health systems. It also requires a sound and durable ‘planetary support’ system, able to provide adequate food, fuel fibre and other ecosystem ‘services’ for humanity to flourish (Corvalán et al., 2005). Overlying and interacting with these ecological foundations is a social superstructure, which can serve to either strengthen or erode other dimensions of well-being and security, including for children, women, the elderly and other vulnerable and disadvantaged groups. The chapter also discusses several scenarios for human well-being, from an East Asian perspective.

16.1 Introduction

Inevitably, common climate and health threads run through all world regions. But the economic dynamism of East Asia (reflected in conventional economic criteria such as gross domestic product (GDP), but also in other indicators, such as the enthusiasm of its young people for social media) brings great opportunities and perils. The time frame for preventive and corrective action is shorter.

This chapter presents a ‘Food in Health Security’ perspective to climate change in East Asia (Wahlqvist et al., 2009). This approach embraces food and nutritional security, agriculture, ecology and health, human rights, ethics and equity. Above all, an integrated approach to issues of development and health is needed. Good population health cannot arise purely from the provision of health care, hospitals and

East Asia

East Asia refers to the greater China area, the Korean Peninsula, Japan and the ten countries that form the Association of South-east Asian nations (ASEAN). It therefore embraces North-east and South-east Asia. With the exception of the Democratic People’s Republic of Korea, the linkage between these countries and their sense of common destiny is growing. But before discussing climate change and health in this dynamic region, five features which contribute to both the problems and any solutions that might be envisaged need discussion.
16.2 Five Cross-cutting Features of East Asia Relevant to Climate Change and Health

Cognate and transitional cultures

The region has been influenced historically and strongly by China, whether by cultural transfer to Japan in the 700s, allegiance with the Ryuku kingdom based on Okinawa from the 1200s or by migration in Indochina and the Indonesian archipelago from at least a millennium ago. Confucian thinking and health constructs like ‘hot and cold foods’ are evident far from China, albeit with progressive dilution. The strength of these beliefs may override conservation of precincts or their fauna. While many aspects of Chinese culture call for respect for nature, the overriding need to feed its people and to maintain social harmony has led to the transformation of vast landscapes, most obviously in the creation of terraced rice paddies. Often, nature is honoured symbolically, rather than in actuality (Elvin, 2004). There has, however, been substantial cultural interaction between people of Chinese origin and the indigenous peoples of the region, who in general have a greater sense of place and its value. But this interaction is not without tension.

Commentators often speak of transition in East Asia as though it were toward the West, but considerable cultural shifts are taking place within East Asia. Their momentum will increase. This is particularly evident with the promotion of South Korean art forms and food culture through North-east Asia. While Islam is a significant way of thought and life in South-east Asia, it is generally culturally interactive, drawing on the local roots of its followers, who sometimes have a high regard for local ecology (Mangunjaya and McKay, 2012).

Climate and natural disasters

Anthropogenic climate change will add to a region that is already climatically diverse. Conditions range from monsoonal to dry: with typhoons and a hot and humid climate in coastal regions; snow in the north-east and mountainous regions; and dusty winds from western China and suffocating forest fires in Indonesia affecting respiratory health in South-east Asia. Huge topographical differences, from coastal plains to mountainous peaks, jungle to wilderness and vast estuaries, river systems and gorges, provide varying microclimates. People accustomed to living in particular localities are undergoing considerable change. Villages that may have changed little for hundreds of years are now connected to a wider world of transport, information and education, financial systems, food and health care. These changes may improve the quality of life, but paradoxically can add to ecosystem decline and climate change. Additionally, increasing population size and density make the disaster potentially worse; albeit dependent on the resource utilization and practices of the populace.

Some disasters are slow in the making, typified perhaps by those emerging in megacities in East Asia. Many, like Beijing, have outgrown their water supply. China’s north is now more prone to drought, including because its aquifers are increasingly dry (Zheng et al., 2010). The Chinese engineering response is to build three massive pipeline systems, all currently under construction, to bring additional water to the north, each with its own environmental controversy. Where can all this end? Hopefully, as China’s population management takes effect, demand will decrease and the problem slowly dissipate. But it may not: even now, millions of people in China’s south-west inhabit a parched landscape and are unable to grow enough food to feed themselves: they are net food importers. How anthropogenic is this ‘natural’ disaster?

Numerous environmental changes induced by megacities underscore the risk, including the paving of arable land, foliage replaced with concrete and hotter dwellings, phosphorus loss via urine into waterways and out to sea (Zhu, 2009) and food waste (which can be fully recycled; Lin et al., 2009; Huang, 2010). The Chinese Academy of Sciences has documented phosphorus flows in Beijing and Tianjin, perhaps giving hope that the Chinese state will implement ways to recycle this essential element (Qiao et al., 2011).

Anthropogenic ecology

It is possible for ecological systems to be changed radically by people and to take on a new kind of
sustainability. The many small farmers of traditional China ran highly integrated farming systems with extensive recycling, including of human waste (Paull, 2011). These practices were not without health risk (including schistosomiasis) (Wang et al., 2008a), but health literacy had the capacity to overcome much of that risk. Much of this is now challenged by urbanization and agribusiness, whose medium-to long-term net effects on climate and health are pending.

### Environmental trends

The global environmental trends of warming, pollution and loss of ecosystems are well rehearsed in this volume. For East Asia, these trends are just as important as elsewhere, but the ‘hot spots’ are worth documenting.

These include polluted waterways in much of China; drought in northern China; drought, persistent agricultural and political inability for the Democratic People’s Republic of Korea to feed itself; and earthquakes and typhoons in the Pacific Rim. These carry multiple risks, including active underwater volcanoes off the east coast of Taiwan, where four nuclear reactors are sited. Furthermore, the world’s largest inland edible fish resource in the Mekong delta is threatened by numerous upstream dams (Ziv et al., 2012). Issues especially relevant to Indonesia include deforestation, vast palm oil plantations and, again, volcanoes and earthquakes. The megacities of Bangkok and Jakarta have been sinking and are increasingly prone to flooding. Shanghai is also vulnerable (Wang et al., 2012). These problems can only worsen as the sea level rises.

Throughout East Asia, increasing numbers of precincts will be less habitable, creating pressures for migration and resettlement in ecologically sensitive areas (Butler, 2011).

### Health and ill-health pattern peculiarities

Patterns of infective illness or transmissible disease are also altering with climate change and other forms of global environmental change. Within East Asia, dengue is becoming more intense and moving north, while the distribution of malaria vectors is enlarging; though, for the moment, insecticides and antimalarials are lowering its burden of disease.

Deforestation and changes in animal husbandry can also cause infective agents to jump species, as happened when Nipah virus leapt from bats to pigs to humans in Malaysia. Severe Acute Respiratory Syndrome (SARS) in China may have emerged in part from the farming of civet cats, infected from bats (Hu and Shi, 2008). Resistance to antimicrobial agents is becoming increasingly serious, including with malaria in Indochina and tuberculosis in Indonesia. Changing strains of influenza virus present major logistic and budgetary difficulties in the region; what is less widely recognized is that viral transformation and pathogenicity are more likely to occur in nutritionally compromised intermediate host animals, especially poultry, with selenium deficiency a documented example (Beck, 2007).

Maternal (and even paternal) nutrition and personal behaviours are now recognized as precursors of intergenerational health problems, of which diabetes and its complications are the most evident. Lower birth weights are an indicator of these risks; and a much greater emphasis will be required to provide more favourable environments for women during the reproductive years.

A looming and related problem is maternal and early life exposure to environmental contaminants, especially those with ‘endocrine disruptive’ capacity. These include phthalates, dioxins and PCBs (polychlorinated biphenyls), which can lead to a wide range of health problems (Wang et al., 2008b). The immune system, the reproductive system, with changes which alter gender orientation, and the central nervous system, with effects on mental health, may all be affected. What at first may look like a familiar feature of the food supply (such as its glycaemic index) as the basis, for example, of abdominal obesity diabetes or cardiovascular disease may, in reality, be attributable partly to a contaminant in the same food or food system. Dioxins in rice as a cause of diabetes is a well-documented example (Wang et al., 2008b). The problem applies in the nutritionally and metabolically vulnerable older age groups as well, as shown in a Swedish study of diabetes in...
the elderly. In the wake of recent, present and, sadly, future industrialization and environmental degradation, we can expect a growing burden of this kind of disease in East Asia.

16.3 Ecology, Ecosystems and Health

The term ‘ecohealth’ has gained currency recently and rapidly across many disciplines, from the environmental to the health and social sciences. In mid-2010, Google had 9.9 million entries for ‘eco-health’ and 0.43 million for ‘ecohealth’. The drivers for this reconceptualization of health include changing patterns of disease (Wahlqvist, 2002a,b), changing demography, with more long-term health needs, and climate change (Butler, 2009), along with rising food prices.

Conceptually, ecohealth recognizes that optimal health and well-being, provided through prevention and care, requires that households and communities share favourable health outcomes (Wahlqvist, 2009). It is increasingly understood, through epigenetic mechanisms, that the effects of a child’s environment (including food deprivation) can be represented in the genome and transmitted to subsequent generations (Bygren, 2010). This also reinforces the importance of a more ecological approach to health than has heretofore prevailed. In turn, these are highly dependent on sustainable living and livelihood conditions, and supported by physical characteristics and biodiversity (see Fig. 16.1).

Ecosystem loss means a loss of ourselves. It is unclear how much more environmental degradation humanity can withstand. Much may be gained by cultural resilience and adaptability, but at the heart of the growing ecohealth dilemma is the viability of the ecosystems of which humans are an intrinsic part. Although ecosystems may undergo reductions in their constituents, and for some time retain functionality, they are likely to collapse at a critical point, analogous to a wave breaking on the shore, which follows the fractal or the mathematical patterns of ‘chaos theory’.

The human species is an integral part of ecosystems; as these collapse, the health and survival of the species dependent on them is threatened by ecosystem loss. Human migration often represents an escape from one failing ecosystem to another. But as population expands beyond the 7 billion people now alive, can sufficient fresh ecological niches be located? Urbanization and megacities temporize this increasing mismatch, as do intensive food cultivation and technological innovations. Some of these may allow us to keep using ecologically depleted localities, such as by plant breeding for salt or flood resistance, or by increasing the nutritional value of nutrient-poor staple crops by biofortification. Food exports to locations where food cannot be grown locally also occur. However, eventually, both fertilizer and the non-renewable energy sources necessary to support these measures will be exhausted.

Access to potable and reliable sources of agriculturally safe water is of increasing concern in much of East Asia (Wahlqvist et al., 2009).

Fig. 16.1. The operations and dimensions of ecohealth.
Norman Borlaug, the father of the Green Revolution, said that he did not expect another such revolution to solve the world’s food problems, but that improvements in infrastructure were the key, especially for transport by road and rail. But, even here, the planned superhighways and railroads across East Asia, from China to Singapore, although enlivening economies and bringing supplies to cope with disasters, will also deliver environmental harm, such as deforestation.

The concept of ecosystems and health also reflects various values about nature that relate to the broader aspect of human development (see Table 16.1).

### 16.4 Climate and Health

Much has been written about how climate change may affect health and is available elsewhere in this book. In East Asia, the following are of particular relevance.

**An ageing population**

East Asia has four of the ten longest life expectancies (Macau, Japan, Singapore and Hong Kong) and among the best disability-adjusted life years (DALYs) globally. Despite this, health costs as a percentage of GDP are uniformly less than 10%, in contrast to about 18% in the USA. This apparent paradox reflects both diet and vigorous public health programmes and universal health insurance (accompanied by greater equity) in the better-performing East Asian countries, illustrated best by Japan and Taiwan (Beck, 2007; Maffly, 2013). In the March 2011 Fukushima tsunami, the aged were affected disproportionately and, in some cases, abandoned: a testimony to the precarious balance between extreme weather conditions and health. Aged people are especially vulnerable to extreme heat.

**Maternal and child nutrition**

The long-standing precarious state of maternal and child nutrition has been improving in East Asia, with a major supporting analysis from South-east Asia (Acuin et al., 2011). There have been rapid reductions in morbidity and mortality in these groups in Brunei, Singapore, Malaysia, Thailand and Vietnam, but efforts are faltering in the Philippines and Indonesia. High rates of undernutrition are now being overcome in Laos, Cambodia and Myanmar. A nexus exists between economic development and health system performance. But these trajectories are fragile and are vulnerable to the loss of healthy environments or ecosystems. The reported gains will be undermined by the rapid emergence in South-east Asia of chronic non-communicable diseases, especially on a background of stunted children.

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**Table 16.1.** Values of nature related to human development (Wahlqvist and Specht, 1998), as proposed by Kellert (1996).

<table>
<thead>
<tr>
<th>Value</th>
<th>Definition</th>
<th>Function</th>
</tr>
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<tbody>
<tr>
<td>Utilitarian</td>
<td>Practical and material exploitation of nature</td>
<td>Physical sustenance/security</td>
</tr>
<tr>
<td>Naturalistic</td>
<td>Direct experience and exploration of nature</td>
<td>Curiosity, discovery, recreation</td>
</tr>
<tr>
<td>Ecological–</td>
<td>Systematic study of structure, function and relationship in nature</td>
<td>Knowledge, understanding, observational skills</td>
</tr>
<tr>
<td>scientific</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aesthetic</td>
<td>Physical appeal and beauty of nature</td>
<td>Inspiration, harmony, security</td>
</tr>
<tr>
<td>Symbolic</td>
<td>Use of nature for language and thought</td>
<td>Communication, mental development</td>
</tr>
<tr>
<td>Doministic</td>
<td>Mastery, physical control, dominance of nature</td>
<td>Mechanical skills, physical prowess, ability to subdue</td>
</tr>
<tr>
<td>Humanistic</td>
<td>Strong emotional attachment and ‘love’ for aspects of nature</td>
<td>Bonding, sharing, cooperation, companionship</td>
</tr>
<tr>
<td>Moralistic</td>
<td>Spiritual reverence and ethical concern for nature</td>
<td>Order, meaning, kinship, altruism</td>
</tr>
<tr>
<td>Negativistic</td>
<td>Fear, aversion, alienation</td>
<td>Security, protection, safety, awe from nature</td>
</tr>
</tbody>
</table>
Proneness to natural disasters

The Natural Disasters Risk Index, released by the global risk advisory firm Maplecroft, is calculated by measuring the human impact of natural disasters, in terms of deaths per annum per million of population, and frequency of events over the past 30 years. It reflects event likelihood and includes earthquakes, volcanic eruptions, tsunamis, storms, flooding, drought, landslides, extreme temperatures and epidemics. Using this method, combined with that of the World Bank, East Asia includes five of the 15 most natural disaster-prone countries (Taiwan, Indonesia, the Philippines, China and Myanmar). Risk management and preventive technologies (such as earthquake engineering, which is advanced in Japan and Taiwan), however, vary considerably, so that the consequences of similar disasters may be quite different within and across these countries. No country has endless resources to reconstruct repeatedly after successive and more severe disasters.

Risk planning rarely considers multiple disasters. The Morakot typhoon of August 2009, which commenced in the Philippines and extended to coastal China (with evacuations of 1 million people), was particularly disastrous for Taiwan. Downpours of 3 m in 3 days followed 2–3 weeks of frequent earthquakes that had destabilized mountain rocks and soils. Mud and landslides quickly submerged whole villages in metres of mud and rock, with much loss of life. About one-third of Taiwan’s agriculture, horticulture, aquaculture and agroforestry was destroyed. The displaced peoples, especially indigenous peoples and farmers, have had difficulty finding safe alternative land away from the central mountain range, because rising sea levels in the Taiwan Straits make coastal areas increasingly less habitable. A consequence was that duck farmers inadvertently moved to contaminated land, which, over several weeks, furnished contaminated duck meat to the Taiwanese market. The conjoint natural phenomenon of severe typhoons and frequent earthquakes may be made more likely by Pacific Ocean warming, which changes atmospheric pressure sufficient to increase the tectonic plate movement in Taiwan’s East Rift Valley. The Morakot experience signals a set of complex climate and environmental changes which are affecting wide areas of East Asia, with varying levels of preparedness and potential for resilience. The health consequences are immediate, medium and long term.

16.5 Three Scenarios

The chapter concludes with three possible scenarios which perhaps could unfold in East Asia. Of course, none are likely to unfold exactly as discussed, but they are included in order to provide insights.

Retreat and survive

This is a scenario of winners and losers. Those with the greatest resources, such as safe and sufficient water, energy and food, and with appropriate health care, may survive. But the lessons of history are that such a scenario may see the demise of the socio-economically and technologically disadvantaged.

The originator of the Gaia hypothesis, James Lovelock, has warned, apocalyptically, that runaway climate change might lead to the collapse of civilization on a massive scale, with only tiny pockets of humanity surviving in cooler niches (Lovelock, 2009). These groups may lose contact with each other, as it is difficult to see how our current energy- and technology-dependent connectedness, relying on orbital satellites and cyber space, may long be sustained in such a breakdown world.

Scenarios such as a badly faltering trajectory for civilization have been dismissed for several decades by most mainstream experts, including eminent economists, futurists and development specialists. This is changing. The leading German climate scientist, Hans Schellnhuber, has warned that the difference between two degrees and four degrees of warming could be civilization itself, a warning echoed in the preface to his co-edited book, Global Sustainability: A Nobel Cause (Schellnhuber et al., 2010). The German Chancellor, Angela Merkel (a physicist, like Schellnhuber), wrote the preface to this book. One of the world’s most respected economists, Nicholas Stern, is a co-editor. The former President of the Royal Society, Martin Rees, is also deeply
concerned about civilization’s short-term prospects, including because of climate change (Rees, 2013).

The projected increase in population from 7 to 9 billion by 2050 will be largely of the poor in compromised environments, some in East Asia; they will accrue the greatest risk. In this scenario, humanity survives, but civilization enters another dark age.

**Technological rescue**

In this world, there is enough technological progress to continue to match resources with additional people. Catastrophic conflict is avoided, so too is a ‘four-degree world. A ‘blue revolution’ in water usage occurs (Wahlqvist et al., 2009). The people and the ecosystems of the planet pass through a bottleneck, emerging to a future in which population is declining voluntarily and consciously, as is already the case in parts of Western Europe and Japan, and is predicted to unfold also in China by 2050.

A new ecological stability emerges. Parts of Kalimantan and Sumatra may be repopulated with orangutans and other charismatic megafauna, kept alive for several generation in zoos, as the economic imperative for palm oil plantations fades, allowing reforestation. Already, in China, great effort is being made to sustain a small population of wild pandas, including some that have been reintroduced to the wild.

The interregnum, the transition, would likely require large populations adapting to living conditions, new energy sources and new foodstuffs to which we are now unaccustomed. Other new technologies might emerge, such as personalized and renewable energy sources, safe water generation systems and climate controlled microshelters.

But even if such resources become widely accessible and affordable, will they be optimal for health? Optimistically, this order of change might be optimized by advanced bioinformatics: but on what would that ultimately depend and how environmentally (or cyber war) robust will that be? Could it be that this scenario would represent a rapid, techno-based evolution of our species, which we might anticipate with fear or excitement?

**All-out war**

A third and most horrible scenario is all-out war for resources. In 2012, Ira Helfand, of the International Physicians for the Prevention of Nuclear War, reported to the 12th World Summit of Nobel Peace Laureates in Chicago that a nuclear war between India and Pakistan would precipitate global famine, partly through aerosol-forced cooling and dimming, persisting for several years (Helfand, 2012). In recognition of the likely conflict-prone nature of resource acquisition, food, health, human and planetary security need to be embraced by the traditional security system (McKay, 2009).

**16.6 Conclusion**

What are the prospects for the people of East Asia, given these multiple interacting determinants and possibilities? Despite its development and slowing rate of population growth, a vast, still-growing population lives in vulnerable areas, highly prone to natural disasters. On the one hand, the widespread acceptance of Confucianism and the importance of group cohesion may mean the region is better placed than many to tolerate and accept a new, but less attractive, form of ecohealth, one in which hundreds of millions experience ecological scarcity in order to maintain a coherent central state.

In recent decades, East Asia has done well, both for cultural and economic reasons, including the ‘demographic dividend’ (Eastwood and Lipton, 2012). Generally, high human capital is another factor, the low levels of education in backwaters such as Cambodia and Laos being exceptions that support the general principle. The region’s labour-intensive workforces in small-scale local agriculture and small business ventures provide an important resource in lieu of financial capital. But this is altering, in many places, due to the low birth rate. The characteristics of communities will alter as migration quickens. This may limit the expansion of a sufficiently sized health workforce to meet the needs of the aged. Communities will also be affected by urbanization associated with climate change. There is also the ever-present risk of conflict and its displacement of people, with climate change itself an increasing risk for conflict.
Some of what happens in East Asia will be favourable to the health and climate change equation as the region extends its small-scale farming and business enterprise around the world, enhancing the localization movement. Experience indicates that the Asian diaspora can influence the whole food system (Wahlqvist, 2012). The Chinese and Middle Eastern ‘land grabs’ are well under way, which will extend China’s influence on global agriculture enormously, with uncertain outcomes (McKay, 2009).

Countering this, food waste, an enormous contributor to food insecurity, is well managed in some Chinese societies like Taiwan (Lin et al., 2009; Huang, 2010). Several East Asian countries are leading manufacturers and users of renewable energy technology. Accelerating this technological transition is vital, but East Asia’s social contribution is also of great importance. East Asia cannot insulate itself fully against the global trends in climate and health, but there are signs, including a concerted effort in China to build urban environmental science (Zhu, 2009), that it may outperform other regions.

Notes
1 Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.
2 Personal communication to MW.

References


