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To cite this article: Nigel K. Downes & Harry Storch (2014) Current Constraints and Future Directions for Risk Adapted Land-Use Planning Practices in the High-Density Asian Setting of Ho Chi Minh City, Planning Practice and Research, 29:3, 220-237, DOI: 10.1080/02697459.2014.929835

To link to this article: https://doi.org/10.1080/02697459.2014.929835

Published online: 24 Jun 2014.

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ARTICLE

Current Constraints and Future Directions for Risk Adapted Land-Use Planning Practices in the High-Density Asian Setting of Ho Chi Minh City

NIGEL K. DOWNES & HARRY STORCH

Abstract
The need to integrate adaptation efforts into land-use planning policies has been only recently recognized in Ho Chi Minh City. The city’s latest planning guidance addresses both flooding resilience and mitigation of urban heat. This paper outlines the development contexts and the current barriers for adapted land-use planning within the city. The key challenge for land-use planning is communicating the important functions and services of open and natural urban spaces and effectively guiding the mainly individual developer-driven development. As the realization of non-structural adaptation measures is in strong contrast to the current market-driven private and short-term developer interests, the main development trajectories are questioned and synergies identified.

Keywords: climate change; adaptation; urban land-use planning; Ho Chi Minh City; Vietnam

Introduction
The emerging megacity of Ho Chi Minh City, formerly known as Saigon and often abbreviated as HCMC, is considered a hotspot of vulnerability to the impacts of climate change (Nicholls, 1995; Dasgupta et al., 2007; Nicholls et al., 2007; Carew-Reid, 2008; Webster & McElwee, 2009; ADB, 2010; Birkmann et al., 2010; Fuchs, 2010; Fuchs et al., 2011; Hanson et al., 2011). Ho Chi Minh City is located in the Dong Nai River system, northeast of the Mekong delta and only 57 km up-river from the South China Sea. Within the city, the need to adapt to the multiple stressors of rapid urbanization, hydro-meteorological hazards and future climate change have recently become increasingly evident.

This paper highlights unique insights gained over the course of a 5-year research project undertaken in collaboration with Vietnamese counterparts to assess the current and future risks to the city and develop sustainable adaptation measures. Working within the research project Integrative Urban and
Environmental Planning for Adaptation of Ho Chi Minh City to Climate Change\textsuperscript{1} funded from 2008–2013 as part of the research programme ‘Sustainable Development of the Megacities of Tomorrow’\textsuperscript{2} by the German Federal Ministry of Education and Research, we evaluated the city’s current planning capacity to reduce and manage risk, with the ultimate aim to mutually develop options for more effective land-use planning.

This paper focuses upon the context and the importance of HCMC as a hotspot of risk, outlining the structure and process of land-use planning in HCMC and the role and responsibilities of the Department of Natural Resources and Environment (DORNE) and their planning functions in relation to climate change adaptation. Our findings are gained from our research results in the mutual development of block level indicator sets and ultimately land-use planning recommendations and from a series of in-depth unstructured interviews conducted over the 5-year period with key staff from both DORNE and other departments involved in both urban development and land-use planning practices in HCMC. Throughout, we emphasize the importance of urban monitoring and the understanding of the relationships between demographic, structural and land-use trends over time. We subsequently present recommendations for future directions in land-use planning.

The Spatial Dynamics of Ho Chi Minh City

The recent transformation of HCMC during the last twenty years has been intrinsically related to the process of rapid industrialization following the Doi Moi reforms of 1987. For Vietnam, the opening up of its markets, the shift to an export-driven economy and globalization led to remarkable economic growth and a reduction in poverty levels. The economic growth has to the greater extent been urban-based and manifested in the rapid urban expansion of HCMC beyond its juridical limits, via both in-migration and the incorporation of already densely populated rural areas into its administrative boundaries (Figure 1).

According to official population forecasts, HCMC will become a megacity and reach a population between 10 and 12 million by 2020 (MOC, 1998; ADB, 2010). The rapid economic expansion and changing of residence laws, not only in HCMC but Vietnam as a whole, placed the country on a similar path as other Asian tiger

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1}
\caption{The development of the built-up extent of HCMC for the period from 1989 to 2007. \textit{Source: Author’s own.}}
\end{figure}
economies, with a large net-migration pouring into cities such as HCMC, seeking work and straining the existing infrastructure (UN-Habitat, 2008). Whilst the current urbanization level in Vietnam is far below those of developed countries as well as many of its Asian peers (see Table 1), social and economic developments are, to a great extent, equivalent to urbanization. As the national economy becomes more and more urban-centred, the current urbanization trends for HCMC and Vietnam are expected to continue well into the future (UNESA, 2004; Yeung, 2011).

The total administrative area of HCMC is about 2,095 km², divided into 24 districts. The division of districts based on hierarchy includes 12 urban districts (districts 1 through 12), 7 rapidly urbanizing peri-urban districts (Go Vap, Tan Binh, Tan Phu, Binh Thanh, Phu Nhuan, Thu Duc and Binh Tan) and 5 mainly outer rural districts (Cu Chi, Hoc Mon, Binh Chanh, Nha Be and Can Gio). The spatial profile of urban population changes for the years 2005–2011 is seen in Figure 2. According to official statistics, in mid-2011, it was estimated that the population of HCMC was 7.52 million (GSO HCMC, 2012). Of these, 81.8% of the residents were classed as urban and 18.2% as rural, with 52% or 3.94 million residing in the urban districts in inner and central HCMC, 29% or 2.20 million living in the peri-urban districts (adjacent to the inner urban districts, but differentiated because of their somewhat lower density) and 18% or 1.37 million in the outer rural districts. The urban districts, making up the inner core, are particularly dense, with an average population density of more than 28,000 pers./km².

Historically, the high density development of the inner core was principally a manifestation of the necessity to adapt to the dominant flood risk situation of the city (Bolay et al., 1997; Bolay & Ngoc, 1999). Originally founded on relatively higher grounds, the city has increased in density through the infilling of open spaces and the redevelopment and extension of existing building footprints. Yet recently, great concern has been raised at the city’s rapid expansion into the lower-lying and former wetland surroundings. The vast majority of HCMC’s administrative area is distinctive due to its low altitude and general flat topography. The terrain elevation varies from 4 to 32 m AMSL in the north-northeast, to the southern coastal lowlands at 0 to −1 m AMSL. In total, 70% of the entire urban area of HCMC is below 2 m AMSL. Furthermore, 99% of the southern rural districts of Nha Be and Can Gio are below 2 m AMSL, whilst in

<table>
<thead>
<tr>
<th>Country/region</th>
<th>Urban population as percentage of total population in 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>46</td>
</tr>
<tr>
<td>Japan</td>
<td>66</td>
</tr>
<tr>
<td>Mongolia</td>
<td>62</td>
</tr>
<tr>
<td>Cambodia</td>
<td>20</td>
</tr>
<tr>
<td>Indonesia</td>
<td>44</td>
</tr>
<tr>
<td>World</td>
<td>51</td>
</tr>
<tr>
<td>Developed countries</td>
<td>75</td>
</tr>
<tr>
<td>Asia</td>
<td>42</td>
</tr>
</tbody>
</table>

contrast, only 38% of the two northern rural districts Cu Chi and Hoc Mon are below 2 m AMSL (Storch & Downes, 2011).

Figure 2 highlights that in contrast to the underlying conditions, between the years 2005 and 2011. The three peri-urban districts of district 7 (+62%), 12 (+50%) and Binh Tan district (+51%), and the three rural districts of Nha Be (+49%), Binh Chanh (+49%) and Hoc Mon (+44%) show the highest rates of population growth. Furthermore, the mapping of changes in composition of the dominant HCMC building archetypes between years 2005 and 2010 highlight the dynamic modifications and transition in the urban fabric (Table 2 and Figure 3).

The comparison of the urban structural indicators of ground coverage and floorspace between the years 2005 and 2010 seen in Table 3 highlights the ongoing densification trend. With the exception of more informal building types, all building types significantly increase in both built-up coverage and in floorspace. This trend is worrisome from an environmental standpoint, as without planning interventions, such increased densities fail to provide for adequate open space provisions.

Storch and Downes (2011) carried out an assessment of HCMC’s urban development strategies against the impact of climate change and derived current land-use from the detailed mapping of urban structure types for 2010. Figure 4 shows the urban structure types in the study classified as non-built-up or built-up structures overlain by a digital elevation model. Figure 4 clearly demonstrates that the current urban form and structure of HCMC has been strongly influenced, and to some extent constrained, by its underlying natural conditions. The few

---

**Figure 2.** Spatial distribution of changes in population between 2000 and 2011 in HCMC.  
*Source:* Author's own.
<table>
<thead>
<tr>
<th>Building type</th>
<th>Coverage (ha)</th>
<th>Floor space (ha)</th>
<th>Height (flr)</th>
<th>Change (%)</th>
<th>2005 (ha)</th>
<th>2010 (ha)</th>
<th>Change (%)</th>
<th>2005 (flr)</th>
<th>2010 (flr)</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apartment</td>
<td>113</td>
<td>560</td>
<td>6</td>
<td>57</td>
<td>120</td>
<td>890</td>
<td>57</td>
<td>5.0</td>
<td>5.3</td>
<td>6</td>
</tr>
<tr>
<td>High-rise</td>
<td>19</td>
<td>120</td>
<td>63</td>
<td>6</td>
<td>13</td>
<td>223</td>
<td>6</td>
<td>7.9</td>
<td>8.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Detached</td>
<td>2,149</td>
<td>5,803</td>
<td>10.3</td>
<td>10.9</td>
<td>2,824</td>
<td>5,890</td>
<td>10.9</td>
<td>10.4</td>
<td>10.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Semi detached</td>
<td>317</td>
<td>341</td>
<td>11.0</td>
<td>11.1</td>
<td>314</td>
<td>374</td>
<td>11.2</td>
<td>11.2</td>
<td>11.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Temp. and other</td>
<td>3,496</td>
<td>7,001</td>
<td>21.0</td>
<td>20.1</td>
<td>3,417</td>
<td>6,981</td>
<td>20.1</td>
<td>20.1</td>
<td>20.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Villas</td>
<td>893</td>
<td>1,504</td>
<td>17.0</td>
<td>17.0</td>
<td>897</td>
<td>1,777</td>
<td>17.0</td>
<td>17.0</td>
<td>17.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Wood-framed</td>
<td>39</td>
<td>160</td>
<td>21.0</td>
<td>21.0</td>
<td>45</td>
<td>226</td>
<td>21.0</td>
<td>21.0</td>
<td>21.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Markets</td>
<td>113</td>
<td>593</td>
<td>5.3</td>
<td>5.6</td>
<td>131</td>
<td>777</td>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Office building</td>
<td>113</td>
<td>593</td>
<td>5.3</td>
<td>5.6</td>
<td>131</td>
<td>777</td>
<td>5.3</td>
<td>5.3</td>
<td>5.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Source: Author's own.
remaining open spaces surrounding the extremely dense core—mainly agricultural land—have an elevation below the current high-tide level of 1.5 m AMSL. These spaces currently act as a natural blue and green belt, akin to flood risk zoning by prevailing topographic conditions. However, recent expansion into these areas has caused the degradation of valuable multifunctional natural areas in the urban periphery, channelling natural waterways, sealing surfaces to varying degrees, creating impermeable surfaces and increasing surface run-off. This has caused the creation of more hardscape features and the loss of space for water, including natural detention and retention areas and the alternation of the natural drainage systems and the urban hydrograph. The result is the growing exposure to risk for both populations and assets in existing settlements, which were once significantly less exposed, as well as the addition of new risks situated in recent developments in low-lying areas.

Drivers and Impacts of Changing Flood Risks

Flooding events are a major problem for HCMC and its planners (Storch et al., 2009). In recent decades, urban flooding in HCMC has become one of the most pressing issues with significant parts of the city already experiencing frequent
flooding. The city is currently incised by a dense network of rivers and canals of around 8,000 km in length, which account for 16% of the total area (Le Vo, 2007). The Saigon River, Dong Nai River, Nha Be River and Long Tau River flow through the city. The rivers and adjoining canals form a complex network that is affected by the tide. Often coinciding with annual rainfall peaks, a significant percentage of the city’s neighbourhoods regularly experience floods, due to a combination of tides, heavy monsoon rains and storm surge floods. The

<table>
<thead>
<tr>
<th>Land-use planning options</th>
<th>Description</th>
<th>Specific structural and non-structural land-use measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density control</td>
<td>Applying occupancy and density ceilings for permitted land uses</td>
<td>Limit occupancy load ground coverage and floor area ratios in high population density exposed to flooding. Desalting or surface coatings.</td>
</tr>
<tr>
<td>Site selection and development</td>
<td>Maintaining inappropriate land uses and development out of hazard areas</td>
<td>Avoid areas where development will increase the likelihood of risk or level of impact, including resettlement. Maintain development out of risk and extreme-risk zones. Flood proofing in medium to high risk zones.</td>
</tr>
<tr>
<td>Design and building regulations</td>
<td>Application of appropriate building controls</td>
<td>Building controls in terms of elevation, high foundation walls, stilts, setbacks, minimum lot size, sealing degree, depending on risk levels. Sustainable drainage systems, detention/retention ponds rainwater collecting and reusing, green roofs, facades, tree planting.</td>
</tr>
<tr>
<td>Protection of critical infrastructure</td>
<td>Critical facilities are ensured of their functionality during disasters</td>
<td>Construct overhead service lines. Protect water and sewer lines, extension and optimization of runoff and sewer system. Hard protection measure (i.e. dyke systems).</td>
</tr>
<tr>
<td>Open space preservation</td>
<td>Specific areas used for low intensity and low density use to minimize damage</td>
<td>Flood plains used only for urban agricultural use, avoid the development of additional settlement areas at risk of flooding. Designation and maintenance of riparian vegetation, conserve and protect the existing natural or near-nature water balance, including aorestation. Wetlands created as a means to absorb peak flows from floods: Establishment of suitable retention and detention areas.</td>
</tr>
</tbody>
</table>

Source: Author’s own.
occurrence of localized urban flash and pluvial flooding, following high intensity or prolonged heavy rainfall leading to overland flow and ponding, is common in many streets (Figure 5).

While occurrence of inner urban flood events is not a new phenomenon, the increasing frequency with which they are occurring maybe attributable to climate change (Phi, 2007; Downes et al., 2011; Storch & Downes, 2011). The dimensions of flooding are constantly changing due to the on-going rapid urbanization such as that shown in Figure 6. Figure 7 shows that following recent heavy investments in storm-water drainage upgrading and expansion, the number of flood-prone areas within HCMC, while remaining fairly constant between 2007 and 2009, was seen to decrease significantly in the inner-city districts (SCFC HCMC, 2011). In contrast, districts located in the urban periphery display an increase in the number of flood events during the same period.

Climate change will undoubtedly influence the future development path of HCMC. However, aside from presenting increased exposure, both urbanization and climate change create a multitude of opportunities to reassess development and consider how future growth can be more efficiently managed. The assessment of urbanization and climate change impacts offers a very dynamic window in which to steer future development and affect urban change, while the very nature of both phenomena stresses a need for a new emphasis to be placed upon forward planning.
Current Challenges for Adapted Land-Use Planning in HCMC

At the national level in Vietnam, the National Target Programme to Respond to Climate Change, approved in late 2008, intends to prioritize adaptation needs and requires all relevant sectors to mainstream adaptation in sectorial strategies, programmes, plans and decision-making processes at all administrative levels. The strategic objectives of the programme are to assess the climate change impacts on sectors and regions and to develop feasible action plans to effectively respond to climate change both in the short and long-term. Assigned ministries, sectors, provinces and cities have the task to develop and implement action plans in response to climate change including:

- Assess climate change impacts;
- Identify responding measures;
- Integrate climate change concerns into strategies, programmes and plans.

The National Target Programme has identified a list of tasks and projects for implementing the programme, including:

![Figure 5. Photograph of a localized flash flood event following heavy rainfall in Nguyen Duy Trinh Street, District 2 of HCMC on 1 October 2012. The cause of the serious flooding was two separate rainfall events of 60.6 mm and 76 mm coinciding with a high tide event of up to 1.5 m. Source: Author’s own.](image)
FIGURE 6. Photograph of the new residential area of Thao Dien Ward in district 2. Recent luxury villa and apartment extensions of the city into low-lying riparian areas of the city.

*Source:* Author’s own.

FIGURE 7. Number of flooding locations in the central and periphery districts of HCMC between 2003 and 2011.

Assess climate change intensity and develop climate change and sea-level rise scenarios; 
Develop and implement science and technology programs on climate change; 
Building capacity of organization, institution and policy on climate change; 
Awareness enhancement and human resources training; 
Enhance international cooperation; 
Develop a standard framework for mainstreaming climate change issues into development; 
Develop and implement action plans to respond to climate change.

The Ministry of Natural Resources and Environment (MONRE) has been designated the lead agency for climate change coordination in Vietnam, while the Ministry of Agriculture and Rural Development holds the overall responsibility for natural disaster mitigation and response. In addition, the Ministry of Construction is responsible for the country’s drainage systems and major public works, while the Ministry of Planning and Investment is responsible for social-economic planning and master planning, and the Ministry of Science and Technology is involved in climate forecasts.

At the city level where adaptation requires place-based approaches (Adger & Kelly, 1999; Cutter, 1996; Cutter et al., 2000; Turner et al., 2003; Walker et al., 2004; Bulkeley, 2006; Bulkeley & Kern, 2006), the HCMC authorities are overburdened with the social, economic and environmental challenges that are typical for the management, public servicing and resource allocation of an emerging megacity. Yet the city’s authorities responsible for planning are very much aware of the gravity of risk the city is facing and their moral responsibility for risk reduction. There is also considerable agreement that a change in the current system of planning and urban management is needed.

The importance of effective land-use planning as a strategy for adaptation (Campbell, 2006; Wilson, 2006; Davoudi et al., 2009; Hallegatte, 2009; Roggema & Dobbelsteen, 2009; Wilson & Piper, 2010; Storch et al., 2011; Hurlimann & March, 2012; Scott et al., 2013; Wamsler et al., 2013) and for better understanding of the relationship between future urbanization and disaster risks is known (Burby, 1998; Godshalk et al., 1998; Burby et al., 1999, 2000; Sudmeier-Rieux et al., 2013). Our research has been carried out in collaboration with DONRE. Ultimately, DONRE has the most crucial policy tools available for embedding adaptation to climate change, which is the task of determining the overall land-use and spatial zoning (DONRE HCMC, 2012).

The rate of transformation of HCMC highlights the grave challenges faced by DONRE in enforcing a more precautionary approach. While adaptation has appeared on the national agenda since 2008, it has made little impact on the development control and zoning of plans. The two most prominent barriers to the integration of adaptation measures into the current land-use planning system are mentioned in detail below.

Institutional Framework

Currently, there are a multitude of actors involved in urban planning and climate change response within the HCMC administrative system: socio-economic
development planning (Department of Planning and Investment), urban construction planning (Department of Construction, Department of Planning and Architecture), regional planning (Regional Planning Steering Committee and Southern institute for Regional and Urban Planning) as well as various additional sectorial planning agencies and departments and the Steering Committee for Flood Control and Disaster Prevention. DONRE is not only responsible for the provincial land-use plan, but also for approving district land-use plans and detailed area plans (ward, industrial zone or project level), the issuance and administration of land-use rights and their transfer, as well as, changes in land-use. DONRE has also the mandate to head and coordinate the cross-sectoral response to climate change in HCMC, the climate change action plan, in the appropriately named HCMC Climate Change Steering Board. It is also DONRE’s responsibility to review all other sector and spatial plans in the city with regards to their environmental sustainability and their effectiveness in meeting climate change adaptation requirements of the city.

Land-use planning in HCMC finds itself juxtaposed within a strongly hierarchical top-down system. Spatial plans are prepared at four levels of detail; land-use planning is orientated to socio-economic development planning, with land-use targets and designations for HCMC strictly set and allocated at the national level (specific targets stated in hectares for specific land-uses designations). The allocation and trickle down of too many rigid land-use targets from the higher levels, makes the city’s land-use planning inflexible and often not downscaled to local needs. At the same time, each actor and planning body has its own orientation and perception on the socio-economic plan. A lack of horizontal integration between these various actors is apparent. To further complicate matters, plans are compiled at different intervals and for different planning timeframes (up to 2020 or 2025 and with visions up to 2025 or 2030) with only subsequent adoption or synchronization. In theory, social-economic development planning should occur first and then orientate the ensuing plans; however, the timeframes of the plans vary widely and thus if there are inconsistencies with previously approved plans, revisions and supplements maybe proposed. Plans, even sector plans which are previously approved at the national level, often form the basis for later plans. For example, the current social-economic development plan of HCMC until 2020, with a vision to 2025, was only approved in 2013 (Decision No. 2631/QD TTg) with a timeframe of 10 years and a vision of 5 years, while the general construction planning of HCMC until 2025 was approved in 2010 (Decision No. 24/QD-TTg) with a timeframe of 15 years divided into three 5-year terms and land-use planning was approved in late 2013 (Decision No. 45/2013QH13). Regional planning was completed in 2010; transport planning was approved in 2007 and revised in 2013, and agricultural planning was completed in 2009. Nevertheless, short-term economic growth is set as a high priority in the socio-economic plan. As is the case in many cities, planners and decision makers mainly get rewarded for the securement of investment and not in the prevention of disasters or the prevention of development sprawling into low-lying lands and besides, often having more immediate infrastructural provision issues to content with.
Lack of Planning Relevant Information

While some institutional data exist to support the forecasting and assessment of climate change impacts, there is currently a lack of consistency across platforms, which restricts urban growth monitoring, plan compliance assessments, and the sharing of data between the different planning actors. To be useful for DONRE, information needs to be at a relevant scale, credible and useful and available in a timeframe for taking action (Amundsen et al., 2010). DONRE, through their land-use planning, are required to consider the impacts of climate change; however, there are insufficient studies and city-wide assessments on the impacts of climate change to provide inputs into planning. A lack of information has resulted in a failure to identify and implement policies and measures to address the risks posed. Furthermore, DONRE notes that an additional formidable challenge is a general lack of targeted tools and methodologies to instruct and inform decision-makers and advance implementation at the local level.

Future Directions

In the emerging mega-urban regions of Southeast Asia, both planned and unplanned urbanization into flood prone-areas appears to be an unavoidable consequence of socio-economic development (Bulkeley & Betsill, 2005; McGranahan et al., 2007; Hara et al., 2008; Bicknell et al., 2009; Adikari et al., 2010; Fünfgeld, 2010, 2011; Storch & Downes, 2011; Chan et al., 2012). Risks occur often not due to a lack of awareness, but seem to be an accepted consequence of maintaining current economic and social progress. As Garschagen (2013) and Garschagen and Krass (2010) highlight in dealing with climate change in conjunction with rapid transformations, urban planning is often reactive. To truly embed climate change considerations into land-use planning is an inherently complex decision-making problem, which requires a response to the information deficit and the careful assessment of the current decision-making process. HCMC demonstrates challenges in applying and embedding adaptation into an existing land-use planning and policy framework. The vigorous development of the city during the last 20 years has rendered many previous plans quickly obsolete by the rapid changes in population and higher income lifestyles.

For HCMC, effective proactive planning policies are required to stem the tide of increasing land consumption in the surrounding high-risk flood-prone areas. Here, without delay, urban containment policies should be considered as a swift adaptation approach. Effective control of planning is needed, i.e. planning restrictions (as well as to some extent building regulations) and the integration of adaptation measures into urban development and land-use planning is essential for managing risks. Table 3 outlines the structure and non-structural land-use planning options and measures in response to solely flood risks. Land-use planning designations can influence the location, type, design, quality and timing of development. Through the maintenance of protective features of the natural environment such as water retention areas, mangrove forests and cold air generation areas, potential risks can be lessened or absorbed. Furthermore, zoning
instruments in plans can designate development in both safe and suitable locations, building resilience and reducing episodic and regular risks prevalent in HCMC.

Successful land-use planning depends heavily on how well the current and probable future risks are understood. For HCMC, the inherent complexity of risks and vulnerabilities require improvements in the use of spatial information, in order to identify hazard patterns, vulnerabilities and risks at a scale that can provide guidance for planning. In the future, HCMC’s land-use planners will play an increasingly important role though risk adapted land-use planning to review existing plans and policies, control development in high-risk areas and initiate climate conscious urban regeneration and climate conscious new development, as well as the provision of building standards, early warning systems and emergency response plans. The spatial planning framework and subsequent urban planning decisions, as currently applied, fail to attach ample importance to the physical exposure and the rate of urban growth associated with the risk of disaster losses. Adapted land-use planning in HCMC has to shift towards the evaluation of land conditions and urban development potentials in a more spatially explicit manner.

The reorientation of land-use planning, by focusing new developments away from the low-lying areas, identifying where current developments should be removed or exchanged for less flood-sensitive land-uses and safeguarding natural mitigating functions, will require a much more spatially focused effort and explicit zoning and protection. New development should be located on land appropriate for building, avoiding low-lying wetlands. The urban fabric of HCMC was built with due consideration of the prevailing conditions of flood-risks, and as the city has grown, partial ‘hard solutions’ have been frequently implemented. Past developments of these have often interrupted natural flooding processes, removed buffering ecosystem components, covered large areas with sealed surfaces and increased runoff and reduced natural storage capacities and interrupted potential flow paths. The current and future city will ultimately require a combination of ‘soft’ (spatial planning) and ‘hard’ measures (flood defences) to manage the increasing risks of sea-level rise (MONRE, 2009; Storch & Downes, 2012).

Conclusion

Land-use planning is one of the most influential instruments towards climate change adaptation. For HCMC, the rapid pace of urbanization over the past two decades has undoubtedly placed a huge burden on the local authorities and has meant that planning decisions have not always been made with sufficient attention to hazard exposure.

Ultimately urban resilience and exposure are dependent upon the choices that are made regarding which structure types to build, their location and arrangement and the local urban context. Over the coming decades, in light of the underlying demographic structure of Vietnam, the strong rural-urban pull of HCMC and the government’s own development targets, a significant amount of further urban development will be required. As the built environment has a design life of over 80 years and settlement patterns and urban form often even far greater longevity, the legacy of these developments will continue to impact the environment and ultimately shape the spatial pattern and long-term vulnerabilities for decades to
come. The need to formulate suitable adaptation policies and spatially explicit zoning regulations is apparent, and it is therefore of highest importance to plan in an integrated manner from the outset. Responses need to address existing climate-related impacts in the first instance via no regret measures that will also help to build resilience in the longer term. Although planning alone is simply not enough. Within its multi-stakeholder environment born out of conflicting interests, land-use planning requires more than ever science-based information to formulate spatially explicit adaptation measures to climate change. Understanding the drivers, opportunities and barriers affecting change and the implementation of mitigation and adaptation measures is crucial to reduce further impacts and to adapt to on-going changes.

Acknowledgements

The contribution is based on results of the research project ‘Integrative Urban and Environmental Planning for Adaptation of Ho Chi Minh City to Climate Change’ which is funded as part of the research programme ‘Sustainable Development of the Megacities of Tomorrow’ by the German Federal Ministry of Education and Research. The authors would like to express their gratitude to Le Thanh Hoa and Thong Nhat Tran who partly supported the geoprocessing.

Notes

1. HCMC Megacity project see website: http://www.tu-cottbus.de/projekte/de/megacity-hcmc/
2. Future Megacities research programme see website: http://future-megacities.org/

References


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