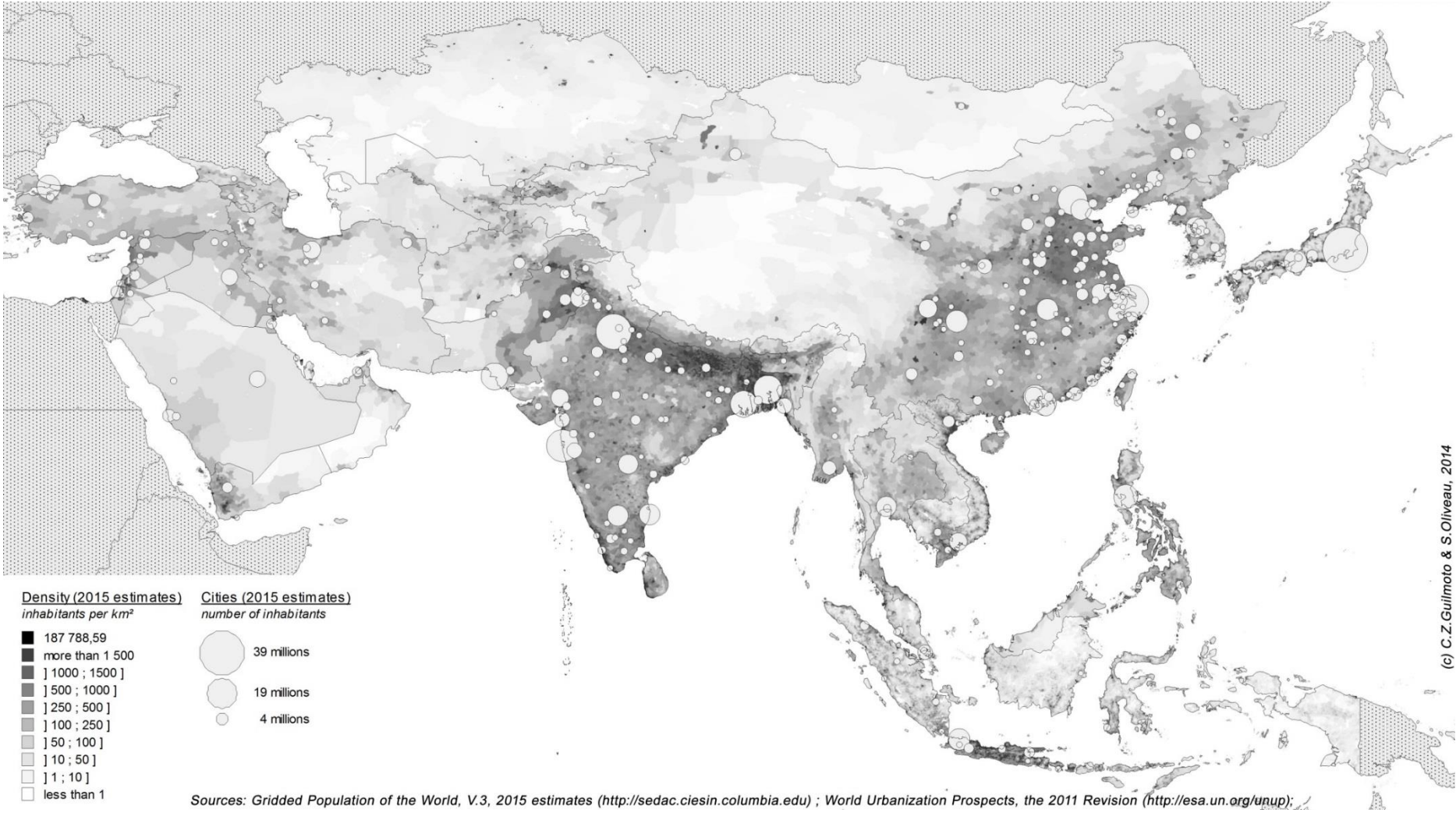
Source: *World Population Prospects: The 2012 Revision*.

Figure 15.2 Lorenz Curve of population concentration in four different continents, 2010



Sources: *World Population Prospects: The 2012 Revision*; Provincial census figures for China, India and Indonesia.

Map 15.1 Population density in Asia, 2015



¹ Asia encompasses here, Turkey (including the Eastern Thrace), the Middle East (excluding Egypt) and the South Caucasus, but it does not include the Asian part of Russia (Siberia and the Far East). As a result, we have left out from our purview, the Siberian and Far Eastern districts of Russia located east of the Ural mountain range. This huge territory spread over 13 million sq. km has a relatively modest population of about 26 million in 2010.

² Unless otherwise stated, all demographic parameters and estimates underlying this chapter derive from the 2013 United Nations population estimates for 1950-2010 (United Nations 2013). Population forecasts up to 2100 are based on the medium-variant projections from the same source. Subregional figures quoted for individual countries are however taken from the latest national census reports.

³ With the exception of the Ottoman census of 1831, the first modern censuses in Asia date from the second half of the 19th century for the British colonies (India, Pakistan, Bangladesh, Myanmar, Sri Lanka, and Malaysia). During the first half of the 20th century, census operations were introduced in Indonesia, Japan and Thailand, but countries such as China, the Philippines, Iran and Viet Nam had to wait until after World War II.

⁴ Population estimates from the HYDE database are described in particular in Goldewijk et al. (2010, 2011). Others sources can be found in Durand (1977) and Maddison (2001). See also Livi-Bacci (2012).

⁵ On Asia's population growth, see notably James (2011), East-West Center (2002), and Guilmoto and Jones (2016).

⁶ Examples of provinces with significant density disparities include Sichuan and Shanxi provinces in China, Rajasthan state in India, Sulawesi and Kalimantan provinces of Indonesia, provinces of central Viet Nam, as well as Punjab and Sind provinces of Pakistan. In these sub-national entities, extremely densely populated rural areas coexist with forested, mountainous or desert terrains devoid of any significant population settlements. It is, however, beyond the scope of this chapter to measure the fractal complexity of population density in Asia.

⁷ GPW data come from CIESIN/Columbia University/CIAT (2005). See also Balk et al (2005) for more detail. Other sources of disaggregated population mapping include the LandScan dataset of 'ambient population' (Dobson et al. 2000) and the HYDE estimates (Goldewijk et al. 2010).

⁸ Night-time satellite imagery provides an alternative source for identifying conurbations, but this procedure may generate additional difficulties of interpretation (Sutton et al. 2001).

⁹ This is the so-called Hu line – running from Heilongjiang to Yunnan provinces – imagined in 1935 by geographer Hu Huanyong. Figures quoted here are from Yue et al. (2003).

¹⁰ On the case of South-Eastern Asia, see Hirschman and Bonaparte (2012).

¹¹ Rain-fed agriculture is most vulnerable, as it is dependent on the irregular monsoon precipitations in Asia. See Wang (2006).

¹² On urban distribution, see notably McGranahan et al. (2007), Bulkeley (2013) and Un-Habitat (2008).

¹³ These figures are based on the rather high threshold of 10 metres. See McGranahan et al. (2007).

¹⁴ McGee (1991). See also DST (2008) for a more recent perspective. See also World Bank (2009) for a detailed description of settlement patterns and density.

¹⁵ A more comprehensive definition of urban agglomerations combines density (above 150 per sq. km), population totals and connectivity (see Nallari et al. 2012).

¹⁶ On internal migration in Asia, see for instance Deshingkar (2006) and Fan (2008). See Hugo (2005) on international migrations.

¹⁷ Forced displacement constitutes a distinct case of population redistribution. Asia has a record number of refugees and internally displaced persons. Major dams have also led to large numbers of relocations.

¹⁸ For a comparison with the spatial distribution of the global human population, see Small and Cohen (2004).

¹⁹ Australia also presents an extremely skewed population distribution, but it is not considered here because of its limited population (24 million in 2015).

²⁰ This situation is already illustrated by the case of China's major metropolises. In Beijing and Shanghai, the natural increase is already negative owing to ultra-low fertility levels, but the massive influx of migrants led to population growth greater than 40 per cent during the previous decade.

²¹ Population growth is, however, only one in a long list of factors associated with environmental degradation in Asia. See AASA (2011).