An aerial photograph of a crowded beach. The top half of the image shows the sandy shore with numerous people, some sitting on towels, others standing. A large red beach umbrella is prominent in the upper left. Several yellow kayakers are visible in the shallow water. The bottom half of the image shows the ocean with gentle waves washing onto the shore. The title 'Sustainable Coastal Design and Planning' is overlaid in large white text across the middle of the image.

Sustainable Coastal Design and Planning

edited by Elizabeth Mossop

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Preface

This book originated from the experience of living in Louisiana during Hurricane Katrina (and subsequently Rita, Gustav, Ike, Lee, Isaac, and so on) and its aftermath in New Orleans and the Gulf Coast. Trite though it may be, it profoundly changed my understanding of the potential impacts of climate change and gave me an education on the cultural dimensions of disaster resilience. While I was personally little affected, people I knew lost close family and friends, their houses and all their possessions, jobs and livelihoods, and the entire fabric of their lives. The experience of spending time in familiar, yet totally devastated, landscapes post-disaster and seeing the intimate debris of people's lives, is one that forever changes your understanding of the fragility of existence.

In the 12 years since the storm, I have been struck by the unevenness of the region's recovery. For some it has brought new life and opportunity and for others the exacerbation of ongoing poverty and dysfunction. The post-Katrina environment has been rich with exploration of what it means to live with uncertainty, and, for those interested in landscape interventions of all kinds, fruitful speculation about future strategies.

My involvement in coastal resilience was initiated by conversations with coastal ecologist Robert Twilley at Louisiana State University (LSU), after his collaboration with planners and designers in the first coastal masterplan process (in 2007), he opened his ideas to how these disciplines approach problem solving. Like many in recent years, Twilley was struck by the studio methods and the creative processes used in the development of planning and design strategies. We then worked together in the establishment of the Coastal Sustainability Studio (CSS) at LSU. The CSS was conceived as a trans-disciplinary design laboratory to develop new strategies for coastal settlements that reduce risk to social, economic, and natural resources. Twilley has continued to lead the studio. Its other board members from 2008 until my departure at the end of 2015 were Clint Willson (civil engineering), Jori Erdman (architecture), John White (coastal ecology), studio director Jeff Carney, and assistant directors Lynne Carter and Mary Bergeron.

The CSS and its many and varied collaborations provided a fertile testing ground for ideas of resilience, for ways of communicating complex coastal issues, and for design speculation about future strategies. Community resilience projects included "River to Bayou: Restoration and Resilience—The Central Wetland Unit and the Lower 9th Ward" and the "Louisiana Resiliency Assistance Program." The issues of visual communication were extensively explored in CSS projects for the Coastal Protection and Restoration Authority and for the Center for River Studies Exhibition Design. Design speculation was a theme for the CSS from the beginning when an early river diversions project, "In the Mississippi Delta: Constructing with Water" became an exhibit for the 2010 Venice Biennale. My colleagues in the Coastal Sustainability Studio and the many faculty and students involved provided a productive and sustained collaboration over many years and gave me the opportunity to initially develop the ideas behind this publication.

From 2012 to 2015, I also served as an expert in regional landscape and planning issues on the technical advisory panel for the Changing Course Design Competition run by the Environmental Defense Fund and the Van Alen Institute. Competing teams were asked to develop 100-year visions for restoring and sustaining Louisiana's Lower Mississippi Delta for the people, communities, and industries that call the region home. The experts of the

technical advisory team and the participants in the three finalist design teams provided a wealth of insights, as well as opportunities for the testing of ideas and strategies.

Through practice with Spackman Mossop Michaels, I have also had the opportunity to be involved in the planning and design of numerous projects in New Orleans, Baton Rouge, and across the Gulf Coast region. Many of these site investigations have involved the development of new strategies for increasing urban and coastal resiliency. My ongoing collaboration and conversation with business partner Wes Michaels has been particularly important in developing the ideas behind this work.

Book contributions are from colleagues involved in all of these endeavors and from the conversations that have come from them. I would also like to thank my colleagues at the University of Technology in Sydney, research assistants Christopher Cunningham-Reid and Judy Robinson, and especially research project manager Jane Reynaud, without whose help I could not have completed this project.

Elizabeth Mossop
Sydney, Australia

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The Mekong Delta: A Coastal Quagmire

Bruno De Meulder and Kelly Shannon

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The future of the Mekong Delta, specifically in relation to the contemporary challenges of climate change, must be grounded in an understanding of both its geology and its context-embedded cultural practices of agriculture, settlement, and floodwater management. This chapter will first briefly review the physical and socio-cultural formation of the Mekong Delta and then introduce the Asiatic concepts of “hydraulic civilization” and *desakota* in order to conceptually expand both past and possible futures of humankind’s organization and settlement of the territory. Finally, the chapter will focus on a plan that was co-produced by a team of international consultants (led by the authors) with the Southern Institute for Strategic Planning for the Ministry of Construction. The Mekong Delta Regional Plan 2030, Vision 2050, was envisioned to respond to warming waters, rising seas, and saline intrusion, and yet not fall back on tried-and-true, global models of adaptation and resilience. It sought to create a contemporary continuum to the region’s material and cultural practices; to update its “hydraulic civilization” and *desakota* settlement tendencies. The main impetus was to accentuate, intensify, and differentiate its regional assets and maintain its vital importance as a fertile, productive urban delta.

Domestication of the Mekong Delta is relatively young, yet has been dramatic and profound. Revolution and rupture have always been more a part of the territory’s history than simple evolution or change. During the last three centuries—through both Viet and French colonization—the Vietnamese component of the delta (40,576 square kilometers (km²) of the 49,500 km² catchment) (Biggs, 2010) transformed from a quagmire, a “heavy water-saturated mud” or “marshy swampy ground,”¹ into a monumental cultural landscape. The original, “as found” landscape was systematically and almost completely altered (Figure 18.1). The frontier river-water civilization (*van minh song nuoc*) consisted of minimal dispersed occupation by Khmers and Chams, marginal Chinese trading posts among the (as majestic as endless) mangroves, and Viet villages resulting from those who migrated from the North (Brocheux and Hémery, 2009).

Today, all appears as radically inverted. The extensive canal mesh made every inch of the hardly penetrable quagmire integrally accessible. The Vietnamese component of the delta accommodated 17.59 million people in 2015 (GSO, 2016). From an almost inaccessible region characterized by an immensely rich and dense tropical biodiversity, the Mekong

FIGURE 18.1

Cochinchine Française 1891. Throughout the Mekong River Delta, there was intense settlement along rivers and along the coast. The rapid domestication of the water-sick territory radiated from Saigon and anchored itself on the riverbanks (the alluvial higher land banks resulting from sedimentation) and the coast in relation to economies of agriculture and fisheries. (Bibliothèque nationale de France, GED-3663; FRBNF40727469.)

delta has become an icon of endless monoculture, methodically unlocked by an enormous and fine-meshed network of canals and rivers. Successive enterprises of hydraulic works—extensive canal and irrigation networks—have been inscribed in the terrain, allowing a green revolution to flourish (beginning with fertilizers and pesticides for agriculture and more recently with antibiotics for aquaculture). The region has historically been the rice basket of Vietnam. During the process of modernization, urbanization, and densification, the marginal local economy initially grounded in subsistence has been overwhelmed by an escalating race of ever-increasing economies of scale and productivity gains. Vietnam is presently the third-largest exporter of rice in the world (USDA, 2014), with just over half hailing from the Mekong Delta.

The territory, 0–4 m above mean sea level, is incredibly varied and rich, due to its complicated system of nine estuaries and its long history of a densely interlaced river and canal network and submerged forests. Tidal pulses from the Gulf of Thailand in the west and the East Sea penetrate up to 100 km upstream in the tributaries of the Mekong, complicating irrigation and transportation. The highly developed water management system includes over 7,000 km of main canals, 4,000 km of secondary canals, and more than 20,000 km of protection dikes to prevent early floods (Le et al., 2007), in addition

to floodgates, saline protection dams and dikes, sluices, and pumping stations. Channel density is estimated at 20–30 m/ha, and the channel area occupies 9% of the delta area (Nguyen, 2002). Canals and channels are part-and-parcel of the Mekong Delta's mutation from a quagmire into rich agri- and aquacultural mosaic.

Most interesting is the very notion of "the coast." The geomorphology of the Mekong Delta is in a constant state of flux due to the intense interaction between river and sea waters. The delta coast has prograded more than 200 km seaward from Cambodia over the past 8,000 years as a result of the voluminous supply of sediment from the Mekong River. The Mekong is among the top ten rivers in the world in terms of sediment discharge—known for an astonishing 145 million tonnes (U.S. metric tons) per year into the East Sea. However, it should be noted that this volume was recorded in 1993 and has been declining due to various reasons, the primary one being the extensive dam building upstream but also forest clearing, arable land expansion, and mere water diversion. According to some, in 2009, the number was less than half, down to 68 million tonnes per year (Kummu et al., 2010). The complex bathymetry and the delta's different tidal circulation systems result in the fact that the delta consists of a 150 km wide subaerial plain and a subaqueous portion. There is a complex movement of sediments from the Mekong that is both wave- and tide-driven, in addition to being controlled by the seasonal monsoon system, which, in the East Sea, shifts direction twice annually in May (from southwestward to northeastward) and October (from northeastward to southwestward) (Xue et al., 2014). There are multifaceted processes of both sedimentation and erosion along the delta's coastline. Presently, sedimentation still prevails near the estuarine inlets, but due to natural and human-induced causes, erosion is occurring away from the inlets and it is anticipated that erosion will increase in the future (Phan et al., 2015).

At the same time, one might read the Mekong Delta as one giant mud plain, a conceptually thickened coastline, one enormous quagmire: "a largely waterlogged world of black mud and mangrove trees, bordered by thick tropical forests where the land rose away from the flooded plain" (Osborne, 2000:21). In such an immeasurable quagmire, gradients of wetness and slight, even minimal differences in topography and soil differentiations and water conditions, lit by the tropical sun, generate a wide variety of ecological conditions, resulting in an astonishing biodiversity where everything is, to a certain degree, about simultaneity: land and water, forest and salt marshes, flora and fauna, birds and fish. The land is saturated with water and the water is full of land. One could say that the mangroves, which covered substantial parts of the "as found" landscape, function as a relatively dark interior that houses an amazing combination of living things. During the domestication process, many of the variations and differentiations were replaced by a simple and categorical trichotomy: water (in rivers, canals, and irrigation ditches), lowlands (paddy fields), and highlands (natural and man-made, including river or canal embankments that are generally stabilized by tree planting, landfill areas for urbanization, and naturally higher elevations of alluvium with orchards and vegetable production). Over time, gradients and transitions in the landscape were systematically exchanged for borders: organic for geometry, curves for orthogonal. Porous environments, where different habitats interpenetrated and overlapped, mutated in a juxtaposition of clear categories: water, paddy fields, and highlands that are stabilized with trees. Nowadays, an enormous wave of fish and shrimp ponds have invaded the territory and extend the water landscape, with what one could consider a mosaic of reconstructed shoreline conditions. Studies have also shown that shrimp farming, which replaces rice culture at an accelerating rate in many parts of the delta, is not only an opportunistic reaction to salination, but also a far more lucrative one than that of rice. Shrimp farming has gained an irresistible momentum as the way forward, out of poverty for many, while causing rapid soil exhaustion and generating many other thorny ecological issues.

“Hydraulic Civilization” and *Desakota*

According to renowned professor of political science and anthropology James C. Scott, the Mekong Delta has become, like so many other deltas, a “high-modernist space” (Scott, 1998). It is a highly ordered, legible, and standardized landscape. As mentioned previously, through imperial and colonial engineers, American advisers, and successive waves of socialist hydro-technicians, the landscape was transformed from a virgin, almost uninhabited jungle into a densely occupied and productive territory (Figure 18.1). Traditionally, populations in the Mekong Delta settled on the natural levees of waterways, creating the river-water civilization. Drainage canals enabled the “river-water” or “canal-creek” civilization to develop linear settlement structures, following the alluvial, unsalinated, high-land banks of waterways while the swampy area of the delta was progressively transformed into fertile alluvial plains for wet paddy cultivation (Figures 18.2 and 18.3). Traditionally, life in the delta was highly dependent on the rhythms of river water regimes. Nuances in the Vietnamese language underscore the sensitivity of *living with water*: it distinguishes between several kinds of floods: *lu* (flood), *lut* (inundation), and *ngap* (submergence). Floods occur when excess water upstream flows over riverbanks or dikes to floodplains. Inundation is effected by floods. Submergence is a phenomenon that occurs when water levels in the plain (fields or land of the inner dike or depression areas or wetlands) are higher than the ground surface area. Inhabitants of the Mekong Delta call the yearly September to October flood period *mau nuoc noi* (water rising season), and *nuoc son* (reddish water) refers to the water color of heavily silt-laden water from upstream. *Nuoc bac* (silver water) refers to greenish and transparent water that flows from fields with acid surface soils (Le et al., 2007).

FIGURE 18.2

Water-based urbanism. A series of French colonial images (1919–1935, by L. Busy and R. Tetard) reveal vibrant urban and rural water-based life throughout the Mekong Delta, including in Rach Gia. The overwhelming productive activity of the time was wet rice cultivation. (Archives nationales d’outre mer, FR CAOM 30Fi107/102.)

FIGURE 18.3

Paddy Landscapes. Busy and Tetard also captured the overwhelming productive activity of the time was wet rice cultivation. (Archives nationales d'outre mer, FR CAOM 30Fi103/40.)

The Vietnamese particularities dovetail into two larger, historic discussions that could potentially frame contemporary development of the delta. A number of Asian settlement concepts developed through the writings of Western Sino-experts Karl Wittfogel 'Hydraulic civilizations' 1956 and Terry McGee ('*Desakota*,' 1967, 1991). They interrogate Asiatic-specific modes of urbanization and their interdependent relationships to landscape. Hydraulic civilization refers to the *raison d'être* of societies, which required substantial and centralized works of water control and, in turn, was reflected in political power and leadership. The concept of an urban countryside/rural metropolis—the mix of consumptive and productive dispersed landscapes—is behind the Indonesian word-play of *desakota*.

Wittfogel, the Frankfurt School historian and sinologist, referred to classical economists, "who with varying consistency recognized that the higher agrarian civilizations of the 'orient' and their urban rural conditions followed a pattern of development decidedly unlike that of the West" (Wittfogel, 1956:152). For him, Asia boasted a juxtaposition of urban and rural, a specific type of social formation founded upon centralized state authority with its own forces and relations of production emerging out of water engineering and control. He set forth a thesis that "hydraulic societies" and despotism were functionally connected. Specifically, he argued that in naturally arid regions, only an absolutely obedient, virtually enslaved regime could possibly have mobilized the concentrations of labor needed to man and maintain the irrigation canals and dikes on which intensive agriculture depended. "Where agriculture required substantial and centralized works of water control, the representatives of government monopolized political power and societal leadership, and they dominated their country's economy. By preventing the growth of strong competitive forces, such as a feudal knighthood, an autonomous church, or self-governing guild cities, they were able to make themselves the sole masters of their society. It is this combination of hydraulic agriculture, a hydraulic government, and a single-centred society that constitutes

the institutional essence of hydraulic civilization" (Wittfogel, 1956:153). Wittfogel's nomenclature admittedly stresses more human action rather than geography and, as he argues, the notion of a hydraulic civilization having developed "a *bureaucratic* land-lordism, a *bureaucratic* capitalism and a *bureaucratic* gentry ... and a cumulative tendency of unchecked power ..." (Wittfogel 1957:4, italics his).

The comprehensive system of the "hydraulic civilization," which employed extensive *corvée* labor and placed a constant upward pressure on the level of population growth, not only created productive water works (for irrigation and drainage) and protective water works (for flood control), but also provided drinking water and communication conduits. Digging, dredging, and damming led to the significant remolding of the ground plain. Wittfogel's thesis is predominately concerned with naturally arid regions, but also comments upon regions of wet-rice cultivation which requires a relatively equitable distribution of water and necessitates a system of canals, dikes, irrigation canals, terraces, and locks to regulate water levels. The notion of a hydraulic civilization—beyond its ties to politics—holds invaluable lessons and inspiration for contemporary deltas. Wittfogel's hypothesis of a "hydraulic civilization" clarifies a man/nature, water catchment/settlement relationship that, leaving the despotism argument aside, needs to once again become fundamentally understood, interpreted, and (re)designed.

As in so many deltas, the fertility of the Mekong Delta's land attracts farmers and generates massive development. And, as in most fertile deltas, development is as intense as it is dispersed. Development opportunities are equally spread all over the territory and are also so excessive that hierarchy is senseless. In opposition to the central place theory of geographer Walter Christaller (Christaller, 1933), settlements are rather equal and above all multiple. If they are differentiated, then it is rather by specialization (such as port city, coastal city, educational center, etc.) than by hierarchy, the exception perhaps being Cantho, the largest city in the delta, centrally located, and at the confluence of the Hau (the lower branch of the Mekong) and Cantho rivers. During the first wave of the delta's urbanization, with the Nguyen lords' 1739 "march to the south," settlers were allowed to freely occupy land and primarily settled in the alluvial plain around Cantho. Land reclamation and settlements were later established through decentralized agricultural colonies (*dinh dien*) and military colonies (*don dien*). When the delta fell under French control in 1876, it was considered the "granary" of Saigon, and massive infrastructure building and densification occurred to exploit commercial agriculture. During the Vietnam War, the Vietnamese "agroville" program was succeeded by the American "strategic hamlet" program, both self-contained, camp-like communities which failed miserably on all accounts.

Today, the Mekong Delta remains a predominantly agricultural area, not to say a rice region. It is densely occupied and generates a very specific settlement pattern, namely McGee's *desakota*, from Bahasa Indonesian *desa* for village and *kota* for town or city. *Desakota* is a hybrid *in situ* urbanism which consists of the overlapping of functionally independent entities into already densely populated agricultural regions, materializing in traditional agriculture existing alongside industry (capital intensive and cottage industry), entertainment (including theme parks and golf courses), retail (malls and strip shopping), and housing (from squatter housing to gated communities).

Theorist Stephen Cairns has recognized three noteworthy repercussions of *desakota*: "First, *desakota* regions are so vast and difficult to navigate that they produce administrative 'blind spots' in which planning regulations are not enforceable in any uniform way. Second, *desakota* regions feature a high mobility of goods and services and a transient pattern of settlement. Third, and closely related, *desakota* regions resist being taken-up into a more formal system of inter-connected, functionally specialized zones" (Cairns, 2002:118). Importantly, there is

potential in the concept that to date has remained useful in terms of describing the context. The recognition and abstraction of the synergy between the urban and rural, the consumptive and productive landscapes, can become potent in the reconceptualization of the delta's "field conditions" to create a more differentiated landscape mosaic, which generates neither hierarchy nor concentration, but rather accentuates diffusion of organized dispersal.

Contemporary Challenges

It is clear that the water-society nexus has had tremendous influence on the Mekong Delta's political formation, socio-spatial order, and economic growth. Numerous scholars have developed lengthy studies on these topics (Taylor, 2001; Shannon, 2004; Mollinga, 2008; Molle et al., 2009; Biggs, 2010; Benedikter, 2014). The contemporary paradigm of land and water management is currently undergoing a fundamental shift that climate change will inescapably further articulate. Living with the floods (in opposition to defensive living behind dikes) and the interconnected canal system is no longer as evident. As previously mentioned, the entire hydrological regime of the Mekong River⁴ has been and continues to be reengineered by Vietnam's riparian neighbors, in particular with dam construction by China and Laos. Water pressure in the Vietnamese Mekong is consequently decreasing. The delta is under pressure from overexploitation of basin resources while upstream damming has fundamental consequences downstream, including the alteration of the flow and nature of the river, disruption of fish migration and significant impact to inland fisheries and food security, threats to aquatic biodiversity and terrestrial system changes due to the natural flood cycles crucial to ecosystems, and, importantly, disruption of recession agriculture—the practice of planting crops in floodplains watered by receding floods (Chellaney, 2011).

The delta today is already bearing witness to the impacts of climate change. Sea level rise, saline intrusion, massive inundation, and periods of intensive drought and rising temperatures have begun to affect the region and are revealing unavoidable consequences on the productive landscapes, rural settlements, as well as for urban areas. The manipulated water pressure from upstream dam building, coupled with sea level rise, makes saline intrusion a tangible threat to enormous territories, especially in the remote southern Ca Mau peninsula and the other coastal regions. The construction of large, protective sea dikes is now on the way in exactly the same region that has always thrived solely from natural processes of erosion and sedimentation (De Meulder and Shannon, 2013). The sea dikes would safeguard coastal security and prevent saline intrusion. Other parts of the landscape, particularly the low-lying Plain of Reeds (where the Mekong enters Vietnam) will be faced with more dramatic and systematic inundation. In short, a new geography is in the making.

The existing Mekong Delta Region Plan (approved in 2009) was solidly based in conventional planning concepts. As if it were illustrating a textbook of ideal abstract planning principles, it superimposes a strong hierarchical system of cities and rigorously applies traditional, sectorial land use planning concepts, which is radically in opposition with the natural condition of the territory, as well as the intense urban culture that mixes urban and rural, consumptive and productive land, formal and informal economies in an inimitable and thriving manner. The plan that resonates rigid, central economic planning dogmas also foresees a conventional transport model with an almost equal distribution of roads and highways over the territory. This dense infrastructural grid would literally equalize accessibility and be expected to catalyze internal, as well as external exchange

in the wake of which trade and industrial development would emerge. It was seen as an urgent necessity to absorb the very fast-growing labor force that exceeds the needs of agriculture. Until today, however, a large part of the surplus labor force is, as it traditionally always has been, attracted to Ho Chi Minh City and many of the sometimes very large scale “Industrial Parks” (IP) and “Economic Zones” (EZ) in the Mekong Delta. The gap between planning based on projection targets and political proclamations in the traditions of central plan economics and current realities on the ground could not be more caricaturized. Processing of local agri- and aquacultural produce is instead a main and growing industrial activity. The Mekong Delta is “losing” population. The question, of course, is how incorrect it is that the Mekong Delta only retains the population that it can effectively support as a predominantly agri- and aquacultural region. Government policies stimulate generic and large-scale industrialization in order to provide local jobs to the fast-growing population that frequently and naturally opts for migration.

Presently, the Mekong Delta Region Plan has no agency, no mandate on the ground. The spatial development of the region is effectively steered—as much as development can be guided in wild ad-hoc development—by the master plans of the region’s 12 provinces and one first-class city (Cantho).² Each plan has been prepared with the socio-economic objectives of the individual provinces/city in mind and is obviously not coordinated with any of the others. (Is there any place on earth where plans on different levels form a coherent whole?) The provincial master plans are an ambitious exercise in the spatial translation of socio-economic projections (and hence attempt to substantiate larger objectives, meaning political and financial claims of the central state) that are too abstract and often alien to the dynamics, characteristics, and realities of the specific geographies concerned. As the objectives and proposed measures are the same for the whole of Vietnam, the existing planning and policy mainly lead to an undifferentiated generic development.

In addition to climate change impacts, the almost systemic mismatch between planning and realities on the ground was a primary motivation for a revised Mekong Delta Region Plan. Another motivation was the turbulent economic and urban development of the last two decades. Massive growth of the middle classes led to explosive building activity. This might not be uncommon in the Asian context, but it remains remarkable nonetheless. In the Mekong Delta region, a generic Vietnamese urbanization is blanketing the territory. At a very rapid pace, the existing indigenous and distinctive urban architectures and morphological particularities are being wiped out—including the predominant importance of the water structures that previously determined the spatial structures of cities and towns. The majority of the settlements that characterize the region are generic, young, and not necessarily aging very well. They are without noticeable variation and are fueled by the generous provision of stereotypical, road-based new allotments and other service building sites, with generally oversized road infrastructure (and a remarkable lack of parking space). One can only pity such a government-driven unleashing of speculation. In the best cases—as can be witnessed in cities such as Ca Mau—intelligent cut-and-fill principles were applied, which resulted in lakes around which new urban quarters were developed.

A New Delta Plan: Return to the Waters

The revision of the Mekong Delta Region Plan³ seizes the opportunity of climate change (and the way it reconfigures the geography of the territory) to realign the plan (and

consequent development) with the (evolving) characteristics of the territory. The main question of the new proposed regional plan was how to organize a constructive interplay between unavoidable landscape dynamics and the social, economic, and cultural dynamics of the region. The main asset of the delta (surely in view of the expected worldwide food shortage) remains its enormous agri- and aquacultural potential. Such a territorial identity is largely the outcome of the interplay between land and water, or more precisely topography (including bathymetry), soil qualities (most broadly alluvia, saline, and acid sulphate) and conditions, and salt and freshwater parameters (volume; quality, including carried sedimentation; height and extent; tides and seasonal variations). Recognition and accentuation of the delta's underlying geography, which has been classified into six broadly agro-ecological sub-regions⁴ (excluding the seven hills and mountainous areas near the Cambodian border), can reestablish its core identity, counterbalance the relative homogeneity of the region's urbanism and rearticulate the productive landscapes of the delta's dynamic ecological territory (Figure 18.4).

The Vietnamese predicted consequences of climate change by 2050,⁵ which in general will create more extreme conditions and inevitably strengthen the differentiation between the six sub-regions (Figure 18.5). The regions include three coastal sub-regions along the East Sea and Gulf of Thailand where saline intrusion will drastically change vegetation and urban, as well as agri- and aquaculture development potentials: the Eastern Coastal Zone, Ca Mau Peninsula at the tip of the delta, and the Long Xuyen Quadrangle along the Gulf of Thailand and bordering Cambodia. The Dong Thap Muoi floodplain (500,000 ha), popularly known as the Plain of Reeds, is the delta's major catchment basin. It is a large natural depression and lowest elevation of the delta (0.5 m below mean sea level) where profound inundation will extend. Finally, there are two centrally located regions: the freshwater alluvial (along the two branches of the Mekong River itself) and Trans-Bassac zones. These regions will remain relatively "safe" from both saline intrusion and inundation and are historically and presently where most of the delta's development has occurred.

These six sub-regions define significant differentiation in the identity of the Mekong Delta. Each of them has its own characteristics due primarily to its soils and hydrology,

FIGURE 18.4

Agro-ecological regions of Vietnam's Mekong Delta. The identity of the Mekong Delta is grounded in its landscape and its six main ecological/geographic regions. (Image credit: RUA, 2016.)

FIGURE 18.5

Vietnam's official predicted inundation and saline intrusion in 2050. Inundation is expected to severely affect the Plain of Reeds in the northwest of the delta, while saline intrusion will be extreme along the coastal area, in the Ca Mau Peninsula, and in part of the Long Xuyen-Ha Tien Quadrangle. (Image credit: RUA, 2016.)

and the revision of the plan advocates the anchoring of development scenarios on these distinctions which, as specific and natural locational assets, can be ultimately turned into unique competitive advantages that complement each sub-region (Figures 18.6 through 18.8). The provinces each could define a further level of differentiation, but until now have only functioned at the national level to implement general policies. Differentiation on this level rather seems to have to do with the dynamism of the administration and its ability to acquire national funds, than with specification of needs or character. Finally, the water management units (120 in total, on average 20 by sub-region, or nine in each province) are of strategic importance, since water regulation (controlling quality and quantity of water allocation over time) defines the territory through compartmentalization. At an even lower level, the drainage structure and parcel system define the mesh of the mosaic landscape, but it is clear that it is the 120 water management units that define, the most important scale of differentiation in the landscape, in addition to the six sub-regions. The Mekong Delta Region Plan explicitly chooses to anchor future economic potential in these six regions and to create a regional center for think tanks and innovation centers for new productive research in each one. In many instances, these coincide with provincial capitals, but not always. Also, the provincial capitals of the MDR will be given socio-economic boosts to support the renewed productivity of each specialty of the sub-region.

Aside from the six agro-ecological sub-regions, the proposed Mekong Delta Region Plan defines three major urban and rural morphologies as a system of wet and dry areas derived from soil types, sedimentation, erosion, and subsidence, as well as the 2050 predictions of inundation and saline intrusion. In all three typologies, the hierarchy of

FIGURE 18.6

Plain of Reeds: Tram Chim flooded forest. The protected area covers 7,588 hectares and is a national park, specifically created to protect several rare birds whose habitat is the inland submerged wetland of inundated grasslands, open swamps, and melaleuca. There is an opportunity to expand the Ramsar-protected landscape. (Image credit: K. Shannon, 2014.)

FIGURE 18.7

Vast rice fields of alluvial plains. The Mekong Delta is the rice basket of Vietnam. Vast waving fields of green cover most of the territory, providing not only food security for the nation, but also an export economy. The proposed plan argues that the Mekong Delta should continue to capitalize and improve on its agricultural legacy. (Image credit: K. Shannon, 2014.)

FIGURE 18.8

Mudflats and mangroves of the East Sea at Bac Lieu. The tidal mudflats and mangrove forests of Bac Lieu along the East Sea are important dynamic ecosystems that are reclaimed for aquaculture and industrial development. There is a challenge to keep ecologic and economic forces in check. (Image credit: K. Shannon, 2014.)

topography, infrastructure, and settlement is reconfigured in relation to the site-specific realities and future projections (Figure 18.9). A “coastal areas” type would be developed for the Eastern Coastal Zone, Ca Mau Peninsula, and the coastal part of the Long Xuyen Quadrangle to form part of a more dynamic and robust coastline. Eventually, sea dikes would be reconceptualized as just one possible element in the complex landscape that organizes the transition between land and sea. Massive mangrove forests would be the more general and natural component of this landscape zone. They would simultaneously allow for a better mix of saline and freshwater systems, providing protection against the increasing threat of storm surges and allowing for a more sustainable aquaculture economy. This zone would also create an economy embedded within an ecology rather than a vulnerable monoculture that replaces an ecology. Mangrove forests can accelerate the gaining and consolidation of land by natural sedimentation processes at the coast of the East Sea and the Gulf of Thailand. Where natural conditions are suitable, dune formation, land gains, and their consolidation can be enhanced with simple “sand or sediment catching” by way of vegetation screens, breakwaters, mangrove forests, and so on. In this respect, the Mekong River’s yearly discharge of 68–145 million tonnes of sediment is noteworthy. Large amounts of these sediments are carried back and forth along the southern and eastern coasts, depending on the monsoon seasons. Settlements in these “coastal areas” would be developed to work with the East Coast’s parallel and alternating rows of sand ridges and back-swamps, successive peat layers, and subsiding lands of the Ca Mau Peninsula. Directly along the coast, settlements would comprise clustered, floating buildings that center on collective spaces in clearings of mangrove forests. Aquaculture (fish and shrimp farming) would be interwoven into a rich mosaic able to withstand the tidal pulses from the East Sea and Gulf of Thailand. The *desakota* principles would adapt to this new situation; organized dispersal of floating settlements would respond to tidal pulses and sea level rise. Densification is not a main issue in coastal areas where expected population growth is to be marginal, however, the security

FIGURE 18.9

New urban morphologies and infrastructure to respond to climate change. Three distinct morphologies are developed: coastal areas that take into account sea level rise and saline intrusion and are protected by massive new mangrove afforestation; a freshwater alluvial area that needs qualitative upgrading; and the extended floodplain near the Cambodian border which will have to deal with high degrees of inundation. (Image credit: RUA, 2016.)

and the re-articulation of the relationship of settlements with evolving environmental conditions and their economic exploitation is. Continued dispersal seems indicated, despite the national centralization policy in rural areas. Within this setting of new mangroves and water bodies, a new and complementary aquacultural economy could be built with a larger emphasis on harvesting naturally renewable resources (there is great potential for wind and tidal energy) and high-end specialized products, such as rare medical plants. As such, these additions, which would succeed what until now was a largely mono-cultural economy, will strengthen the robustness of the economy and the sustainability of the development of the Mekong region, while simultaneously rebuilding a biologically diverse environment ([Figure 18.10](#)).

An “extended Plain of Reeds” type would be developed for Dong Thap Muoi and part of the Long Xuyen Quadrangle. The area is expected to be significantly inundated as time marches forward, and thus the region could once again thrive as an area of controlled flooding and water storage. Buildings would be on stilts and the central spine of clustered areas of urbanization would be a dike, at a minimum safety height to avoid inundation in the predicted worst-case flood scenario. Large monsoon collection basins would be inscribed into the existing canal and irrigation system and would be able to release freshwater into the delta system during the dry season, as well as serve as aquaculture

FIGURE 18.10

(a,b) Coastal morphologies. In the coastal areas, the new settlement strategy would comprise clustered, floating buildings that center on floating collective spaces in clearings of mangrove forests. Aquaculture (fish and shrimp farming) and renewable energy would be interwoven into a rich mosaic that is able to withstand the tidal pulses from the East Sea and Gulf of Thailand. (Image credit: RUA, 2016.)

landscapes. Nowhere here, other than in one center of excellence/think-tank for productive landscape experimentation, is densification on the agenda. Fish farming, indigo farming, and other activities that can flourish in such extreme environmental conditions would be strengthened (Figure 18.11).

FIGURE 18.11

(a,b) Upstream flooded morphologies. Upstream flooded morphologies are premised on the prediction that massive inundation will occur in the coming years and progressively increase over the decades. Buildings would be on stilts and the central spine of clustered areas of urbanization would be a dike, at a minimum safety height to avoid inundation in the predicted worst-case scenario. Monsoon collection basins would be able to release freshwater into the delta system during the dry season, as well as serve as aquaculture landscapes. (Image credit: RUA, 2016.)

A “freshwater alluvial” type would be developed for the Trans Bassac Depression and the Freshwater Alluvial zones where a requalified system of urbanism on relatively high land would work together with a diversified productive landscape of rice, orchards, and vegetables. The existing settlement types would be modernized, densified, and clustered.

This area, the relative “highland” of the delta, is the most fertile and the most productive, and will be the region of the delta least affected by climate change. Paradoxically, it will gather the largest concentration of people in the near future as a consequence of climate change and the restructuring of the agriculture in the other areas of the Mekong Delta. Therefore, extension of settlements will be severely restricted and needs to be cleverly redirected toward densification for the diffuse *desakota* urbanization patterns that safeguard agricultural land, the main asset of the region (Figure 18.12).

The infrastructure for the new Mekong Delta Region Plan is reconceived in light of climate change and vulnerability of the territory. The deliberate choice is not to build new, extremely expensive infrastructure where there will be inundation anyway. A number of planned highways by the Ministry of Transportation could not be considered optimal investments, as they were going to be flooded by 2050. Instead, the plan proposes to create connections, not as equal access or a homogenous grid across the territory, but via a strategic selection of highways, comprising a main highway collector, a central spine located on guaranteed dry land in the center of the delta, and feeders or linkages to important socio-economic destinations, including Ho Chi Minh City, ports, and transversals to Vietnam’s border gates. The TransAsian Highway is proposed to be perpendicular and complement the spine. The further from the spine, the more modest the profile of the feeders, and probably the more natural structures such as mangroves and water elements would take over as structuring devices of the territory. The feeders recuperate existing “national roads” that are upgraded and modernized where necessary, an operation that should go hand-in-hand with the upgrading and modernization of their parallel canals. The canals and embankments, the national roads, their respective interstices and adjacent lands literally superimpose a man-made framework that unites the territory. As such, the systematically planted section of this recurrent sequence is of the utmost importance. It not only organizes the water and road mobility flows, but simultaneously articulates the water/land relation (including the management, regulation, and protection of floodwaters) and hosts construction, as well as vegetation of all kinds, such as the majestic tree rows that are instrumental for creating a livable micro-climate. Planted segments alternate spontaneous vegetation and old construction with brand new investments.

In this infrastructural section that Lewis Mumford undoubtedly would have qualified as polytechnic (Mumford, 1934), all is condensed and nothing is monocultural. The polytechnicity is evident from the manner in which the delta’s infrastructural sections merge the technical with civic and economic with ecological performances. Throughout the Mekong Delta, this is done in quite an urban way, balancing order and spontaneity, regularity and messiness, fixity and openness, regulation and freedom. While modernizing and upgrading the infrastructural section, the new regional plan cherishes and intends to enhance the polytechnicity. The intention is to extend the planned new highways, which inevitably will have to become adapted to the dynamic tropical climate. The plan also very importantly stresses and rebalances road transport with water transport, for passengers and cargo. It remains a simple fact that canal construction and maintenance is many times more economic than road construction, given the particular, unstable soil composition within the Mekong Delta.

Finally, there would be a major coastal flagship project located in the southeastern coastal province of Bac Lieu, home to nearly 900,000 people and south of all the Mekong branch outlets into the East Sea. The project would drastically reformulate Vietnam’s current infrastructural practices. It would assemble a number of the Vietnamese government’s on-going projects, including tidal and wind energy parks, a central international airport

FIGURE 18.12

(a,b) Alluvial plain morphologies. In the alluvial plain, the existing settlement types would be modernized, densified, and clustered: it is the most productive and will be the region of the delta least affected by climate change. The productive landscape will be modernized, diversified, and combined with renewable energy. (Image credit: RUA, 2016.)

for the Mekong Delta, an international deep seaport (an ambitious role comparable to Thailand's Kra Canal—which would shorten shipping routes through the Malacca Straits), the start of the TransAsian highway, and the building of a sea dike (which is the first defense structure of this nature in the Mekong where dikes are historically not used). The project would create an interplay with the natural processes existing in the delta's dynamics to

FIGURE 18.13

Coastal mangrove necklace. Mangrove forests are proposed to protect against storm surges and to create a healthier brackish water environment. Integrated shrimp and fish farming, in addition to renewable energy production in mangroves would be encouraged, as opposed to exclusively shrimp farming. Restoration of coastal mangrove belts would include the planting of numerous native species, including many plants with uses and applications in medicine. (Image credit: RUA, 2016.)

generate synergies, increase coastal protection, and simultaneously create a new type of land reclamation program. The Mekong Delta Regional Plan proposes to enhance a controlled and increased sedimentation along the East Sea in order to drastically scale up the natural land-gaining process. It capitalizes on the flows of discharge to build land. The systematic implantation of obstacles (breakwaters) on the sub-aqueous delta platform would break the existing streams' deposits. As such, they are efficient coastal protection devices. Moreover, they slow down the water current and halt it locally. This strongly enhances sedimentation and consequently induces an accelerated formation of sand banks that ultimately results in a land-gaining process, further consolidated by the systematic planting of mangroves. This will not only strengthen the ecological structure of the Mekong Delta, but also increase its resilience in case of storms ([Figure 18.13](#)).

The proposed process can be compared with the well-known techniques of dune formation and reconstruction through the placing of windbreaks and consolidation through succession and adapted plants. The main technical issue of the land-gaining program defines the design of the "obstacles" (breakwaters), the distribution pattern that would be tailored in relation to dominant water current directions and their variations, and the indicated openings and distances between the obstacles. The optimization of these parameters would steer the process that can be adapted to the dynamics of the sea and desired land formation and targeted interesting alterations between water and land, deep and shallow water, and so on. These variations would allow the creation of optimal conditions for a variety of habitats (shrimp, oysters, and other seafood, fish, birds, plants, wood). Differentiations in the shape and depth of the breakwaters, distribution pattern and orientation, and distances in between the breakwaters will allow the generation of a variety

of landscapes and could include new waterways of various characters. The technique can be applied both in areas along the East Sea that already gains land naturally (and speed up the process there), as well as areas nowadays suffering from erosion by intensifying density and dimension of breakwaters as coastal defense systems.

This principle of almost natural, but accelerated land creation might appear farfetched, but in the end, it merely capitalizes on the natural processes of sedimentation (and erosion) that exist throughout the entire Mekong Delta region. Ultimately, the Mekong Delta is one gigantic, unstable mud plain that oscillates between being ground and water, land and sea. Hence, there is actually no real or precise shoreline, but an entire territory that could be considered as one extended shoreline. The sea dike that was planned before is replaced, in this plan, by a larger territory with a substantial (ever-growing) depth. The heroic “hold the line” paradigm of the dike is exchanged for a majestic landscape. This new induced landscape reproduces a natural, self-renewing Mekong Delta and works as an infrastructure. It protects (from the sea) and organizes transitions between salt, brackish, and freshwater, while supporting a wide range of activities. A mosaic of appropriations anchor themselves on the natural conditions, ranging from new ecological shrimp farms to tidal energy installations to fishing villages and other sustainable coastal settlements, from fish farms to nurseries of medicinal plants and oyster banks and other seafood nurseries, to bamboo and melaleuca plantations, farms and new state-of-the-art fishery ports.

As previously mentioned, the landscape will host a number of the flagship projects of the Vietnamese government: the region’s international airport, wind farms, and a deep seaport. These are consciously built offshore. This way, they neither require (land expropriation nor cause the loss of valuable productive land (which remains the main asset of the Mekong Delta). They will, on the contrary work as mega-breakwaters, form important stepping stones, and are consciously designed and positioned to accelerate the very land reclamation that, in the long run, will absorb them. As the landscape absorbs these areas, they simultaneously become the infrastructure that gives the necessary support to ecological development (coastal protective mangrove forests) and the various water and land variations that will generate the mosaic of appropriations enumerated earlier.

The revision of the Mekong Delta Region Plan is a first step to reengage with the context-embedded dynamics that nature imposes on the territory. Renewed logics of the “hydraulic civilization” and organized dispersal of *desakota* are inherently part-and-parcel of the contemporary plan, which is to strengthen its agricultural importance in light of the delta’s intrinsic value and Vietnam’s need of national food security. The landscape of the delta is the result of a highly managed and choreographed interplay between land and water in all the volumes, measures, and gradients one can imagine. The main operation of the revised Mekong Delta Regional Plan is to predict the optimum water-land interplays in light of climate change. The basic unit of the plan’s 120 water compartments (grouped in five water sub-basins), six agro-ecological sub-regions, three broad landscape and settlement types, the selection and layout of infrastructures all have to do with these new water conditions. They re-articulate the register. The proposal is to graft the further development of the Mekong Delta on this sophisticated water register. The conventional infrastructure and the new landscape induced here work as warp and woof, but roles are inverted. Landscape becomes infrastructure, resistance becomes source, bypasses act as parallel avenues to other features, rather than the over-mechanized and centralized—should we say run-down—territory of the post-industrial era. This is an infrastructure for the twenty-first century, one that purposefully reengages with the dynamics of nature and the notion of a larger deltaic coast; a new and self-renewing ecology that, from the onset, instantly supports a multitude of activities and simple technical interventions which can induce a majestic and varied world (Figure 18.14).

FIGURE 18.14

Mekong Delta Region Plan 2030 Vision to 2050. Infrastructure and development are realigned to take advantage of climate change and the vulnerabilities of the landscape. The delta is optimized as a productive landscape a new state-of-the-art polysynthetic reclamation is conceived on the East Sea. (Image credit: RUA, 2016.)

Endnotes

1. The Mekong River is the largest river in the tropical Western Pacific in terms of length (4,750 km)—the world's 12th longest—and freshwater/sediment inputs. It originates high

up in the Tibetan Plateau, flows through six countries: China, Myanmar, Thailand, Laos, Cambodia, and enters the East Sea through Vietnam's Mekong Delta region. The basin measures 795,000 km², making it the 21st largest river basin in the world. Its delta plain is the third largest in the world. The Vietnamese component of the delta shares 300 km of border with Cambodia, has more than 700 km of coastline, and includes approximately 360,000 km² of territorial sea.

2. The Vietnamese planning system classifies cities based on their population numbers, as well as the cities' importance in the overall national socio-economic structure. Cantho, whose borders remain the size of a province, is the only first-class city of the Mekong Delta region, meaning its planning and economic policies are directly overseen by the national government in Hanoi.
3. Revision of the Mekong Delta Region Plan 2030–2050 is an ongoing work that began in November 2014. RUA, Research Urbanism Architecture, is the international consultant to SISPP (Southern Institute for Strategic Planning). RUA and SISPP were commissioned by the Ministry of Construction in Hanoi, Vietnam. The RUA team is led by Bruno De Meulder and consists of Kelly Shannon, Claudia Rojas Bernal, Christina Hood, Donielle Kaufman, Michael Waibel, Tracy Collier and Eric Heikkila. From January to March 2016 the RUA team was assisted by M. Fancier and Superjacent (K. Majewski, A. Paradowski, C. Torres).
4. The six agro-ecological sub-regions have long been recognized by geographers in Vietnam; their precise boundaries vary depending on authors. See for example David Biggs. 2010. *Quagmire: Nation-building and Nature in the Mekong Delta*. Seattle, WA: University of Washington Press, and Nguyen, Duy Can, Le, Tanh Duong, Nguyen, Van Sanh and Fiona Miller. 2007. "Livelihoods and resource use strategies in the Mekong delta" (Chapter 2), in *Literature Analysis, Challenges to Sustainable Development in the Mekong Delta: Regional and National Policy Issues and Research Needs*, Tran T. B., Bach T. S., and F. Miller, eds. Bangkok: The Sustainable Mekong Research Network (Sumernet). 69–98.
5. SIWRP (Southern Institute of Water and Resource Planning). 2012. Master Plan in the Mekong Delta for Impact of Climate Change—Sea Level Rise, Ho Chi Minh City.

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