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Liquid territories: the configuration of geographic space in the cartography of the Mekong River's catchment areas

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Abstract
The role played by the Mekong River in the organization of land and people is inextricably linked with a particular spatial category. The concept of the hydrological catchment extends the space of the river far beyond the limits of the river's perennial waterbodies, to encompass vast areas inhabited by millions of people speaking different languages. Fundamental to the estimation of precipitation and water volume, areal denotations of the Mekong's basin, delta and floodplain have been repeatedly drawn on maps by geographers, planners, engineers and cartographers. Mapped representations of the Mekong River however are not only the result of recording the flows of water, nor the domain of a single discourse. With diverging intentions, distinct and sometimes conflicting projections of the basin, delta and floodplain have prescribed the differentiation and unification of parts of mainland Southeast Asia, to articulate liquid territories that are outside a single state's jurisdiction. To understand how the Mekong's catchments emerge as the geographic reference for human activities, the paper examines the technical and cultural notions that underpin the preparation of these maps. Focusing on early European maps of the Mekong's delta and floodplain, the paper draws on the discourses of hydrology, geography, and cartography to ask what territories are produced and maintained by evoking the geography of the river's flows.

Keywords Mekong River · Catchment area · Delta · Floodplain · Territory · Cartography

Introduction

Following a course that descends from the Tibetan Plateau to reach the coastal lowlands of the South China Sea, the mainstream of the Mekong River collects the water flowing from melting glaciers, forested mountain valleys and densely inhabited plains. The countless waterways which merge to form the river are the primary source of water for people speaking multiple languages and included in the jurisdictions of separate national, social and political groups. Delimited by lines representing embankments, the cartographic depiction of the river appears to suggest a linear body of water flowing over the terrestrial surface.

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The result of surveying, charting and compiling information from multiple sources, maps of the river are not merely pictorial descriptions of the flows of water. Referring to the ubiquitous 'wetness' of monsoonal environments, landscape architect Dilip da Cunha has argued that successive mapping efforts "invented" the river by systematically "separating water from land" (Da Cunha 2019). Derived from observations of the Ganges, Da Cunha's insight resonates with the historical cartographic record of the Mekong River. In the case of the Mekong however the spatial relationship between surface water and dry land is not restricted to the width and length of the river's seasonal flows. Expressed as a *catchment area,* the measurable geographic space contributing to the collection and drainage of the river's waters can extend far from the mainstream, encompassing the sometimes dry slopes of distant mountains, submerged plains and sedimented lowlands. In the form of the river's basin, coastal delta or floodplain the Mekong's catchments have been repeatedly drawn by geographers, engineers and cartographers since before the violent start of European colonization. Maps of the river's catchments however are not always the result of recording the flows of water, nor the domain of a single discourse. With diverging intentions, distinct and sometimes conflicting projections of catchment areas on maps have structured geopolitical strategy, the exercise of military power and regional planning. As a result, the areal articulation of catchments is reflected in the design of water infrastructure but also in the configuration of the national boundaries of riparian states and proposals to organize agriculture and settlement.

The article approaches the catchment's depiction from a critical perspective. Rather than assume that maps purporting to show the Mekong's basin, delta or floodplain are visual instruments whose sole aim is to represent existing natural phenomena, it describes how these hydrological concepts were adopted by cartographers to formulate a particular territory from a section of the river's flows that enabled scientific analyses, rationalised governance decisions, supported territorial claims and justified marginalisation. As such, the examination of cartographic material takes into consideration both the technical production of the map as well as the social and cultural discourses which shape the map's appreciation and the use of the information that it communicates (Harley 1989; Wood and Fels 2008). Focusing on maps prepared by European cartographers and the *Service Géographique de l'Indochine* during France's colonial rule over Southeast Asia, this paper examines the emergence of the floodplain and delta and draws attention to their appreciation as geographic knowledge. Concentrating on recurring depictions of the Mekong's inundated lowland, the first part examines the "Plain of Reeds", a geographic area of inundated wetland, to argue that maps of this section of the floodplain presented an uninhabitable *atopia* beyond the jurisdiction of the colonial state. The second part discusses a map of settlement patterns in the Mekong's delta prepared by the Service Géographique and used by French geographer Pierre Gourou to confirm the extent of a catchment equivalent to the space of its residents' social activities. Drawing from the discourses which shaped the content of these maps and their appreciation by geographers, engineers and administrators, the paper speculates on the significance of mapping and delineating the Mekong's catchment areas.

Articulating inundation

Divided into seasons of heavy rainfall (wet) and intense sunshine (dry), the tropical year in Southeast Asia alternates between periods of abundant water and drought. When the accumulated wet season rains cause rivers to overflow beyond their cartographically prescribed

Fig. 1 Map from the early period of French colonization showing the Mekong River "mouths" and its floodplain (Malte-Brun 1866, p. 384)

limits, a particular extent of ground can be submerged for weeks or even months. Although a single flood's occurrence cannot be assigned to only factor, when drawn on a map, this seasonal process occupies an area that suggests a specific geographic space. Cartographically delineated, the allusion to a 'stable' ground onto which water periodically invades, not only contradicts the interannual variability of inundated zones but also the succession of ground conditions which range from waterlogged to patches of dryness. If today numerous maps, hydrological studies, sociological as well as environmental research are focused on the people, the water and ground conditions of the Mekong River's basin, delta or floodplain, the geography these catchment areas refer to was perceived differently at the start of European colonization. Invading the southernmost part of the Vietnamese empire in 1858, the French army eventually established the colony of Cochinchina which encompassed the Mekong's outflows into the South China Sea. Prepared by naval hydrographers, early maps of the colony concentrated on articulating the main branches of the Mekong, which connected existing densely clustered, riparian settlements. Between the main waterways, however, depictions of the interstitial, inundated areas were devoid of geographic detail. Introduced almost a century earlier by the French cartographer JBB d'Anville (1697–1782), the deployment of pictorial "voids" on maps was a reaction to the practice of depicting uncharted regions with imaginary creatures or terrains (Chester 2000, p. 257). Thus, rather than considering these areas to be featureless, such blank spaces indicated a lack of verifiable topographic knowledge about the physical geography of these terrains. On maps from the early colonial period, inundated areas are referred to as "grande plaine d'herbes couvert d'eau" [large plain of grass covered with water] in Cochinchina and "vaste plaine inondée" [vast flooded plain] further north in what is today Cambodia, covering a significant portion of the map, but lacking any additional details on the topography (Fig. 1). But in a region where the ground continuously fluctuated between states of wetness and dryness, mapping

the ground was itself a challenge. The use of typical cartographic notations that differentiated land from water such as coastlines or embankments, only represented a momentary glimpse of a monsoonal region where water was everywhere, in numerous forms, throughout the year.

A local perspective on the relationship between the flood and geographic space was captured by the Vietnamese scholar Trương Vĩnh (Petrus) Ky. Written in French for use in colonial schools, Ky's *Petit Cours de Géographie* (1875) presented the critical factors underpinning the colony's geography (Ky 1875, p. 12). He emphasised that land is formed by "deposits of alluvium" brought in by "the action of water" and "held back" by the roots of different trees (cf. ibid.), suggesting a condition inseparable from the behaviour of the flood acting on an existing stable "surface". With water creating the colony's ground, Ky challenged contemporary accounts by French officers which equated the Mekong's delta with the colony. For him, the ground encompassed by the delta was confined downstream from the town of Vinh-Long where the Mekong's "six mouths" flowed into the sea, and where sediments formed fertile 'garden lands' known as *miệt vườn* to the Vietnamese. Considering Ky did not think it worthwhile to include the term *delta* in his French-Vietnamese dictionary or his translation of geographic terms for the colony's bureaucrats, the importance of the delta was arguably limited at least in terms of determining a particular dimension for the alluvial soil.

The contradiction between the seasonal influence of water and the stillness of maps, also surfaced in French accounts of the Mekong's geography. Discussing the emergence of "*real* islands of extraordinary fertility" ["*véritables* îlots d'une fertilité extraordinaire" (my Italics)], the naval officer Oswald Taillefer identified these relatively drier areas as most suitable for the location of settlements and intensive rice cultivation (Taillefer 1865, p. 45). The *reality* he recognised was produced by the replenishment of land by the Mekong's annual sediment deposits, which gave the riparian 'garden lands' the appearance of permanence and durability. Beyond such naturally occurring havens from the invading waters however, the perpetually soaked ground of the floodplains was considered part of a separate domain. The wetness of the vast inundated floodplains and brackish coastal marshes of the Mekong was directly implicated by French natural scientist Jules Harmand (1845–1921) as responsible for the spread of tropical infections. Pointing to these nameless places on the map, Harmand's commentary associated the intangible threat of disease with the physical condition of the ground, suggesting that the terrain itself was suffering from the constant presence of water (Harmand 1874, p. 14). Siobhan Carroll (2015) has called these natural regions which remained blank on colonial maps *atopias* or "non-places" in the sense that their intangibility, inhospitality, or inaccessibility did not allow them to be converted into spaces of inhabitation. In colonial Cochinchina, these *atopias* manifested around areas of 'excessive' wetness where the action (and inaction) of water inhibited the formation of firm land.

The pathologies of the map's empty spaces overlapped on the Mekong's floodplains. Flat, wet and covered in more than a metre of floodwater for months, these areas were in every way the ontological opposite to Taillefer's dry, fertile islands. On early colonial maps, the geographic space annotated as "plaine inondée couverte d'herbes" or "plaine d'herbes couverte d'eau" extended from Cambodia to the western doorstep of the French administrative capital in Saigon. Cartographic zones of the colony alluding to particular characteristics of the terrain, presented the extent encompassed by the "Plaine des Joncs" (Plain of Reeds) as equivalent to the water-logged ground on either side of the Mekong (Fig. 2). However, the chosen name did not describe a grass-covered plain. While today trees are a rare sight, historical botanic research describes a region covered

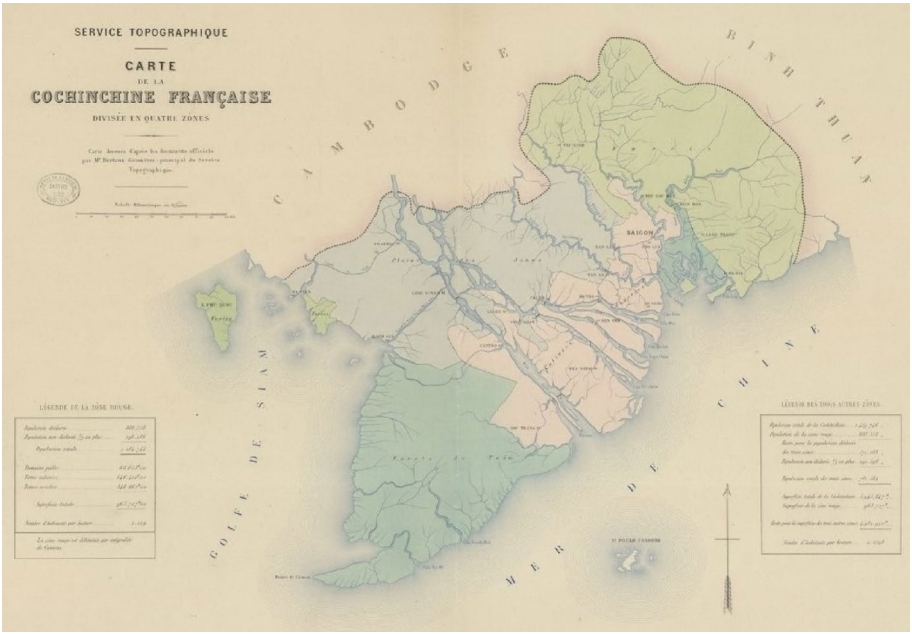

Fig. 2 Map of French Cochinchina divided into four zones (Bertaux 1882). Extending on both sides of the Mekong, the light blue coloured area on the map represents a geographic space annotated as "Plaine des Joncs". Rather than describing the extent of a grass-covered ground, this zone encompasses the flat, inundated wetlands adjacent to the colony's waterways

with clusters of melaleuca forest, with only limited areas of grass (Le 1993). Rather, as naval captain Paulin Vial noted in his report on the French colony of Cochinchina, colonial references to vegetated plains indicated a generic 'overgrown' and unproductive region, an *atopia* centred on the "deep depressions in the ground occupied by marshes" [de profondes dépressions du sol occupées par des marais] between the branches of the river (Vial 1874, p. 31). The perceived disorder of these peripheral landscapes was further compounded by the absence of solid ground to pursue those resisting colonial rule. Citing the area known as "Plaine de Joncs", the colony's official newspaper *Courrier de Saigon* described the "childish" threat to colonial authority posed by "agitators" (Courrier de Saigon 1865) such as Võ Duy Dương whose stronghold was located north of the river in the ruins of Thap Muoi. Surrounded by swamps, pursuing armies needed to laboriously wade through the stagnant water, making the exercise of military control almost impossible and the wet condition of the ground tantamount to a state of lawlessness. From the viewpoint of the newspaper's journalist, the plain was located as far from colonial authority as if it was beyond the colony's frontiers ["au-delà de nos frontières"] (Courrier de Saigon 1865).

When in 1873 these frontiers were finalised, they delivered a new geographic focus for cartographers and administrators which required depictions of the terrain to adopt new toponyms and subdivisions. On maps, the annotation "Plaine des Joncs" was increasingly used to signify only the inundated land within the boundaries of French Cochinchina located north and east of the Mekong. Moreover, new administrative districts (*arrondissements*) appeared to subsume control of the floodplain's amorphous

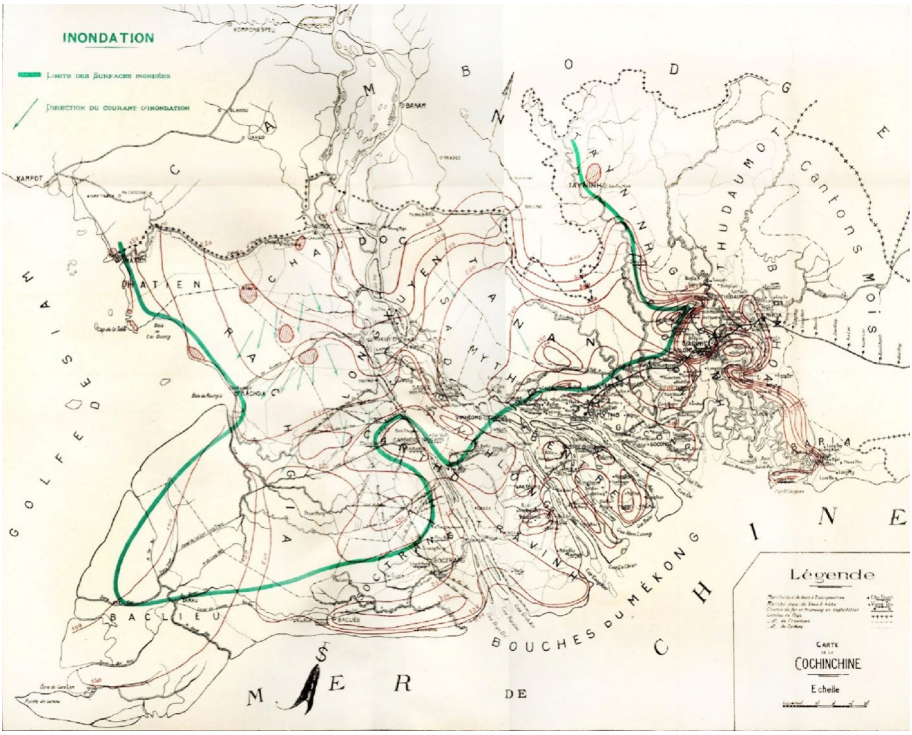

Fig. 3 Encompassing a significant proportion of the entire colony, the green line displays the limits of the geographic space covered by floodwater during the wet season (Pouyanne 1911)

ground into a regional hierarchy that privileged the drier, higher landforms around rivers. With the notional centre of the map focused on the Mekong's inhabited banks, the inundated plain appeared as a permanently submerged hinterland on the margins of civilization. Yet, in relation to the entire extent covered by floodwater, the geographic area constituting the floodplain was not immediately evident. The observable and thus recordable condition of the ground during wet season rains was not limited to a particular type of landscape or a single distinguishable terrain.

Observing that the whole of Cochinchina, was an immense plain with very slight undulations ["Toute la basse Cochinchine, dont la superficie attaint environ quatre million d'héctares, constitue une immense plaine qui présente de très faibles ondulations"], the Algerian-born engineer Albert Pouyanne defined the limits of inundation in relation to the colony's boundaries rather than to the Mekong's delta (Pouyanne 1926, p. 98). The planimetric depiction of the flood's maximum extent however did not just differentiate between areas of seasonal wetness and dryness (Fig. 3). Within the cartographic limits of inundation, regions with notable topographic, historical or cultural differences were all presented as unified by the impact of a single phenomenon. This apparent unity however was only temporary and contradicted the different rates at which particular areas became inundated or drained. For an engineer like Pouyanne, the delineated area experiencing inundation was not merely the record of a particular condition. Later appointed colonial Inspector of Public Works for all Indochina, he identified the problems related to flooding in the Red River

Delta, located in the north of Vietnam, as the focus of the colony's public works projects (Pouyanne 1926, p. 130). Pointing out the dangers that floods posed to agriculture and the lives of villagers throughout Indochina, the mapped outline of inundated land clarified the colonial engineer's primary area of operations.

From this perspective, areal depictions of flooded areas alluded to a particular inundated extent confronted with similar problems. At the same time, the deficiencies in topographic knowledge that created blank spaces on the map could also indicate the inhospitability of flood-prone areas or a refuge for "rebels". As a part of the entirety of flooded areas, the "Plaine des Joncs" supported claims regarding a singular terrain threatened by impending danger. The uninhabitable swamp or the distant hinterland of riverine settlement was presented as a separate domain. And while 'amputation' would be an exaggerated way to describe the notional separation between the plain and the rest of the colony, the marginalization of this *atopia* was consequential in supporting different ideas referring to the same geographic extent. Although the planar surface area covered by water could be visually equated with the floodplain's extent as it appeared on a map, the succession of ground conditions that followed inundation ranged from water-logged to relatively dry, until the next rainy season restarted the process. As a mapped boundary of both a specific space and an annual phenomenon, the floodplain's outline referred to the temporary accumulation of water rather than to an extent of land. This accumulation could be understood in terms of the annual sequence of human activities such as agriculture, that were contingent on the changeable condition of the ground. Considering the immense human labour involved in cultivating, inhabiting or domesticating any part of these inundated areas, the floodplain's delineation reflected an intimately anthropocentric conceptualization of the Mekong's riparian areas. The improbability of ever defining an indisputable limit to the floodplain made the 'accuracy' of the mapped outline secondary to the conviction of the cartographers' arguments which made its visual presence on the map necessary in the first place.

Shaping the delta

In mapping the temporary accumulation of water, the cartography of the Mekong's lowlands articulated part of another hydrological catchment. With the dawn of the twentieth century the term *delta* begun to slowly replace or appear alongside the idea of a river's "mouth" (*embouchure*) in maps and descriptions of the colony's ground. Describing the landform produced by the accretion of sediment, the idea of a *delta* on the Mekong River conflated the appearance of exploitable fertile soils around the river's outflows with the extent of Cochinchina. Designed initially to connect between destinations and facilitate army patrols, one of the most important change in the condition of the ground during French colonial rule was the construction of new waterways. To construct the canals, slow mechanical dredgers sliced through the compact clay soils in continuous straight lines that paid little attention to topographic nuances. These public works became a key feature of colonial maps, on which their colossal scale seemed to rival the length and importance of many natural waterways. Crossing the empty spaces of the map, the solid blue lines representing the canals, filled the void with the man-made geometry of water. With each individual canal's contribution to a wider system of hydraulic flows, the network of waterways began to resemble a regularly spaced grid that extended to the limits of the colony's jurisdiction.

The depiction of Cochinchina's waterways in Pouyanne's hydrological maps would suggest hydrological knowledge on the level of the entire colony. However, the actual behaviour of water within the network of waterways was only partially understood and the changes in surface flows caused by canals was not fully anticipated by the engineers responsible for their design. Along with the several million cubic metres of dredged soil stacked alongside their embankments, canals redirected water, transforming what could once have been the edge of a marsh into farmland, or flooding fields that had previously been drained by existing streams.[1] The failure to anticipate the impact of canalization was attributed to both problems in the execution of secondary infrastructure, and the fundamental complexity of the lowlands' hydrology (Biggs 2010, p. 80). Despite triggering geophysical processes that gradually transformed the quality of agriculture soils, the regularly spaced intersections between canals became the favoured points for the foundation of new villages and hamlets by tens of thousands of migrants arriving in Cochinchina every year. Dimensioned to accommodate French patrol boats, new waterways provided access to interstitial lands far from their confluences. Historians have described how individuals following the paths of mechanical dredgers, laid claim and cultivated plots adjacent to manmade waterways (Brocheux 1995; Biggs 2010). Born in the south of Cochinchina in 1926, the Vietnamese scholar and writer Sơn Nam described such a settlement near his birthplace. He related that the village of Dong Thai appeared to stretch for 30 kms along an even longer waterway in 1914 and that "when enough numbers were reached, the remote hamlets" on the village's extremes "became new villages" (Sơn Nam 1973:135). Uncultivated "wasteland" between clusters of buildings could be considered sufficient to initiate the subdivision of an existing settlement into new taxable entities, as was the distribution of markets, educational facilities and spaces for communal gatherings (Sơn Nam 1973:57). Taken as the relationship between individual buildings and the focus of a community's social activities, the centrality that was apparent around confluences or in organized villages built on higher ground, was dispersed along kilometres of navigable, manmade waterways.

Popular for his adventure novels and historical accounts of the *đồng bằng sông Cửu Long*—the Vietnamese name for the Mekong Delta—Sơn Nam himself grew up along one of the canals designed by French engineers. Rather than a village, he described having spent his early childhood "near the 4th canal" of an area known locally as *miệt thứ* (cited from Bourdeaux 2014). Composed of numbered canals flowing from the melaleuca forests of U Minh to the Gulf of Thailand, the *miệt thứ* was perceived to form a particular region. Built in groups which local residents gradually extended, canals allowed the Khmer farmers and Vietnamese migrants living in dispersed households and small hamlets to trade and communicate with each other. At the same time, by changing surface flows, the canals initiated changes in the habitat areas of snakehead and catfish, that became a source of income for local residents (Sơn Nam 1973:132). Underpinned by the access provided by such networks of waterways, floating markets, schools and temples were not just features of individual villages. As Philip Taylor has highlighted by examining the social role of fresh water tanks in Theravada Buddhist temples, communal facilities located along canals could act as the centres of "dispersed riverside settlements" (Taylor 2014:105) whose inhabitants collaborated on common tasks and thus formed distinct social groups. Circumscribed by canals creating a 'local' network, the geographic space reachable by boat collectively

[1] These conditions led to multiple appeals for colonial justice by existing residents, especially when mechanical steam dredgers cut new canals through cultivated lands, violating existing property rights (Biggs 2010).

described a habitable region encompassing multiple settlements, as well as the sometimes more remote households in between. For different inhabitants the same waterway could form the centre of social activity, function as a fishery, join distant towns, connect individual houses into villages and unify distant villages into settlements encompassing regions. With few exceptions, the extent of geographic space within which the inhabitants of groups of villages operated did not correspond with the limits of any single pre-existing geophysical condition that could be distinguished on a map.

Specifying the cartographic dimensions of villages was nonetheless an important tool for governance. A measure of population and property, villages were critical to pre-colonial Vietnamese administration, where in matters such as taxation and *corvée* labour, the state dealt with the village as an entity rather than with individuals. As the Vietnamese historian Đînh Đâu Nguyễn has observed, the village units entered into pre-colonial cadastral records of Cochinchina did not uniformly correspond with typical settlement designations such as *xã* (commune) or *thôn* (hamlet) (Nguyễn 1991). Especially far from the cities, the answer to the question of which group of buildings, land, or people constituted a particular settlement was different from that of villages in northern Vietnam, where the empire's bureaucratic codes had been developed. Typical of the lands created by the Red River's sediment, the socially autonomous villages of Tonkin around Hanoi have been described by various scholars as "isolated islands" with their own lands, property, justice and customs (Trần and Nguyễn 2016). These settlement units were sometimes demarcated with physical structures or bamboo hedges, which were symbolic of the limit of the emperor's direct control over the residents in the villages. The areal relationship of villages to geographic space was an important feature of these new maps. In this regard, the *Cartes des Deltas de l'Annam* which were first published in 1908 by the *Service Géographique de l'Indochine* set a new standard for depictions of the colony's terrain. Unlike the 1:100,000 scale used for mountainous areas, maps of Indochina's coastal lowlands were prepared at the scale of 1:25,000 which was considered suitable for planning water infrastructure as well as the cadastral operations which determined taxation (Robequain 1926). Including the maps of Cochinchina and the Tonkin Delta, a total of 277 maps are reported to have been prepared at a scale of 1:25,000. (Les Armées Françaises D'outre-Mer 1931). Showing a geographic space that extended about 40 kms inland from the coast, a characteristic of this series was the representation of settlements [Fig. 4]. With individual built structures visible, villages were distinguished from cities, towns and other clusters of buildings and shown to occupy a specific delineated extent. Drawn on a separate layer from the topography by the cartographers of the *Service Géographique de l'Indochine*, the green shaded limits of villages emulated the vegetated clusters of village orchards which appeared more like "masses of greenery" rather than agglomerations (Gourou 1942). Their areal dimension made villages and their residents into 'visible' entities subject to specific legal obligations, but also made local people wary of cooperation with the Service's mapping operations (Bowd and Clayton 2003).

Yet, even with the support of local inhabitants, mapping the deltaic lowlands was considered a delicate operation. Surveyors needed to account for a terrain whose flatness and lack of vertical landmarks challenged accurate levelling. The topographic homogeneity and dense geodesic canvas however, made deltas suitable for the deployment of a relatively new cartographic technique. Beginning in the 1920s, the *Service géographique* introduced the use of aerial photography for surveys throughout the colony. Photographic proofs taken at scales similar to the desirable level of cartographic detail would be sent to the Service's specialist laboratory in Hanoi where technicians would confirm their location in relation to geodetic reference points, and trace over identified features with a pencil (Gouvernement

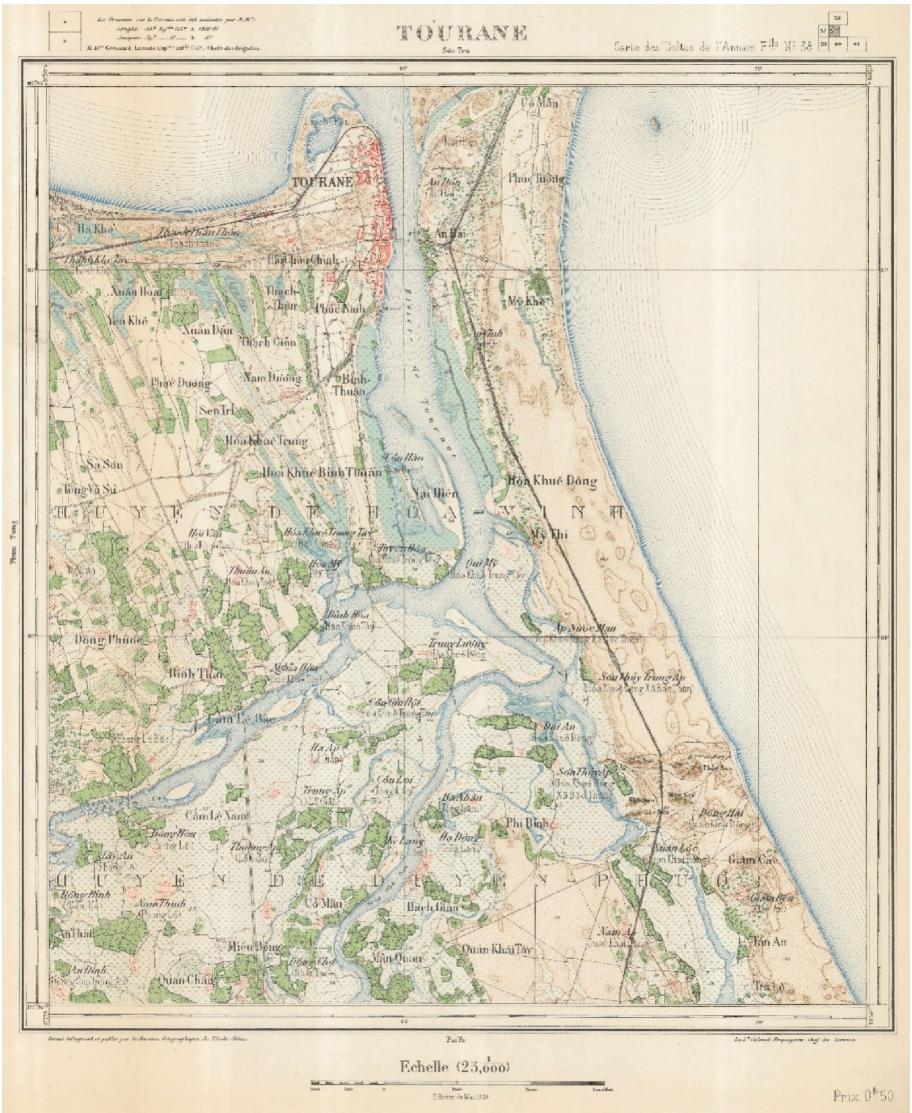

Fig. 4 Prepared at a scale of 1 to 25,000 that allows individual built structures to be distinguished, this map of Tourane (Đà Nẵng) depicts the lowland areas adjacent to the Han River. The map differentiates the city (red building footprints) from other settlements. Villages are represented within a green-coloured cartographic space, distinct from other clusters of buildings on the coast or along roads (Service géographique de l'Indochine 1908)

de l'Indochine 1931). Unlike ground surveys, the aerial views of the topography provided by military airplanes did not require surveyors to access remote or hostile regions. This significantly accelerated the pace of surveys and, by expanding the geographic coverage of maps at the same level of detail, revealed recurring visual relationships between farms, settlements and topographic features. Interpreted as patterns by geographers, the apparent repetition of particular features across the map supported scientific arguments that framed

the "region" as a function of the interaction between people and their environment. The most influential French geographer of the period, Paul Vidal de la Blache, introduced a new methodological approach by positing that these regions could encompass valleys, coastal plains or entire river basins. Focusing on the scientific study of "places", for Vidal the "character" of a region, which geographic science aimed to identify and explicate, was inseparable from the practices of the people concentrated within that particular region. Based on observations derived from maps, his thesis was particularly attuned to the relationship between human habitats and the qualities of soils that enabled different agricultural techniques. Observing that homogeneous soil conditions propagated the same type of village, he concluded that "the hamlet type and the village type seem to correspond well to geographic differences" ["le type hameau et le type village y semblent bien correspondre à des différences géographiques"] (Vidal 1922, p. 152). The correlation between a group of people and particular features of the cultivated terrain resonated with geographers working in the colonial regions of Indochina.

In his monumental study of the villages in the Tonkin Delta, the Tunisian-born French geographer Pierre Gourou argued for a unity between people, settlements and the surrounding environment that was made apparent through mapping and aerial imagery (Gourou 1936). Published in 1936, Gourou's anthropological research was prepared after several years of intensive fieldwork carried out in collaboration with his Vietnamese colleagues at the University of Hanoi. Following the principles of Vidal's geography, the delta's "natural" topographic uniformity was presented as critical to the creation of the "human unity" represented by village communities. Gourou himself stated that "the natural uniformity of a deltaic country has done much to create this natural uniformity and human unity, which, by helping each other, have created a remarkably homogeneous country and a perfectly coherent nation" ["l'uniformité naturelle d'un pays deltaïque n'a pas peu contribué à créer cette unité humaine. Uniformité naturelle et unité humaine, en s'aidant l'une l'autre, ont créé un pays remarquablement homogène et une nation parfaitement cohérente"] (Gourou 1936, p. 14). The methodological axis of his studies on settlements pivoted on each village's discernible form in relation to the topography. Using photographic reduction techniques and colour tints to distinguish building clusters, Gourou constructed maps on which, in his opinion, even the smallest hamlet was visible. Depicted in solid black, these maps focused attention on the planar arrangement of buildings, that while important, were only one of the many characteristics—including communal lands—that defined a *làng xã* as a state-recognized entity. Examining the settlements that appeared together on the maps he described how "guidelines" ("lignes directrices") determined the different types of villages. The idea that common rules or guidelines could underpin the spatial arrangement of a group of villages, redirected emphasis to the collective form of the buildings depicted on the map. Yet, not all guidelines correlated with the limits and magnitude of building clusters. As Gourou pointed out, especially in agricultural areas, where the distance between farmhouses varied considerably and communal land was non-existent, the dikes and canals subdividing the Tonkin Delta conferred a semblance of structure to the disorder and individualism apparent on the map. Dikes encircling a particular extent of geographic space, that were called *casiers* by the French, were a typical feature of the Delta, with each village—rather than the state—responsible for the maintenance of their own flood-control structures. While not equally distributed throughout the region, the unit of geographic space encompassed by dikes was considered emblematic of north Vietnam's agricultural landscape. For Gourou and indeed many other colonial scientists, the hydraulic compartmentalisation of the Delta's topographic "uniformity" and the labour required to build and maintain these *casiers*, reflected the "heroism" of the hardworking Tonkin peasant (Biggs 2010). Thus, although

dikes had altered the hydrological regime by detaining floodwater even after inundations had subsided elsewhere, water infrastructure was associated with a pastoral ideal that was characteristic of Vidalian human geography.

The order which was visible on the planar views of settlements, however, was not limited to the impression that waterways simply "enclosed" clusters of buildings. Rather than considering the village as an areal form equivalent to the mapped lines of a *casier*, as the observable outcome of a process taking place over decades, Gourou's maps suggested that the collective disposition of houses within the *casiers* was also underpinned by particular rules. Groups of buildings confronted with similar conditions such as higher ground on a lowland plain or a linear flood-defence structure, appeared to coalesce into distinct areal forms, allowing Gourou to conjecture that waterways and other topographic features were responsible for their arrangement.

The classification of villages into types reflected this notion. By relating the settlement to the topography, the disposition of buildings along riverbanks or along the edges of hills were entered under different registers. To the extent to which village morphology was suitably adapted to the conditions of the deltaic topography, where particular village types were concentrated on the map, also indicated the prevalence of particular topographic conditions. Visualised on the map, the grouping of these "isolated islands" into coherent systems helped to explain complicated social phenomena. For example, the areal magnitude of villages in relation to the number of their inhabitants, exhibited population densities that were thought to exceed the capacity of the land to feed its residents. Based on these observations, the cause of poverty in the Tonkin Delta was attributed to "overpopulation" (*surpeuplement*) rather than the devastating economic impact of the Great Depression or the colonial taxation system. According to scholars of Gourou's work, these conclusions affected French officials that began to consider mass migration to Cochinchina as the solution to the "problem" of density (cf. Bowd and Clayton 2003, p. 161).

Applying his cartographic methodology to the lowlands of the Mekong River, Gourou's 1942 study of the rural population in Cochinchina was prepared under the colonial Vichy administration. Unlike the years of fieldwork which had contributed to his previous study, however, the Cochinchina he described was based almost exclusively on maps and statistics, of which only relatively few were as detailed as Tonkin's. The 1:25,000 maps of Cochinchina were initially limited to the most densely inhabited parts of the colony. With the introduction of aerial photography approximately 30,000 square kilometres were recorded in images and from 1928 onwards photo-topography was also applied to the cadastre (Les Armées Françaises D'outre-Mer 1931). Arguing that density was the most important factor dictating the difference in conditions between "Cochinchine deltaique" and the "Delta du Tonkin", the narrative of his report divided the colony into subregions that differed primarily in the enumerated spatial concentration of residents (Gourou 1942, p. 10). With the "east" appearing far more populated than the "west", and "central" areas having an "optimum" population, the distribution of the region's inhabitants was interpreted as showing the "underpopulated" portions of geographic space with the capacity to host migrant resettlement from the north. Created using the same mapping techniques as his previous study of Tonkin, the map of Cochinchina's villages only depicted the extent of settlements [Fig. 5]. Projected onto a background of fine blue lines representing the embankments of perennial waterways, the blocks of black ink depicting "villages" displayed the geographic distribution of inhabitation. Seen through the configuration of ink on paper, the map's striking correlation between settlement and waterways was not of the same fine grain of detail as Gourou's previous study, and at 1: 250,000 tended to exaggerate the magnitude and continuity of built areas. Articulating village form would therefore

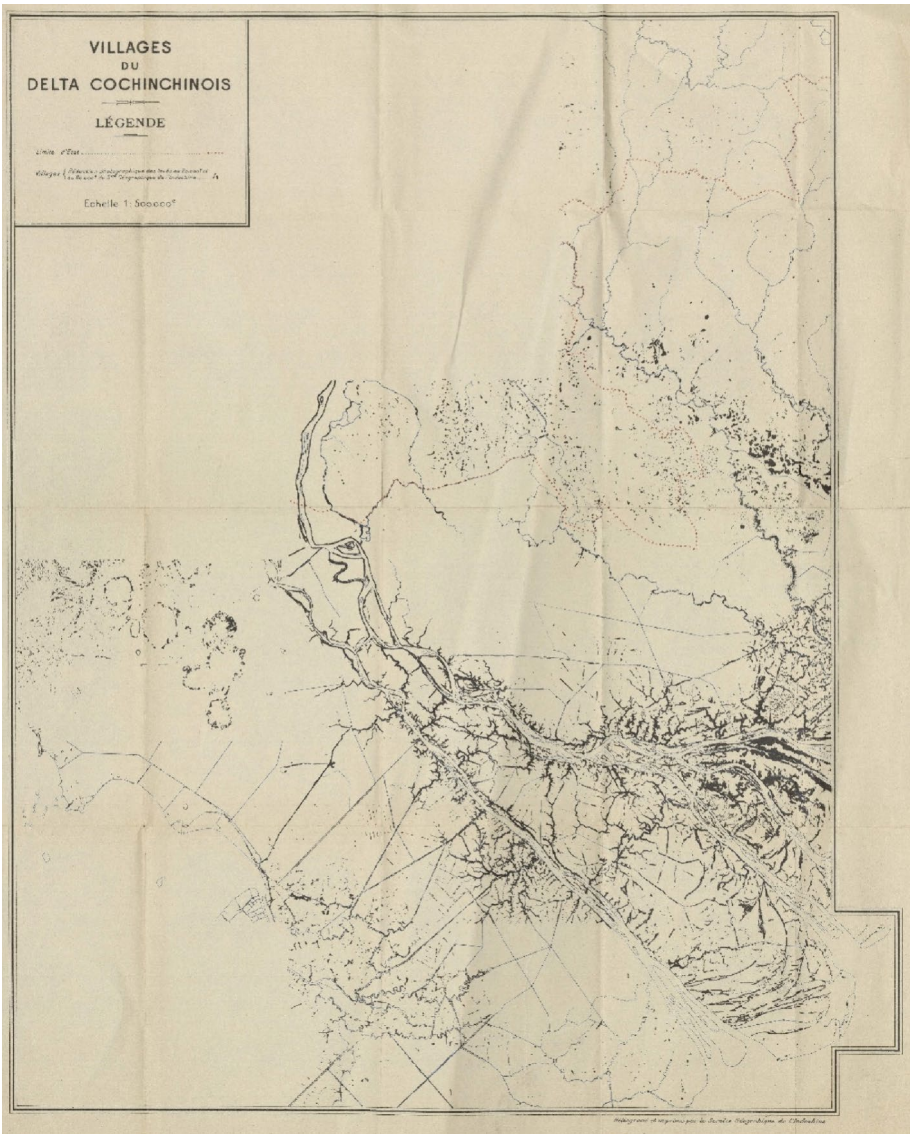

Fig. 5 Coloured black, the map displays built areas in the French colony against a background of perennial waterways depicted with fine blue lines. Although there is considerable exaggeration of the magnitude of built areas due to the techniques employed in the map's preparation, their distribution along waterways represents the condition of settlement in the region. The most uniform coverage of built areas appears between the main rivers in the areas known as *garden lands* due to their fertile soils (Service géographie de l'Indochine 1940)

have been inconceivable without assuming that just like in Tonkin, guidelines underpinned the visible patterns of built areas. Given the observable but general relationship between settlement and waterways, the two main village types discerned from the black shapes indicating built areas were those following the sinuous turns of rivers and streams (*villages*

arroyos) and those built on the flat and relatively drier alluvial plains closer to Saigon (*villages de relief*). Using the map as a guide, Gourou distinguished multiple variations of these types, as well as more contextually unique arrangements of buildings, throughout the region. Inasmuch as a settlement's planimetric morphology aligned with the embankments of waterways or clustered behind riparian sediment deposits (*bourrelets*), Gourou believed that as inhabitation adapted to particular topographic conditions, villages collectively adopted the *areal form* of natural regions ["Le village ou plutôt ensemble des villages épouse la forme même du plateau et arrête á ses limites"] (Gourou 1942, p. 25). The fact that mapped villages could be interpreted as to signify where certain geophysical relationships began, suggests that the geographic space discernible as a distinct region acquired, at least in part, its own cartographic form by the way it was assumed to be inhabited. Considering that on the flatness of the Mekong's lowlands the topographic limits of a swamp or an alluvial depression were only determinable by their temporary differentiation with adjacent areas, for Gourou the cartographic dimension of settlement reflected, but also appeared to define the delta's natural geographic limits.

If Gourou's cartographic distinctions between Cochinchina's settlement types implied a correlation between human inhabitation and specific qualities of the terrain which constituted the delta, this relationship did not account for the countless manmade modifications which underpinned the hydrology and ground conditions experienced by Sơn Nam. Inhabitants burned and cleared forests accelerating the processes initiated by canalisation that dried brackish swamps or allowed tides to funnel salt water inland. And with demand exceeding the supply of available plots, recent migrants settled wherever possible, requiring the colonial government to reserve the land up to one kilometre from intersections for civic uses (Biggs 2010). Gourou's hypothesis concerning the typological arrangement of villages therefore reflected only one part of the relationship between waterways and settlement. By following the logic of Tonkin's self-contained villages, the hypothesis concerning the adaptation of villages to the delta's geography could not directly account for the fact that the geography itself was also changing and not the stable background in relation to which groups of people adapted their practices. Yet, in suggesting that a group of villages constituted a distinct region, the black blocks of ink representing built areas were able to convey the idea of a specific delta. Thus, even if the apparent configuration of settlement was the consequence of the terrain's characteristics, the ability to alter these characteristics by building and inhabiting new waterways gave inhabitants, but also the state, the agency to also physically construct what constituted a distinct region. If the delta of the Mekong was therefore apparent on the map, it was not the same delta that could be described with reference to sediment accretion. The delta constructed through the cartographic discourse on villages and population density appeared less as an extent of the hydrological terrain and more as an areal unit whose geographic magnitude was coterminous with its inhabitants' social relations.

Conclusion

In the period of colonization, the capacity to distinguish a specific catchment area from the Mekong River's surface flows was contingent on the visual evidence provided by cartographic representations of the terrain. The value of referencing the delta or the floodplain however was not in the way those hydrological concepts described the behaviour of surface water. Although the Mekong's overflow was considered beneficial for agriculture in the 'garden lands', the 'empty' unmapped spaces on early colonial maps which corresponded to the Plain of Reeds were viewed as threats. From different perspectives, mapped

descriptions of the stagnant water retained within topographic depressions, the ground's perennial wetness and soil conditions supported arguments that saw the Plain in terms of a territory of risk. The risks denoted by the floodplain could equally refer to the destructive nature of rising waters as much as the dangers of a poor harvest, of disease, of military violence or of the marginalisation of the hinterland's inhabitants. In these cases, mapping the floodplain aligned the temporary extent of inundation with a permanent state of impending danger to health, inhabitation and state security. For Gourou on the other hand, the dialectic between the areal form of settlement and the 'entirety' that was made visible by the pattern of villages underpinned the estimation of population density as a function of the total surface area equated with the delta. Even if Gourou appreciated that the ground influenced settlement, on a map on which building clusters were drawn only in relationship to perennial waterways, the flood-prone, unproductive soils characterising the"underpopulated " parts of the Mekong's lowlands were simply extents of geographic spaces available for human inhabitation. Constituted on separate maps and under different premises, the contingencies which allowed inundation to be delimited, or a delta to be differentiated from the ground condition of adjacent terrains appear to be primarily concerned with human activities rather than the "action of water". Instead of a basic hydrological concept onto which social, technical and political discourses are subsequently interwoven, these anthropocentric concerns are calibrated in relation to the geographic 'whole' alluded to by the catchment's outline on the map.

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