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Impacts of Human Habitat Development on the Environment – Challenges and the Way Forward

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ABSTRACT

Ever since homo sapiens appeared on earth some 2.5 million years ago, their need to build human habitats have impacted upon the environment. Early homo sapiens were largely constrained by Environmental Determinism which did little harm to the environment. However, Possibilism and Human Determinism of the modern era left inerasable scars on earth. Increasingly, as humans advanced in science and technology, and preferred to live in urban habitats, they have inadvertently impacted upon the environment very significantly, often to the point of irreversible damage. Modern humans and the construction of their habitats have significantly impacted upon and changed the environment as follows: changed the atmospheric characteristics resulting in climate change (initially at the local level but now globally); changed the hydrological characteristics resulting in floods, droughts, water crises and other hydrological disasters; changed the lithospheric characteristics resulting in soil erosion, landslides and other mass movements; changed the biosphere resulting in loss of natural habitats (of indigenous people, flora and fauna); and changed the cryosphere resulting in global melting and retreating of ice shelves and ice sheets leading to sea level rise and a host of other environmental disasters. However, a combination of realisation of environmental degradation, the environmental movement, and the rise of sustainable development have led to environmentally-friendly human habitats. To achieve sustainable development in human habitats, humans need to control urban growth, control population growth, illegal immigrants and proliferation of slums, ensure adequate (quantity) and appropriate (quality) housing, institute legislation for disaster-resistant habitat structures, develop technology for early warning system of major risks to habitats, and mobilise politicians to commit to environmental management of human habitats vis-à-vis economic development. Most of all, future human habitats should be modelled and developed as "eco-habitats".

Key words: Human habitat, urbanisation, environmental change, environmental hazards, sustainable development

ABSTRAK

Sejak manusia awal wujud di muka bumi kira-kira 2.5 juta tahun yang lalu keperluan mereka untuk membina habitat manusia telah mengimpak terhadap alam sekitar. Manusia awal dikekang oleh Determinisme Persekitaran dan tidak merosakkan alam sekitar. Bagaimanapun, Possibilisme dan Determinisme Manusia pada era moden menyebabkan kerosakan di bumi yang tidak dapat dipadamkan. Tambahan pula apabila manusia mencapai kemajuan dalam sains dan teknologi dan memilih untuk tinggal dalam habitat bandar, mereka telah menyebabkan impak yang lebih teruk dan tidak boleh di perbetulkan lagi. Manusia moden dan pembinaan habitat mereka telah secara signifikan mengimpak dan mengubah alam sekitar seperti berikut: mengubah ciri-ciri atmosfera dan menghasilkan perubahan iklim (mula-mulanya pada peringkat lokal, tetapi kini di peringkat global); mengubah ciri-ciri hidrologi menyebabkan banjir, kemarau, krisis air dan lain-lain bencana hidrologi; mengubah ciri-ciri litosfera menyebabkan berlakunya hakisan tanih, tanah runtuh dan pergerakan jisim yang lain; mengubah biosfera dan menyebabkan kehilangan habitat semulajadi (orang asli, flora dan fauna); dan mengubah kriosfera yang menyebabkan pencairan dan kemunduran litupan dan pelantar ais global sehingga menyebabkan kenaikan aras laut dan banyak lagi bencana alam sekitar yang lain. Bagaimanapun, kombinasi kesedaran tentang kemerosotan alam sekitar, gerakan alam sekitar dan peningkatan pembangunan mapan telah mewujudkan habitat manusia yang mesra alam. Untuk mencapai

pembangunan mapan dalam habitat manusia, kawalan perlu dilakukan terhadap pertumbuhan bandar, pertumbuhan penduduk, imigran haram dan pertumbuhan setinggan, memastikan perumahan yang mencukupi dari segi kuantiti dan kualiti yang bersesuaian, menyediakan perundangan bagi struktur habitat yang tahan bencana, bangunkan teknologi untuk sistem amaran awal tentang risiko utama terhadap habitat, dan gerakkan ahli-ahli politik untuk terlibat dalam pengurusan alam sekitar habitat manusia di samping pembangunan ekonomi. Yang lebih penting, habitat manusia masa depan sepatutnya dimodel dan dibangunkan sebagai 'eko-habitat'

Kata kunci: Habitat manusia, urbanisasi, perubahan alam sekitar, bencana alam sekitar, pembangunan mapan

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INTRODUCTION

Though the term *habitat* comes from ecology, and is usually applied to mean natural habitats for flora and fauna, the term human habitat is specifically coined to refer to habitats where humans live or inhabit. A human habitat comprises many interrelated features, including the immediate physical environment, the urban environment, and the social environment. Hence, a human habitat is the space or environment in which human beings live, work and interact. For example, a house is a human habitat, where human beings feel secured, live, socialise, relax, sleep and eat. In the past, perhaps the original human habitat of the homo sapiens was almost totally "natural habitat" just like the habitat of some existing tribes or indigenous peoples who still inhabit the wild or live in the natural habitats of rainforests. A good example is the Orang Asli of Peninsular Malaysia or the Penans of East Malaysia, some tribes of whom still live and survive in natural habitats. Historically, human habitats have mushroomed in some of the most fertile river valleys of the world, such as the Babylonian Empire in the confluence of the Tigris-Euphrates, the Eqyptian Empires in the Nile, the Chinese Dynasties in the Hwang Ho, and the Hindu Empires in the Ganges. These river valleys have unearthed archaeological evidence that they supported the first urban human habitats. This is not surprising as the fertile flood plains of these river valleys produced adequate food, the rivers offered water for domestic supply and irrigation and transport, and protein (fish and other aquatic edibles). Unfortunately, the modern urban human habitats built in these valleys also brought about serious environmental problems, leading to the demise of some of these civilisations (Ponting 1991).

Human habitats include a wide variety of structures such as dwellings and shelters, houses, igloos, prisons, monasteries, camps (include also concentration camps and refugee camps), tents, huts, squatter settlements, hamlets, villages (include ecovillages), communes, shanty towns, towns, cities, megacities and even space stations. Human habitats are built by humans and architects and planners call the environment of human habitats the "built environment", i.e. an environment that is created or built by humans. Often, the phrase built environment refers to the human-made surroundings (i.e. environment) that provide the setting for human activities. Hence, a built human habitat reflects the design, construction, management and use of human-made environment and its relationship to the human activities which take in the habitat over space and time. In the past, due to economics and style, architects rarely incorporate environmental conservation or sustainability into their designs. This is because, traditionally, building and habitat design is largely influenced by economics, marketing, aesthetics and design style, technology, public policy, law, and management. It was only in recent decades following the environmental movement, and most recently following the bandwagon of global warming, that architects have incorporated environmental considerations and sustainability into their designs. As the majority of urban habitats and their structures/buildings are designed by architects, planned by urban planners, traffic engineers, zoning authorities and interior and exterior designers, none of whom have much training in environment, environmental conservation and environmental sustainability and management, it is inevitable that human

habitats end up the way they are. Consequently, the built environment is in stark contrast to the natural environment. For example, the natural habitat is referred to as virgin jungle, pristine rainforest or untouched natural vegetation. In contrast, the urban built human habitat or city is referred to as the "concrete jungle". Ironically, after megacities have been built, politicians and city mayors attempt to "green" their concrete jungles by creating parks and green lungs. But this is too little too late as even a huge park like Central Park in New York or Hyde Park in London does little to hide the ill-effects of the built habitat on its environment. Perhaps only Singapore has done a good job by gazetting more than three-quarters of its land area as water catchments. By doing so, the city state has managed to conserve much of its natural forests. Singapore has also planted as many trees as possible and kept as many green spaces as it can. Not withstanding its noble action, however, the city of Singapore does not feel natural despite the quality of natural surroundings, as it is completely human-made and "built".

As the modern world becomes more and more urbanised, with more and more people moving to live in cities, the quality of the environment of the human habitat has suffered. To put it bluntly, urbanisation has led to environmental degradation which in turn has generated environmental risks, hazards and disasters. The fact is when a large percentage of the humans live in cities of which the environment is manmade, humans as well as the artificial environment consume large quantities of resources which has an impact on the city as well as its hinterland (e.g. huge ecological footprints), problems with wastes disposal, and environmental pollution and degradation of quality of life. There is no doubt that there is considerable impact of the built environment of a human habitat on human health as well (www.activelivingbydesign.org 2/5/10).

HUMAN HABITAT DEVELOPMENT AND URBANISATION

The 21st century is a century of urbanisation as more and more people move to cities and make their homes there. The city is invariably attractive as a human habitat. Urbanisation is described as a process involving the physical growth of cities and urban areas. It is also a process involving migration as people move from rural to urban areas with population growth almost equal to the rate of rural-urban migration. The United Nations estimated that half of the world's population would live in urban areas at the end of 2008 (*The Associated Press* February 26, 2008). Urbanization is also a process that is closely linked to modernisation, industrialisation, and the sociological process of rationalisation[1]. People love to habitat in cities due to improved opportunities for jobs, education, housing, business, and other socio-economic gains. City folks also have the advantage of the opportunities of proximity, diversity, and marketplace competition. In the year 2005 or thereabouts, for the first time in the history of the human race, the majority of the world's population will live in urban human habitats, i.e. cities. Yet, according to Parker (1994), for most of human history people have lived in small villages and towns, and this global shift to city life has far reaching implications for the human race, not least a potentially more hazardous way of life. The reality is that people prefer to live in cities. People love to live in cities (Earth is increasingly an urban reality). In 1900, only 14% of humanity lived in cities. By the century's close (2000), 47% of us did so, and in 2007, 50 % of humanity lived in cities. The estimated proportion of urban population in the world in 2020, 2030, 2040 and 2050 are 54.41%, 58.97%, 63.85% and 68.70% respectively (http://esa.un.org/unpd/wup/index.htm 3/5/10). In 1950, there were 83 cities with populations exceeding one million; but by 2000, this had risen to 411. In 2000, there were 18 megacities and in 2007 there were 20 megacities. This year, 2010, there are 22 megacities. Living in

[1] Rationalisation is a process whereby an increasing number of social actions become based on considerations of teleological efficiency or calculation rather than on motivations derived from morality, emotion, custom or tradition. Many sociologists and philosophers have argued that the spread of rationalisation has a dehumanising effect on Western society.

megacities has economic, social and other benefits but equally, it has risks and hazards. In his inaugural professorial lecture titled *Hazards in London megacity*, Parker (1994) warns about two significant transformations and the poorly understood connections between them. These are the transformation of human habitats from rural to a predominantly urban one, and the transformations of the nature of hazards from a rural setting to an urban one. Not only do cities have more hazards, the potential for multi-hazards occurring simultaneously is frightening. Furthermore, the speed of these simultaneous transformations render existing means of managing hazards ineffective (Mitchell 1994).

GROWTH OF URBAN HUMAN HABITATS, UNSUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL HAZARDS

It is ironical that the growth of human urban habitats is achieved at the expense of natural habitat destruction. Natural habitat destruction is a process by which natural habitats such as forests are damaged irreversibly and rendered functionally unstable to the extent that they are unable to support natural species of flora and fauna inhabiting them. During the process of human habitat expansion which replaced natural habitats, the organisms which previously inhabit the site are displaced or destroyed, leading to loss of biodiversity. In a way, we can say that expansion of human habitats create habitats for humans at the expense of natural habitats and their inhabitants. Furthermore, natural habitat destruction by human activities is carried out also for the purpose of natural resources exploitation, food production (agriculture), industrial production (includes pharmaceutical) and for urbanisation. In most developing countries, deforestation (clearing natural habitats) is for urbanisation and agriculture. This includes Malaysia, which is a good example of a rapidly developing country whereby the impacts on the environment are significant (Jamaluddin Md. Jahi 1996). The environmental effects of natural habitat destruction (including via conversion to human habitat) are environmental pollution (air, water and land), species extinction, climate change, ecosystem change and environmental hazards/disasters. Additionally, natural habitat destruction also causes "loss of water resources (due to destruction of catchments)", poor air quality, soil erosion and land degradation, and degradation of other environmental quality that diminishes quality of life (http://www.il-ireland.com/il/qofl07/show_country.php?country=Malaysia 3/5/10)[2].

Modern humans and the proliferation of their habitats have significantly impacted upon and changed the environment, often leading to environmental hazards that can exacerbate into disasters. Urban geographers have long studied urbanisation in the sub-field of *Urban Geography*, i.e. the study of urban areas. Increasingly, urban geography also deals with the study of environmental impacts in urban areas. According to Jamaluddin Md. Jahi et al. (2009), there is interaction between various components of the environment, viz. the atmosphere, the lithosphere, the hydrosphere and the biosphere which are all interdependent in a symbiotic manner. When one component fails, the others cannot function effectively as it is vital to achieve dynamic equilibrium between the components to ensure environmental stability. Disturbance of one component may render dynamic equilibrium unattainable and leads to environmental degradation (Jamaluddin Md. Jahi et al. 2009). Hence, human exploitation of natural resources and improperly planned and inadequately controlled development activities often lead to environmental degradation in the following key components of the environment:

The Atmospheric Environment – The micro-climate of cities are markedly different from that of natural habitats such as forests as well as rural habitats such as agricultural landscapes. There is no argument that human habitats have significantly changed the atmospheric

[2] In 2007, Malaysia's Quality of Life Index was averaged at 61. This figure was averaged from cost of living (86), leisure & culture (69), economy (45), environment (70), freedom (50), health (71), infrastructure (43), risk & safety (86) and climate (29). The country was placed at number 84 out of 195 countries.

characteristics resulting in a micro-climate that is markedly different. It has also been argued that if we add up the combined effects of micro-climate change of all the urban areas in the world (which is now more than 50%), climate change (which is initially at the local level) would escalate into the global dimension. According to Obasi (1996), urban habitats/areas contribute directly to emissions of greenhouse gases into the atmosphere due to the increasing populations and the heavy industrial activities of the mega cities. Obasi (1996) also estimated that a city of one million inhabitants generates about 25,000 tons of CO_2 every day. This alone makes cities the major contributors to global climate change. Data from the Second Scientific Assessment Report of the WMO/UNEP Intergovernmental Data from the Panel on Climate Change 1995, suggests that there is now clear evidence that human activities have a discernible influence on global climate, as the global mean temperature is projected to increase to be between 1 to 3 ^{o}C by the end of the 21st Century (Obasi 1996).

In urban habitats, poor urban planning and inappropriate architecture have resulted in the excessive, costly and inefficient use of energy for heating or for air-conditioning. This has resulted in higher temperatures in a city than the surroundings, creating a "local climate" which manifests itself through what is called the "urban heat island" (UHI). The UHI phenomenon of micro-climate in cities shows that city centres are significantly warmer than their peripheral/surrounding areas. The UHI was noticed way back during Victorian and Roman times whereby travellers would notice the heat of the cities of London and Rome as they enter it from the countryside. More significantly, travellers would also notice the foul air and highly polluted atmosphere in cities (due to coal and firewood burning). As cities grew from having populations of thousands to hundreds of thousands, to millions and then to tens of millions, the UHI was markedly visible. Nowadays, the UHI is largely due to modification of the land surface by urban development, air pollution due to automobiles and industries, generation of anthropogenic heat, and loss of vegetation to transfer sensible heat upwards via evapotranspiration. Dark and heat absorptive construction materials such as asphalt, cement, concrete, tar and others effectively retain heat. Waste heat generated by automobiles, industries and other energy usage is a secondary contributor. Latent heat of vapourisation is transferred from the land surface upwards at an average rate of 600 calories per gram of vapour (Sham Sani 1982). However, a city that is devoid of vegetation does not transfer the latent heat upwards. Instead, the heat stays on the surface leading to higher temperatures during daytime and night-time. Significantly, cities that conserve green spaces or parks (with trees such as Central Park in New York) can reduce the UHI effect significantly. Gill et al. (2007) found that an additional 10% green space in cities can mitigate UHI by up to 4 °C. Other than temperature, other climatic elements that degrade the quality of the urban environment are the high concentrations of atmospheric pollutants and the dust dome. Wind patterns are also affected in that city areas (due to the skyscrapers effect on surface roughness) experience weaker winds. Consequently, this results in atmospheric pollutants being unable to be transported out of the city environment. Related to this is the higher frequency of haze occurrence in cities. Cities also experience acid rain due to the high concentrations of air pollutants, especially SO_2, NOx and CO_2. All these render the city atmosphere “unhealthy” and “hazardous” to human health.

In Malaysia, a rapidly developing country, Sham Sani (1979) has documented that many aspects of air pollution climatology in a Tropical City such as Kuala Lumpur have been altered as a result of urbanisation of the environment. The city centre of Kuala Lumpur exhibited higher temperatures of 2-3 degrees Celcius compared to peripheral areas and the city parks. Sin and Chan (2004) have also studied “The urban heat island (UHI) phenomenon in Penang Island” and found that the city of Georgetown experienced markedly higher temperatures for all seasons and all months when compared to forested areas. Chan et al. (2006) studied the highland habitat of Cameron Highlands and found that local warming and heat island effects due to expansion of human habitats in the main towns. Other than the UHI, Jamaluddin Md. Jahi & Ismail Ahmad (1988) has identified the urban dust dome. Lee and Chan (2002) have also shown that the incidence of acid rain in Peninsular Malaysia was significant and had negative implications on

surface water resources. All these studies show that atmospheric quality has been severely affected by urban human habitats, some to the extent that urban environmental quality has degraded drastically leading to health effects. Though Malaysians often blamed their neighbours for the annual haze episodes during the South-west Monsoon season, expanding cities and their knock-on effects such as high concentrations of motorised vehicles, industries and human settlements contribute just as much to the haze (Radiah et al. 2000).

The Hydrologic Environment – Construction of human habitats at the scale of megacities has totally changed the hydrological characteristics of not only river and underground water flow but also the atmospheric portion of the hydrological cycle. Atmospheric moisture in city atmosphere is markedly more than non-city areas due to higher concentrations of hygroscopic nuclei produced by air pollution sources (Sham Sani 1975; 1982). City rainfall totals are also, surprisingly, markedly more than non-city areas. All these changes in the hydrological regime have given rise to exacerbation of floods in cities (Parker 2000a; 2000b). Keizrul bin Abdullah (2002) has demonstrated that Integrated River Basin Management is necessary to manage rivers effectively in Malaysia. In Malaysia, Chan and Wan Ruslan Ismail (1997) have demonstrated that changing natural habitats such as forests into human habitats such as cities has significantly changed the hydrological regime, leading to higher frequency of floods of greater magnitudes. Malaysian geographers such as Abdul Samad and Tohardi (1973), Sham Sani (1973), Leigh and Low (1978), Jamaluddin Md. Jahi (1985), Sooryanarayana (1988) and Chan (1995a, 2002a, 2005a) have examined in detail flood hazards occurrence and have related them to human causes, amongst which is human habitation on flood plains. Chan (2003) emphasised the use of wetlands as natural forms of flood control. Our studies have documented how choice and constraints of human habitats (residential location) along rivers have resulted in persistent occupance of floodplains that has increased exposure and vulnerability of people to river hazards (Chan 1995b). Our studies have also shown that urbanisation has led increased frequency of flash floods of greater flood peaks due to high runoff rates (caused by impervious surfaces), insignificant canopy interception of rainfall, reduced capacities of rivers, inadequate urban drainage and alteration of river by habitat construction (Chan 2002b). The classic example of a disastrous flood whereby the human habitats were built on a dry river bed was that in Keningau in 1996 which killed 241 people, destroyed about 500 houses built on the river bed, and cause damage about RM300 million.

Effects of urbanisation on hydrology are not just in the form of floods (water quantity) but also in the form of water pollution (water quality). According to Chan (2005a), rivers are the cradles of civilisation as major civilisations have developed on river banks, estuaries and flood plains. Rivers have always held a prominent place in human society. It is at the banks, confluence, estuaries and floodplains of major rivers that many great civilisations emerged. The majority of the world's major rivers have survived the vicissitudes of time, witnessing the rise and fall of great civilisations on their banks. In Egypt, historical records indicate that not only do Egyptians worship the Nile but they also worship Hopi, the presiding spirit of the Nile (Butzer 1976). In ancient Mesopotamia, the Babylonians worshipped the Euphrates and the Tigris as gods, both with practical value (irrigation and water resources) as well as their spiritual role (Ponting 1991). In India, the Ganga River is sacred so much so that pilgrims make pilgrimages there to cleanse themselves (Das 2001). In China, the Hwang Ho and Yangtze Rivers are not just the foci of civilisations but also the "sorrows" that bring massive destruction (Zhang et al. 2000). Malaysia is no different. During historical times, rivers were the hub of life with not only the major settlements lining the banks but rivers also play an important role in the economic and social life of the people (Nik Hassan Shuhaimi Nik Abdul Rahman 1998a, 1998b). Despite their vital importance, humans have largely neglected, abused and mismanaged rivers all over the world. According to Ismail Serageldin, Chairman of the World Commission on Water for the 21st Century, more than one-half of the world's major rivers are being seriously depleted and polluted, degrading and poisoning the surrounding ecosystems, thus threatening the health and livelihood of people who depend upon them for irrigation, drinking,

washing, recreation, power, and industrial water (http://www.serageldin.com/SpeechDetail.aspx?SID= WwwB%2bwE2PSLWmaRpyVoBkA%3d%3d 4/5/10). All over the world, overuse and misuse of land and water resources in river basins (both in advanced industrial countries and developing countries) is the main reason for the degradation of rivers, contributing to about millions of environmental refugees in 2001. In Malaysia, rivers are also grossly polluted, mostly when rivers enter the cities. The Kelang river (Chop & Juhaimi Jusoh 2002), the Pinang River (Universiti Sains Malaysia Consultancy Team 1999), the Juru River (http://www.sungaijuru.com/v2/ tag/juru-river-pollution/ 6/5/10) are a few of the badly polluted rivers that are now of little use except as conduits of drainage and as raw sewers (Chan 2005b). In the agricultural habitat of Cameron Highlands, excessive use of pesticides has polluted rivers threatening the human health (Wan Abdullah 2002).

Our studies have demonstrated that the occurrence of flood hazards in urban habitats is considered a sign of unsustainable development of those habitats (Chan et al. 2002). This is largely due to rapid development (often haphazard) of human habitats on urban floodplains. These include legal (housing and commercial buildings) as well as illegal habitats (e.g. squatter settlements). Rivers in developing countries are generally constricted and development literally comes to the rivers' doorstep, i.e. up to their banks. There is no buffer zone or river reserve leaving rivers no room to manouevre. This has reduced their drainage capacities somewhat. Furthermore, rapid urbanisation of urban floodplains and upstream development of hill land have altered surface characteristics and significantly affected the hydrological cycle, particularly reducing the time in which rain drops enter the rivers and the volume of runoff (Chan & Wan Ruslan Ismail 1997). Consequently, human habitats along rivers can be said to have degraded the environment leading to increasing flood hazards of more severe magnitudes. Because flooding causes significant property damage, loss of business, inconvenience, stress and sometimes loss of life, its impact on urban living is devastating. Flooding is undesirable and inevitably a form of unsustainable development. Policy makers ought to understand the complicated relationships between development, urbanisation and flood hazards and plan/manage a balance between them with a view to reducing flood hazards. With the right balance, rivers and their corridors in urban habitats can be effectively managed/used for economic development, urban habitat development and flood mitigation. Human habitat in the form of squatter settlements in many cities in Malaysia has also contributed to a poor quality environment. Squatters do not have proper sanitation and discharge solid wastes and greywaters straight into rivers. Squatters are also responsible to a large extent of illegal dumping of all sorts of wastes into rivers, though there are other culprits as well. Due to their role in degrading the river environment, squatters are at least partially responsible for causing river flood hazards (Radiah et al. 2004). Perhaps the most convincing argument linking flood hazards with human habitats is that almost all the major cities and towns in Malaysia are either located on the bank of a river or on its floodplain (Chan 2002b). Some of the major examples are Kuala Lumpur (Kelang and Gombak rivers), Kota Bharu (Kelantan River), Ipoh (Kinta River), Kuala Terengganu (Terengganu River), Pekan (Pahang River), Georgetown (Pinang River), Alor Setar (Kedah River), and Teluk Intan and Kuala Kangsar (Perak River). Loss of forest cover in Penang Island is claimed as the major reason for increased soil erosion, landslides, water pollution, siltation and floods (Chan et al. 1999).

Major lessons can be drawn from great floods of recent decades. Floods impact heavily on vulnerable communities in human habitats (Parker et al. 1997; Chan 2000). Though developed countries such as the UK, USA and Japan have the resources and know-how to see to it that reafforestation of forests and restoration of wetlands proceed smoothly, it may not be so smooth sailing for developing countries like China and those in South-east Asia and South America who depend on forestry and farming. The survival of the ambitious reforestation and timber production cutback plan, may well depend upon how the economies of these countries perform – the poorer they are, the more likely they will go back to cutting forests for export. Clearing of

forests and wetlands for human habitats is another serious issue as it reduces nature's capacity to cope with floods. The major floods in China in 1998 were attributed to loss of natural habitats due to conversion to habitat and farming (Cai et al. 2001). In the USA, it was reported that destruction of wetlands due to urbanisation, levee building, deforestation or other human land uses have caused silting and made flooding much worse. Flooding has become much worse in recent decades all along the Gulf Coast due to human encroachment, chief of which is habitat development. Building human habitats has meant that the natural water flows are impeded, with the gradual straightening of the Mississippi River, and the draining wetlands (Usborne 2005). When Hurricane Katrina hit New Orleans in 2005, many attributed it to global warming. But many scientists say the real problem is what has been wrought on the ground in the Gulf Coast region itself, as most serious of all may be the loss of the wetlands. Wetlands, along the edges of rivers and near the coast itself, are vital for absorbing and storing floodwaters. Their destruction meant that the urban human habitat of New Orleans was left without a natural defence against storm surges such as the one generated by Katrina, leading to massive damage and loss of life (Usborne 2005).

Effects of a warming world are also severely felt in the *Cryospheric environment* whereby melting of ice sheets and expansion of warm oceans has already led to sea level rise. With deadlocks in climate talks on the Kyoto Protocol and recently in Copenhagen, it is expected that global temperatures will continue to rise leading to rise in sea levels world-wide. This will spell disaster for coastal habitats (both human and natural) as the seas will inundate low lying areas. It is expected that low-lying countries such as Bangladesh and Mauritius and small island states such Kiribati, Tonga and Tuvalu will be completely flooded. Consequently, in all probability, all human habitats in these low-lying areas will be destroyed. This is the real threat of a melting cryosphere on the coastal environment. Current sea level rise has occurred at a mean rate of 1.8 mm per year for the past century (Douglas 1997). Measurements by satellite show that sea levels have increased at faster rates, between 2.8 ± 0.4 to 3.1 ± 0.7 mm per year (1993–2003) (Chambers et al. 2003). Huq et al. (2007) estimated that about 634 million people live in coastal habitats within 9 m of sea level, and that about two thirds of the world's urban habitats (cities) with over five million people are located in these low-lying coastal areas. To put sea level rise in perspective, a sea-level rise of just 0.4 meter in the Bay of Bengal flood about 11 % of the Bangladesh's coastal habitats, creating 7 to 10 million climate refugees. In the case of Malaysia, sea level rise (depending on the severity) will flood many coastal cities either entirely or in part.

The Biospheric Environment – The biosphere is the place where humans and all living things inhabit. Ideally, all species should co-exist in harmony to ensure the continued existence of all. Ironically, however, the over-bearing power and influence of one species, homo sapiens, has favoured the survival of this species at the expense of all other species. Not surprisingly, therefore, natural habitats have been changed into human habitats at lightning speed, bringing about extinction of many natural species at alarming speed http://www.sciencedaily.com/releases/2002/01/020109074801.htm 3/5/10). Not withstanding the importance of such biodiversity loss, destruction of the natural biosphere such as forests has categorically increased incidence of floods in recent decades in many countries, particularly the USA, China and Malaysia (Cai et al. 2001; Chan 2009) have been largely attributed to loss of natural water retention systems such as forest ecosystems. Research has shown that natural undisturbed forest systems are the best forms of flood defence. Furthermore, rehabilitated forests, though not as effective as their natural counterparts, are also capable of reducing flood hazards. Forest systems, in contrast to urban systems, are stable and possess inherent mechanisms and their own ways and means of maintaining the hydrology of an area. In the USA, riverine forests and floodplains, also commonly known as wetlands, are nature's way of controlling floods but their replacement by urban and agricultural land use has resulted in increasing flood hazards. In China, loss of upstream forests and lakes/wetlands has also resulted in greater incidence of floods. Forests and wetlands also control floods by retaining rainfall at source, a concept only

recently adopted by flood control agencies in Malaysia. Multi-structured densely forests intercept a significant amount of rainfall and can regulate the flow of rain outside the system. Important processes such as interception, throughfall, at-source storage, infiltration and vegetated surface impedance, reduces the flow and prolongs the rain from reaching the river. Least interception occurs when forests are thinned and exposed due to clearing, while maximum interception occurs with dense virgin forests made up of evergreen trees. Forests hold the water and release it slowly. When forests are cleared or destroyed, all the rain water gets into rivers at a relatively rapid time, resulting in flash floods. The concentration of water into the main river channel over a much shorter period of time dramatically increases flooding. It is vital for engineers and all scientists to work with natural systems rather than against them. In this respect, there is a shift towards using natural systems to manage floods in the USA and China. In Malaysia the mandatory Manual for Environmentally Friendly Drainage which focuses on at-source retention of rain for all development projects and forest conservation programmes are employed to reduce floods (N.A. Zakaria et al. 2004).

In Malaysia, Chan and Wan Ruslan Ismail (1997) have emphasised the importance of conservation of natural habitats such as forests and mangroves as natural forms of flood control. Chan (1995b, 2002b, 2005b) has examined in detail flood hazards occurrence and have highlighted the role of vegetation in interception, runoff control and flood control. Chan (2003) emphasised the use of wetlands as natural forms of flood control. One of our major studies on sustainable development in Cameron Highlands, a largely forested area that also serves as water catchment, in recent years has indicated that the expansion of agricultural human habitats has caused, amongst other effects, siltation of rivers and general environmental degradation in the highlands (Barrow et al. 2008). Chan et al. (2004) documents how environmental characteristics of Pantai Acheh Forest Reserve in Penang Island, Malaysia can be degraded by encroaching human settlements. Chan et al. (2004) examined forest conservation and rehabilitation experiences from the USA, China and Malaysia and found that forests are crucial in flood control as well as for other ecosystem services[3] [Millennium Ecosystem Assessment (MEA) 2005].

Disturbance of the biospheric environment such as habitat encroachment, fragmentation, and eventual destruction has produced a plethora of other problems as well. Natural habitat destruction caused by human habitat encroachment is a leading cause of species endangerment/extinction. Habitat encroachment reduces the natural habitats (and food range) of animals forcing them to move into human habitats to look for food. This inevitably results in humans-animals conflict. In Malaysia, the loss of jungle and tiger prey have forced tigers to hunt for livestock as well as in some cases attack on villagers in human habitats adjacent to tiger habitats (Sheema Abdul Aziz 2009). Human-tiger conflicts have also occurred elsewhere such as the Russian Far East, India, Nepal, Bangladesh, Sumatra (Indonesia) (http://wwf.panda.org/what_we_do/endangered_species/tigers/tigers_threats/human_tiger_conflict/ 5/5/10). In the USA, human-alligators come into direct conflict in Florida as urban sprawl invades the state's wetlands (http://harmonyfl.com/lih/wildlife/conflict.htm 5/5/10). In Indonesia, illegal logging was claimed to be the greatest threat to the survival of orang utans, with human settlements a close second.

Most alarmingly, habitat encroachment by human habitats is responsible for the recent emergence of diseases like Ebola which is a real threat to humans. Intact habitats tend to inhibit the spread of infectious agents. Damaged, altered, and degraded habitats trigger the spread of

[3] Nature or natural ecosystems provide human society with a multitude of natural resources and natural processes that are vital for humankind's survival. Collectively, these benefits are known as *ecosystem services* and include natural resources such as clean drinking water, fresh air, fish and aquatic food, food plants and medicinal plants, as well as other intangible but important processes such as the decomposition of wastes. Despite being of utmost importance, these services are often not taken into consideration by humans.

new and existing diseases to humans. In the year 2005, the United Nations reported that the deadly Nipah virus, normally found in Asian fruit bats, is believed to have passed over to humans. Apparently, forest clearance for oil palm plantations have brought bats in contact with pigs, which later passed the virus to humans. More alarmingly, vector-borne diseases such as malaria and dengue fever escalate as a result of changes in the biosphere, especially when related to changes in micro-climate. And because urban human habitats such as megacities have such huge populations, any such disease epidemic would infect and possibly kill millions.

The Lithospheric Environment – Human habitats need land on which to build. Also, some human habitats are built into the land/ground as underground habitats. During the Vietnam War, the Vietnamese dug thousands of kilometres of underground tunnels to hide from and fight against the Americans. These underground tunnels also double up as underground living quarters or subterranean habitats (http://www.sustainablebuild.co.uk/Construction Underground.html (6/5/10). In some countries, extreme weather and other reasons have necessitated the building of underground habitats. Underground habitats have been around for thousands of years, mostly developed through mining and more recently through transport, housing and commercial industries. For example, the Channel Tunnel linking Britain to France, the London Underground, the British Library, and many shopping centres in London are all examples of underground buildings, though not all of them are used as habitats in the strictest sense. Hence, invariably, construction of these habitats will impact upon the land (lithosphere) negatively. Usually, construction of habitats will change the lithospheric environment as well as characteristics resulting in soil erosion, landslides and other mass movements. Generally, underground habitats produce less negative impacts on the environment compared to above ground habitats. However, both types of habitats have significant impacts on the lithospheric environment as earth is moved, added or disturbed. In the case of habitats on hill slopes and hill peaks, the habitat itself is already considered hazardous. Globally, there have been countless incidents of massive landslides that have buried whole towns and villages. On April 8, 2010, a torrent of mud dislodged by heavy rain ravaged a hillside slum near Rio de Janeiro, burying dozens of residents. The worst rains in 40 years, which started on Monday, triggered close to 200 mudslides that pulverized shacks in hillside communities, killing at least 180 people and leaving thousands homeless in and around Brazil's second-biggest city (http://www.scientificamerican.com/article.cfm?id=update-3-rio-rescuers-sco 6/5/10). The effects of Hurricane Stan that hit Mexico‘s Yucatan Peninsula on Oct. 4, 2005 caused severe landslides. In Guatemala, the worst damage centered around the department of Solola where mudslides buried entire villages. It was estimated that more than 1400 people were buried. In some villages the devastation was so severe that officials abandoned search efforts and declared some as graveyards (http://knightcenter.utexas.edu/knightcenternews_article.php?page=5078 6/5/10). In the Philippines, 181 people were killed in a series of landslides brought about by days of heavy rains (http://globalnewsblog.com/blog/2009/10/09/philippines-philippine-mudslides-floods-kill-more-than-160/ 6/5/10).

In Malaysia, our studies in landslides in relation to human habitats have revealed highly significant relationship between the two. Chan (2006) has studied issues and challenges of sustainable development in the Cameron Highlands, a highland habitat where towns and villages are built on steep hill slopes. He found that highland habitats built on steep slopes are hazardous as they are highly susceptible to soil erosion and landslides. Many landslides have occurred in Cameron Highlands involving not only property and agricultural damage, but also loss of life. Elsewhere in Malaysia, immense development pressures due to lack of land has forced developers to build on hill slopes and hill land. This has not only changed the environmental stability of slopes but also endangered inhabitants living in hill slope habitats (Chan 1998a). According to Chan (1998a), landslide hazards are increasing in rapidly developing Malaysia as human habitat construction on hill slopes is a case of economics versus environmental protection, with the latter losing out invariably. In Penang Island, lack of land has also resulted in habitat construction in hill land. Chan (1998b) examined environmental

hazards associated with hill land development in Penang Island and found that landslides are a major effect. There are many examples of a degraded hill slope environment that led to environmental disaster such as landslides. The Highland Tower disaster whereby an apartment building collapsed occurred on December 11, 1993, in Taman Hillview, Ulu Klang, Selangor that caused the deaths of 48 people and led to the complete evacuation of the other two blocks due to safety concerns. The apartment collapsed when 10 continuous days of rainfall led to a landslide. This is a classic case of building on hill slopes which backfired. On 20 November 2002, the bungalow of General (RtD) Tan Sri Ismail Omar collapsed due to a landslide also in Taman Hillview. Another hill area that has hogged the limelight is *Bukit Antarabangsa***,** a hillside township in Ulu Klang, Selangor which is dubbed the *Beverly Hills of Malaysia* because many famous Malaysian celebrities and artistes live there. On 15 May 1999, a landslide occurred near the Athenaeum Tower condominium, Bukit Antarabangsa, trapping many people in their homes. On 6 December 2008, another landslide buried 14 bungalows in nearby Taman Bukit Mewah. These two incidents are proof enough that the area has a high risk potential for landslide caused by a combination of high rainfall, steep hill sides, poor soil type/geological foundation and disturbance of the lithospheric environment (and biospheric environment – due to forest clearance) by habitat construction. However, it is not only the large scale disturbance of hill slopes due to massive building construction (such as condominiums) that trigger landslides. Examples in Malaysia show that even small scale building of human habitats, such as those by indigenous people can also degrade the hill slope environment leading to disaster. On 29 August 1996, a mudflow near Pos Dipang, an orang asli settlement in Kampar, Perak, buried and killed 44 people and almost an entire village built on the hill slopes. In another incident on 26 December 2007, two villagers were buried alive in a major landslide that destroyed nine wooden houses in Kapit, Sarawak.

CHALLENGES IN SUSTAINABLE HUMAN HABITAT DEVELOPMENT

In the past, humanity has been faced with challenges or food security, disease epidemics, wars and ethnic strive. While many of these challenges are still lurking in the corner in this new millennium, environmental challenges such as global warming, destruction of biosphere and loss of biodiversity, and sea level rise emerge as the most serious challenges. Now, humanity is faced with an entirely different set of challenges and opportunities than that from the "pre-urbanized" era. If humans can manage urban habitats/cities well, it will make all the difference in not only humanity's present ability to develop and prosper but to ensure that the habitats of future generations are not destroyed or degraded to such an extent that threaten human health and security.

As more than half of humanity now lives in urban habitats, one of the most obvious challenges is to find ways to harness the enormous potential of cities for development, while managing the environmental challenges posed by them. Historically (since 1976), the identified milestones in human settlements policies are as follows: 1976 (Vancouver, Canada) - United Nations Conference on Human Settlements (Habitat I): human settlements and urbanization appear on the international agenda; 1978 – establishment of United Nations Centre for Human Settlements (UNCHS), which later became United Nations Human Settlements Programme (UN-HABITAT); 1988 – adoption of the Global Strategy for Shelter (GSS) to the Year 2000; 1992 (Rio de Janeiro, Brazil) – United Nations Conference on the Environment and Development (UNCED): adoption of Agenda 21 and the popularization of the concept of sustainable development; 1996 (Istanbul, Turkey) – second United Nations Conference on Human Settlements (Habitat II): adoption of the Habitat Agenda and the Istanbul Declaration on Human Settlements; 2000 – Millennium Summit: Millennium Development Goals; 2006 (Vancouver, Canada) – 3rd World Urban Forum (UN-HABITAT 2007) State of the World's Cities Report 2006/2007.

The many challenges of sustainable habitat development or sustainable development as applied to cities are many. First, cities need to ensure that they can meet the needs of the present such as (i) *Economic needs* – These include access to adequate livelihood (includes minimum income or economic/welfare security when unable to work due to various reasons). (ii) *Social, cultural and health needs* – These include shelter or habitat that is healthy, safe, affordable and secure, within a healthy neighbourhood environment with all the basic amenities. (iii) *Political needs* - These include democratic freedom to participate in all forms of politics and in decision-making, especially that concerns one's habitat and its environment and neighbourhood, and the freedom for civil participation and political rights and respect and protection of the environmental (via legislation and enforcement). Secondly, sustainable development of human habitats should proceed without jeopardising/reducing the ability of future generations to meet their own needs (World Commission on Environment and Development 1987). Thirdly, cities should by all means attempt to minimise the use of waste of non-renewable resources. For example, this includes minimising the consumption of fossil fuels (e.g. in the domestic front, in offices, in commerce and industry, and most of all in transportation). Cities must attempt to use alternatives such as renewable resources, reduce use and minimise waste (e.g. practising the 5 Rs - reducing use, reusing, recycling, reclaiming and refraining from using). Fourthly, cities are cultural and historical depositories as they are rich in traditional, cultural, historical and natural heritage. The challenge is how best to conserve these while not forgoing development. The historic districts, parks and natural landscapes, and natural heritage that are endemic to certain cities provide city inhabitants with space for play, recreation and access to nature, not to mention green space and fresh air. Fifthly, cities must achieve sustainable use of renewable resources. This includes managing freshwater resources sustainably (reduce the water footprint to a minimum), minimising its ecological impact in terms of land area on which producers and consumers supply the city (i.e. keeping its ecological footprint to a minimum), wood products and biomass fuels. Finally, cities must manage their own wastes in a sustainable manner without dumping them elsewhere. Cities need to be responsible and keep their wastes within the absorptive capacity of local and global sinks. For example, the challenge is to ensure cities manage their solid wastes sustainably, whether the method employed is a landfill or an incinerator. Cities should also be able to maintain (and not overtax) the capacity of rivers to break down biodegradable wastes. Cities should also be able to manage/deal with persistent chemicals, including greenhouse gases, stratospheric ozone-depleting chemicals and other pollutants (Mitlin & Satterthwaite 1994).

According to Jamaluddin Md. Jahi (1999), the greatest challenge to sustainable development, be it for a nation, a city, or for the world, is to find a balance between development and environmental conservation. This is especially true for developing countries trying to play catch-up with the developed world. This sentiment is also mirrored by Chan (2004).

THE WAY FORWARD IN MANAGING HUMAN HABITAT DEVELOPMENT

A combination of realisation of environmental degradation, the environmental movement, and the rise of sustainable development have led to environmentally-friendly human habitats. To achieve sustainable development in human habitats, humans need to control urban growth, control population growth, illegal immigrants and proliferation of slums, ensure adequate (quantity) and appropriate (quality) housing, institute legislation for disaster-resistant habitat structures, find funds and technology for early warning system of major risks to habitats, find funds for mapping of environmental hazards in human habitats, set-up disaster/emergency management system/plan for urban habitats (i.e. cities), mobilise politicians to commit to environmental management of human habitats (air, water, land, energy) vis-à-vis economic development, teach politicians to "adjust their sails rather than to try to change the wind" and "to be proactive rather than reactive" in managing and developing "sustainable cities", revert

from “centralisation” to “decentralisation” of human habitats, and to convince rural folks that “there is better quality life” outside urban habitats or cities.

Governments and the international community should act to ensure the sustainability of the primary human habitat, i.e. the cities. There are many successful examples of sustainable human habitats all over the world. Despite all the negative effects discussed in this paper, cities and urban habitats need not be the “polluter” but can be turned around to be the “solution” to all these environmental problems. The solutions to some of the environmental problems of the cities are closely related to human comfort and health. Some solutions are to be found in appropriate mitigation efforts against climate change and environmental disasters. If left unchecked, the environmental effects could escalate with runaway rapid urbanization impacting on climate and global resources. This in turn would have a whiplash effect as a warmer climate and degraded environment and maimed resources would then impact negatively on human settlements, including especially urban habitats such as cities. The future of human habitats, especially urban human habitats, would be characterised by environmentally friendly habitats that have the minimum impact on their environments and resources. There is a need to start designing and building urban habitats (and related structures) in harmony with the atmospheric (climate), hydrologic, biospheric and lithospheric environment. This means the need to ensure that the habitats incorporate only energy and water efficient infrastructures. In this way, it is possible to mitigate many of the negative impacts on the environment due to urbanization at various levels from the local to national and global. Human habitats, just like industrial or agricultural structures, should be constructed with clean technologies, that are affordable and appropriate to the local environment so that they are comfortable as well as also improve the lives of inhabitants.

Perhaps the ideal human habitat that has minimal impact on the environment is the so-called ecovillage. This is a planned village habitat which aims to be more socially, economically and ecologically sustainable. Usually, the village is small, with a population of between 50 to 200 individuals or about ten to fifty families. However, some ecovillages can be up to about 2,000 individuals. In an ecovillage, the inhabitants share similar aims in life and practise similar lifestyles. They are usually bound by similar or shared environmental, social-economic, ecological and cultural-spiritual values (Van Schyndel Kasper 2008). Ecovillage inhabitants believe that ecovillage is the only way to address environmental disaster, reverse the breakdown of traditional forms of community, change wasteful consumerist-lifestyles, and restore natural habitats and ecosystems. Although small in scale, when ecovillage are combined, their effect can be significant. One example is the Global Ecovillage Network. Gilman (1991) defined an ecovillage with the following characteristics: human-scale; full-featured settlement; with human activities harmlessly integrated into the natural world; supportive of healthy human development; and can be successfully continued into the indefinite future. Gilman (1991) contends that there is hardly anything more appealing - yet more elusive - than the prospect of living in harmony with nature and with each other.

Similar to the ecovillage concept is the ecotown. One good example is the Kitakyushu Ecotown. In the 1960s, rapid economic development projected Kitakyushu into one of the four largest industrial zones in Japan, but this was achieved at the expense of the environment as air and water were grossly polluted resulting in urban habitats “unlivable”. The city of Kitakyushu founded the Environmental Pollution Control Bureau (currently the Environmental Bureau) and established 'The City of Kitakyushu Pollution Control Ordinance,'. In addition, there was a large-scale urban greening movement in accordance with the 'Green Kitakyushu Plan.' These movements were highly successful and restored Kitakyushu from a polluted urban environment back to a clean environment. It is an example of a city transformed from a 'Gray city' to a 'Green city' (http://www.city.kitakyushu.jp/ 8/5/10). Kitakyushu has also drawn up the 'Kitakyushu Ecotown Plan,' which emphasizes the promotion of environmental and recycling industries by involving all its urban inhabitants. The Ecotown Program aims to 'Use all waste as material for other industries, reduce waste as much as possible (zero emission)' and foster a

resource recycling urban habitat society. In the Ecotown, there is recycling of electric appliances, automobiles, plastic bottles and other recyclable wastes, etc. Furthermore, many facilities are conducting research and development on the most advanced waste disposal and recycling technologies, with the cooperation of enterprises and universities, and local inhabitants.

Perhaps the most famous of urban habitats that comes close to being declared a sustainable urban habitat is the city of Curitiba in Brazil. Curitiba demonstrates to the world how a sustainable habitat should be. Since air pollution is the primary problem in most cities, this city sets out to achieve sustainable transport. Curitiba is able to integrate sustainable transport considerations into the business sector, infrastructure development, and local community development. The city's first Master Plan in 1965 had its main goals of limiting central area growth. The plan also aimed to provide economic support for urban development via a model of local community self-sufficiency by providing all city districts with adequate education, health care, recreation, and park areas. Most of all, the plan called for the integration of traffic management, transportation, and land-use planning on the basis of sustainable development. So efficient is it public transport system that Curitiba's buses carry 50 times more passengers than they did 20 years ago, but people spend only about 10 % of their yearly income on transport. People also rarely use their cars resulting in the city's gasoline use per capita being only 30 % below that of eight comparable Brazilian cities. Other results include negligible emissions levels, little congestion, and an extremely pleasant living environment (http://www. dismantle.org/curitiba.htm 8/5/10).

CONCLUSION

Human habitats have come a long way since homo sapiens lived in caves. However, humans now have a tendency to prefer living in urban habitats. Hence, rapid urbanisation and the incessant expansion of megacities with very dense populations are among the most significant transformations of the 21st century. Urban human habitats have hitherto been blamed for all the environmental woes in urban areas as many cities, especially in developing countries, continue this trend of degrading the environment. However, human habitats need not necessarily produce only negative effects on the environment. In an age of sustainable development, green technology and educated and environmentally sensitised human populations, urban human habitats can hold great promise for the protection, conservation and wise use of the world's natural resources. This is because urban habitats have the ability to support huge populations and hence can effectively limit their impact on the natural environment. As more than half of humanity now lives in urban areas, urban human habitats/settlements should therefore be at the centre of concern for sustainable development. Urban habitats are essential for social and economic progress and, increasingly should play a pivotal role in environmental protection in order to ensure a good quality of life for urban dwellers. And because urban areas depend on their rural counterparts for food, water and other resources, humans are living in an increasingly interdependent world, and it is crucial not to degrade the environment on which both urban and rural populations depend on.

Sustainable human habitat should not solely be a government responsibility nor should it be that of international organisations such as the UN. Sustainable human habitat must be achieved at the local level, and solutions found locally. Global population will further expand from the 6 billion now to some 9 billion by 2025. Such a large increase can only be absorbed and sustained in cities as there is no way rural areas can absorb the additional three billion people. This is due to the lack of habitat, amenities and infrastructures and the fact that rural areas cannot support them without devastating environmental consequences. Hence, like it or not, cities are here to stay and people are pouring in by the millions. Urban human habitats are the world's future and if they are managed sustainably, environmental effects can be minimised and they can be made liveable. The ecovillage is one good example.

Cities, however, cannot offer every folk a home. Even the largest megacities cannot provide housing for all. Hence, some 100 million people living in cities, most of them women and children, are homeless. It is also estimated that at least 600 million people live in shelters that are life or health threatening in developing world cities, areas known as slums, squatter colonies, ghettos, or shanty town. In order to achieve sustainable human habitat development, these slums, or whatever we call them, need to be erased from the surface of the earth or at least improved to such an extent that they resemble a human habitat. A novel way to improve human settlements such as slums is to identify the "Best Practices" for urban development or re-development projects for slums. The criteria for these "Best Practices" in cities should incorporate the following: (i) Cost Effectiveness and Affordability; (ii) Minimal Environmental Impact; (iii) Smart-Partnerships between Government, Industry and Civil Society; and (iv) Sustainability. In the final analysis, sustainable human habitat is a place where all people have adequate shelter, basic services and amenities, a healthy and safe environment, education, recreation, and reasonable employment that is freely chosen.

The good news is that there is a recent emergence of sustainable habitat development in the form of environmentally-friendly human habitats. However, to achieve sustainable development in human habitats, humans need to control urban growth, control population growth, illegal immigrants and proliferation of slums, ensure adequate (quantity) and appropriate (quality) housing, institute legislation for disaster-resistant habitat structures, develop technology for early warning system of major risks to habitats, implement mapping of environmental hazards in human habitats, set-up disaster/emergency management system/plan for urban habitats (i.e. cities), mobilise politicians to commit to environmental management of human habitats (air, water, land, energy) vis-à-vis economic development, teach politicians to "adjust their sails rather than to try to change the wind" and "to be proactive rather than reactive" in managing and developing "sustainable cities", revert from "centralisation" to "decentralisation" of human habitats, and to convince rural folks that "there is better quality life" outside urban habitats or cities. Most of all, future human habitats should be modeled and developed as "eco-habitats".

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