

On the Geographical Organization of World Urbanization

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Geography speaks, proclaiming certain fundamental truths. It has been explained that mechanical speeds have upset regulations, which were secularly and over thousands of years in equilibrium - these speeds which have recently taken all forms, from the railway line to the radio [...] The world is spread over the entire surface of the earth, from one pole to the other including these poles themselves, a world made of quarries and mines, or gigantic powers of production, of gigantic means of circulation and of transport. From quarries, mines or other sources of primary materials to this consummation of products, which will be an act of intelligent distribution, life will be born creating inhabited places, punctuating the surface of the earth, places of transformation of primary or secondary material into consumer goods [...] In the first machinist stage, they were dispersed everywhere perpetrating the mess that exists. It will be more worthwhile, seeing that a century and a half of experience yields us the lesson to force ourselves to discover the principle.¹

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First published in 1943, this lengthy excerpt from *The Three Human Establishments*, one of Le Corbusier's less canonical and rather elusive discussions on urbanism, describes the loss and search for the geographical regulations and principles of urbanization in an era in which the patterns of human occupation of the earth were being radically reorganized. But how can these geographical principles of urbanization be defined? Every condition of urbanization is, obviously, inherently geographical. As a continuous process of (re)organization of the human occupation of the earth, anchored upon – but not limited to – a pattern of dense agglomerations, urbanization necessarily unfolds through a series of both social and geographical transformations. However, the dynamics behind this complex interplay - between urbanization and natural geography - have been notoriously elusive to define throughout history. Today they are becoming even more difficult to conceptualize, as urbanization becomes an increasingly globalized and geographically pervasive phenomenon. Yet, under these circumstances, a theoretically grounded and precise understanding of the geographical principles of urbanization becomes not only more challenging but also more imperative than ever.

This issue of MONU thus comes at a critical point in time, when a series of dominant intellectual perspectives on the topic seem to have reached an almost complete reversal: from the environmental determinism of the early 19th century, when natural geography was thought to decisively shape patterns of sociospatial organization, to the possibilism of the second half of the 19th century and the Vidalian tradition that introduced a weaker agency of the natural environment in producing potential forms of settlement, environmental determinism quickly waned during the 20th century. Subsequently, the pervasive emphasis on the economic, cultural and behavioural dynamics of spatial relations privileged a multifaceted social determinism, in which sociospatial organization was generally considered to be

independent of natural geography.² More recently, under the auspices of debates on sustainable development and the growing interest in the environmental consequences of urbanization, natural geography has resurfaced. This time, however, geography is no longer considered a shaping agent; on the contrary, it is thought to be itself shaped by the expanding and degrading activities of humanity.

Returning to what Le Corbusier describes as 'upset regulations', already in the late 19th century, industrialization and technological developments in transport and communications were causing a serious rupture with previous forms of urbanization, which had been thought to be more properly aligned the specificities and rhythms of natural geography.³ These putative ruptures to the natural condition of equilibrium corresponded to certain preoccupations regarding what could be characterized as a regional organization of urbanization. Following the Vidalian tradition, regional geography highlighted the importance of natural geographic principles in shaping historically emergent territorial bonds, which were said to define a balanced social and ecologic unit of life, largely reflecting preindustrial, more stable, preindustrial patterns of urbanization.

Within this context, urbanists sought to establish a new alignment between an underlying geographical determinism and the instrumental spirit of modernity that Le Corbusier had championed. Yet this agenda stood in stark contrast to the more canonical, defensive interpretation of natural geography that was meanwhile also being foregrounded by influential 20th century urbanists, such as Patrick Geddes and Lewis Mumford. For them, a new form of regional organization was to be promoted as a counterforce against what they viewed as an exploitative, utilitarian operationalization of natural geography by metropolitan forms of development that, aligned with capitalist forms of development, were destroying the organic regional order and

reducing regions to the role of specialized economic links in a world system of exchange.⁴ The geographical principles of urbanization could still be found, they argued, but only through a rejection of metropolitanism and a selective regional closure, as proposed in the 1930s by the Regional Planning Association (RPA) of America.⁵ However, in an era in which industrial capitalism was becoming increasingly expansionary, incorporating more areas of the world into the global system of circulation (as Le Corbusier highlighted), trying to avoid capitalism's discontents through the partitioning of geographic space not only proved utopian, but also prevented a much-needed macroscopic appreciation of geography.

Indeed, what appeared largely promising was not a denial, but an instrumentalization of the multiple scales of sociospatial organization. But, while Le Corbusier envisioned a rational utilization of the earth's surface, not by denying the need for global circulation of people and resources, but by reinventing the geospatial logic of industrialization, the rationality behind the functional organization of urbanization that dominated the first decades after World War II was much more abstract. Under the growing influence of formal models coming from economic geography and, in particular, the tremendous impetus of location theory during the 1950s and 1960s, spatial relations were largely interpreted in functional, economic terms. During this time, the empirical, descriptive, site-based and historically specific approach of regional geography was largely superseded by efforts to develop a positivist, nomothetic spatial science that attempted to uncover the – supposed - universal laws underlying spatial configurations.⁶

As approaches to the functional organization of urbanization promised to grasp its planetary dimensions by analyzing and optimizing the locations of settlements and industries and the flows of capital, workers, resources and commodities, urbanization

became increasingly detached from its organic synergy with natural geography, foregrounded by regional approaches. Natural geography disappeared into the background, since, as University of Chicago Geographer Allen K. Philbrick suggested in 1952:

*Attempts to understand the activities and the distribution of human society as either the direct or indirect result of the influence of natural environment have been signally unsuccessful. The conclusion that human occupation should be viewed as taking place in a setting with the rest of nature rather than because of it seems to be the most significant way to give to the natural setting its proper role in the affairs of man [...] In the final analysis, also, is it not through functional connections established by people between people that the race as a whole has developed locational and internal organization with roots in specific places?*⁷

It is exactly these principles of functional areal organization, which Philbrick was trying to systematically decode on this 1952 exemplary map of the nodal organization of the United States shown in figure 01. As the analysis of sociospatial relations emphasized their internal organizing principles, conceptualizing them through abstract topologies of nodes and links, natural geography was reduced to a deforming platform, interpreted either as some type of friction to be annihilated through the development of transport and communication infrastructures (e.g. cost-distance), or as pure location to be integrated into the overarching system of circulation (e.g. specialized regions and resources). Urbanization was considered to be unfolding according to its internal logic, formalized into ideal patterns that did not emerge out of, but were only distorted by the specificities of natural geography.

Paradoxically, this methodological detachment from natural geography was happening at a time when the physical imprint of

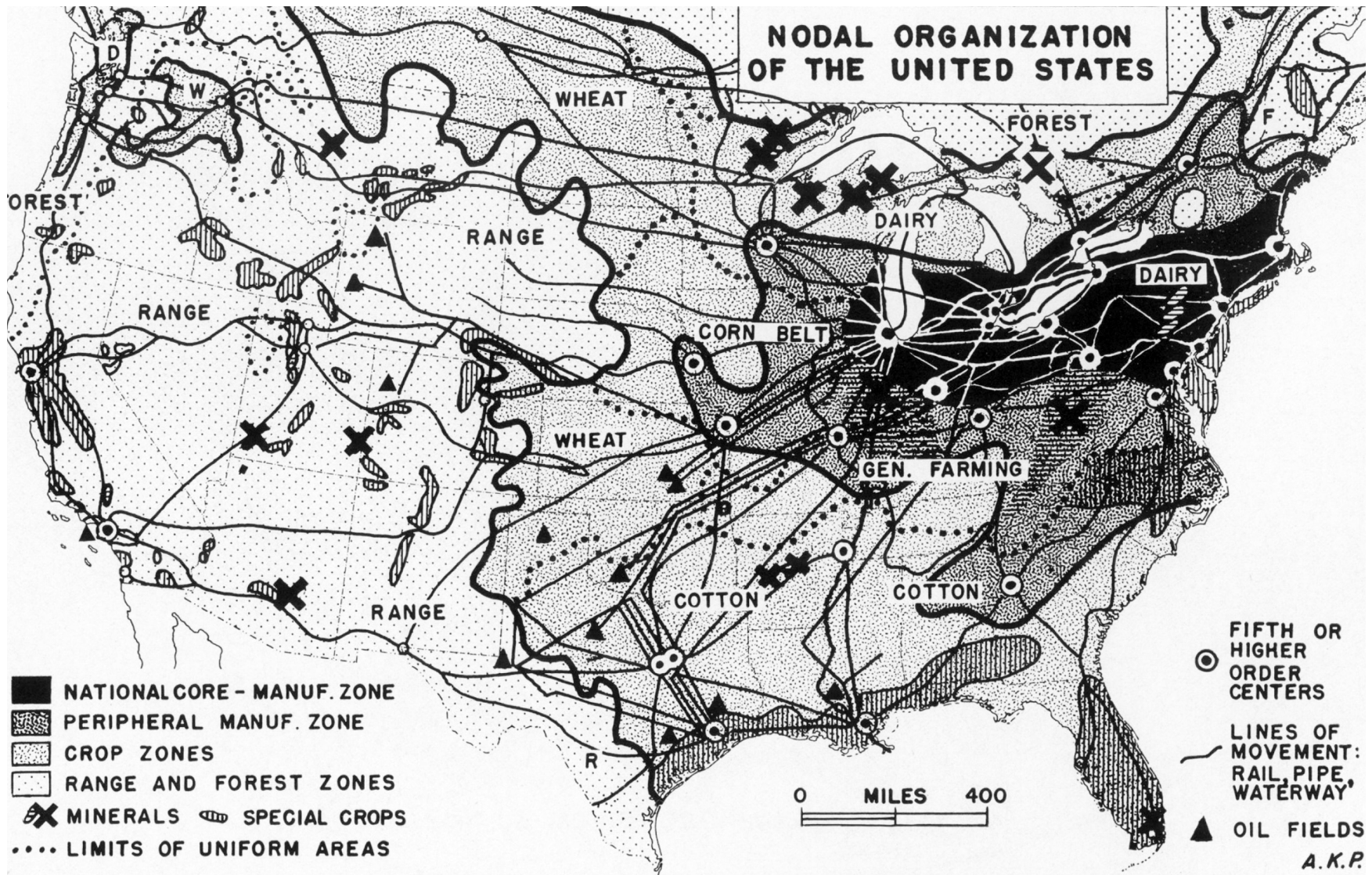


Figure 01: Nodal Organization of the United States. Source: Allen Philbrick, "Principles of areal functional organization in regional human geography." *Economic Geography* (1957): 333

urbanization was expanding in unprecedented ways, becoming increasingly intermeshed with geographical formations. Already in the late 1950s, in his seminal study of the northeast US, Megalopolis Jean Gottmann, would emphasize the extensive transformations in land use and infrastructure systems that were not limited to the densely built up areas, but also included zones of agricultural production and forestry, transportation corridors, hydrological regimes and irrigation infrastructures.⁸ Building upon Gottmann's exemplary study, the Greek architect and planner Constantinos Doxiadis considered megalopolitan formations as intermediate stages in the unfolding of an increasingly continuous urbanization fabric that would eventually merge into an inevitable future condition of complete urbanization, a condition that he termed Ecumenopolis.⁹ Doxiadis would embark on a detailed investigation of the pattern, structure, density and dimensions of the global fabric of urbanization, the "ekistic fabric" of Ecumenopolis. The study of Ecumenopolis revealed in a dramatic way that, as urbanization acquired continental and subsequently planetary dimensions, it engaged with the asymmetries of natural geography in an unprecedented way (figure 02).

However, while it was evident that geographical principles could not be ignored in the articulation of world urbanization, their interpretation was reduced into quantifiable variables and indicators, reflecting the positivistic approach that was prevalent in the late 1960s. A monumental and overly ambitious example of this overarching technoscientific logic, Ecumenopolis was the result of the application of extensive large-scale modeling. The structure of the ekistic fabric was the synthesis of a series of simulated social and demographic processes, including the centripetal expansion of existing agglomerations; the population growth rates of regions; and the centrifugal forces of major transportation corridors, economic and industrial clusters. Natural geography was largely considered an container whose

dimensions, asymmetries and capacities delineated and deformed the structure of the ekistic fabric. The whole surface of the earth was classified based on its suitability for habitation (using environmental criteria such as elevation, climate and the availability of fresh water), creating a "composite habitability envelope" which defined the extents of inhabitation, while at the same time certain geographical features, like mountain ranges or coastal zones were incorporated into the model as deviators, or attractors (figure 03). Geography was indeed reintroduced, but not truly internalized, in the study of urbanization. The attempt to systematize the geographic principles of world urbanization, alongside other nomothetically conceived variables, reduced them into quantifiable indicators, naturalizing and concealing their historical and social contestation (figure 04)¹⁰.

As urbanization becomes an increasingly globalized phenomenon associated with numerous social and environmental challenges, Doxiadis' hypothesis of a future condition of complete urbanization remains highly relevant.¹¹ However, driven by the dominant paradigm of sustainable development, most contemporary approaches that aspire to offer a synthetic and global appreciation of this relationship interpret it in a quite unilateral way. Concepts such as the "urban ecological footprint," which tries to grasp the radiating ecological influence of cities, or the popular paradigm of the Anthropocene, which suggests that human activities have such a significant impact on the earth that they resemble geological forces, address urbanization solely through its negative influence on natural geography.¹² Such notions largely reintroduce, in a reversed form, the pervasive, and ultimately unproductive, dichotomy between natural geography and the social dynamics of urbanization. Thus, contrary to the simplified linear causality of 19th century environmentalism, in which natural geography was thought to shape urban patterns, contemporary urbanization is now largely considered to shape the surface of the earth.

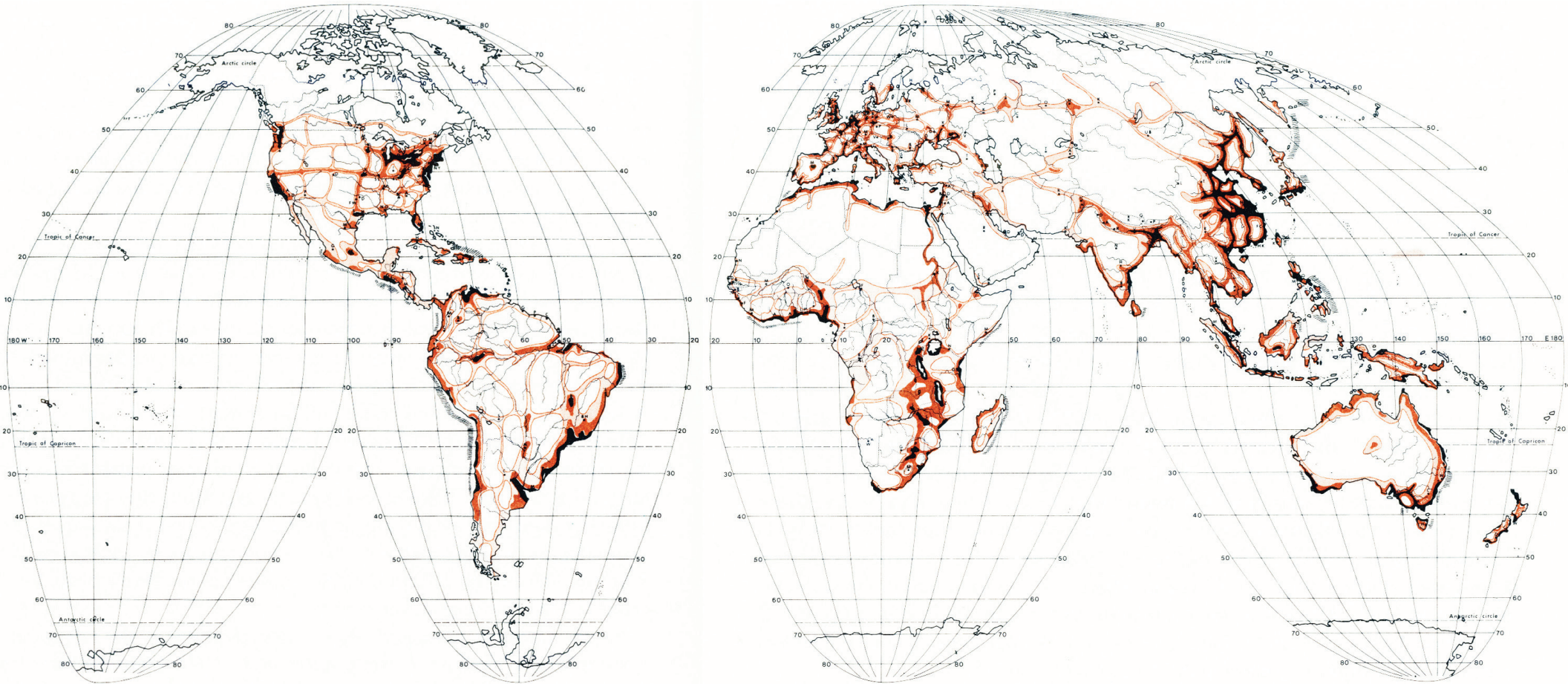


Figure 02: Probable Structure of Ecumenopolis in the Year 2100. Source: Constantinos Doxiadis and John Papaioanou, *Ecumenopolis: the inevitable city of the future*. New York: Norton, (1974): 368-369. Courtesy of Constantinos and Emma Doxiadis Foundation.

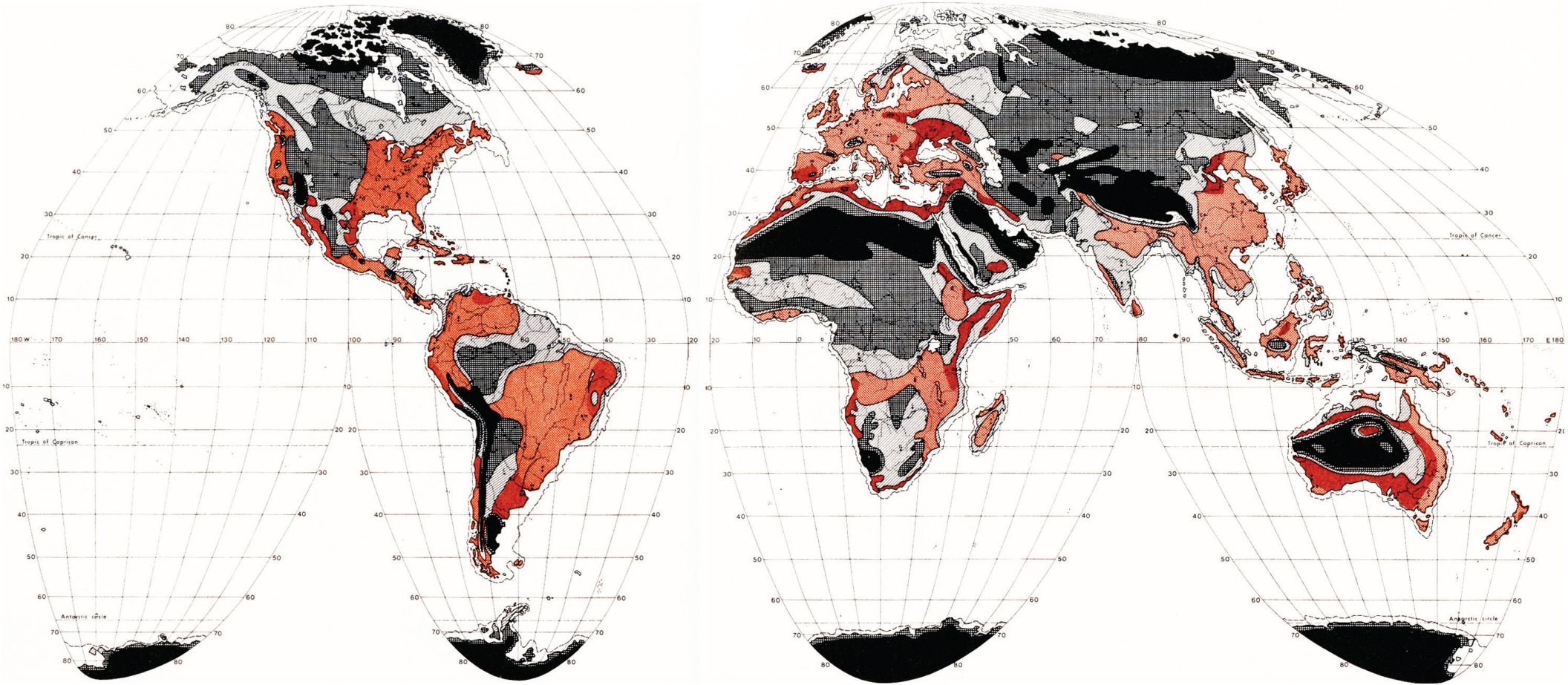


Figure 03: Composite Habitability of the Globe in the Year 2100. Source: Constantinos Doxiadis and John Papaioanou, *Ecumenopolis: the inevitable city of the future*. New York: Norton, (1974): 192-193. Courtesy of Constantinos and Emma Doxiadis Foundation.

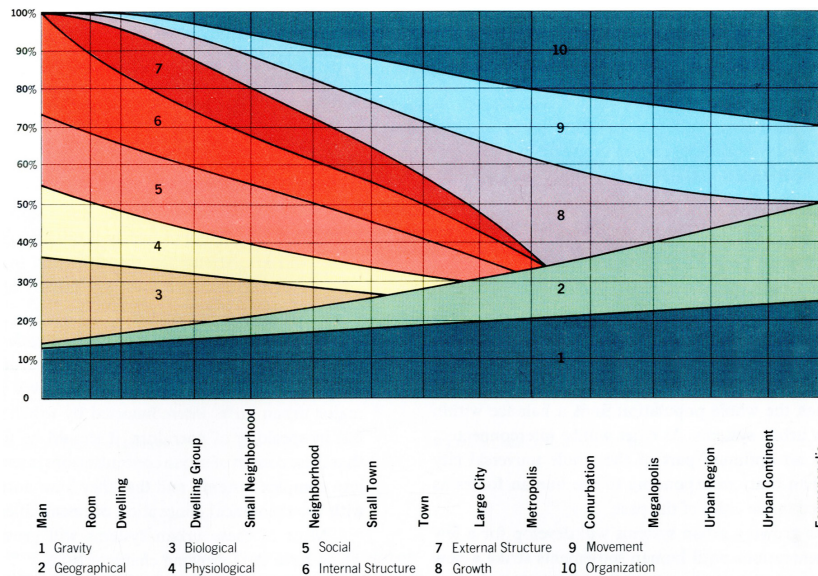


Figure 04: Forces of Ekistic Synthesis across Scales. Source: Constantinos Doxiadis, *Building Entopia*. Athens: Athens Publishing Center, (1975): 295. Courtesy of Constantinos and Emma Doxiadis Foundation.

Alongside such assumptions, however, an alternative discourse has also recently emphasized the need for a critical understanding of both the unprecedented dimensions and the hybrid nature of socio-environmental processes associated with what Brenner and Schmid have characterized as a condition of planetary urbanization.¹³ This evolving agenda promises to overcome, through a dialectical approach, unproductive dichotomies such as that of the city - countryside, and urban - natural, highlighting the need to conceptualize contemporary urbanization as a planetary phenomenon “without an outside” in which:

... agglomerations form, expand, shrink, and morph continuously, but always via dense webs of relations to other places, territories, and scales, including to realms that are traditionally classified as being outside the urban condition.

The latter include, for example, small- and medium-size towns and villages in peripheralized regions and agroindustrial zones, intercontinental transportation corridors, transoceanic shipping lanes, large-scale energy circuits and communications infrastructures, underground landscapes of resource extraction, satellite orbits, and even the biosphere itself.¹⁴

Insofar as the problematique of planetary urbanization highlights the dynamic interdependency of the increasingly continuous web of dense agglomerations with their “operational landscapes” of production, extraction and circulation that sustain them, it allows for a much more inclusive conceptualization of the materialities of urbanization, foregrounding their geographical embeddedness. And while the urban fabric has been largely associated with the traditional structures and infrastructures of the city, it is suggested that the concept of the urbanization fabric could more successfully address the extended dimensions of the variegated equipment and utilization of the earth. A series of cartographic representations, based on contemporary global datasets, aspire to sketch a first impression of the layers that synthesize this contemporary fabric of urbanization. Instead of trying to delineate the boundaries of agglomerations, figure 05 offers an impression of the approximate density and distribution of the more than 600 thousand square kilometers of artificial surfaces paving the planet.¹⁵ While obviously concentrated around dense agglomerations, these surfaces extend far beyond them, including smaller settlements, establishments and infrastructures, as for example the more than 64 million kilometers of roads connecting the globe. Figure 06 maps the most important of these transportation arteries as well as the major marine routes.¹⁶ Exploding the traditional categories of urbanization, figure 07 aims to question how the soft fabric of the 15 million square kilometers of agricultural production landscapes could be also considered part of the operational geographies of urbanization; figure 08 reveals that much of this ‘natural’ landscape is actually heavily equipped for artificial irrigation.¹⁷

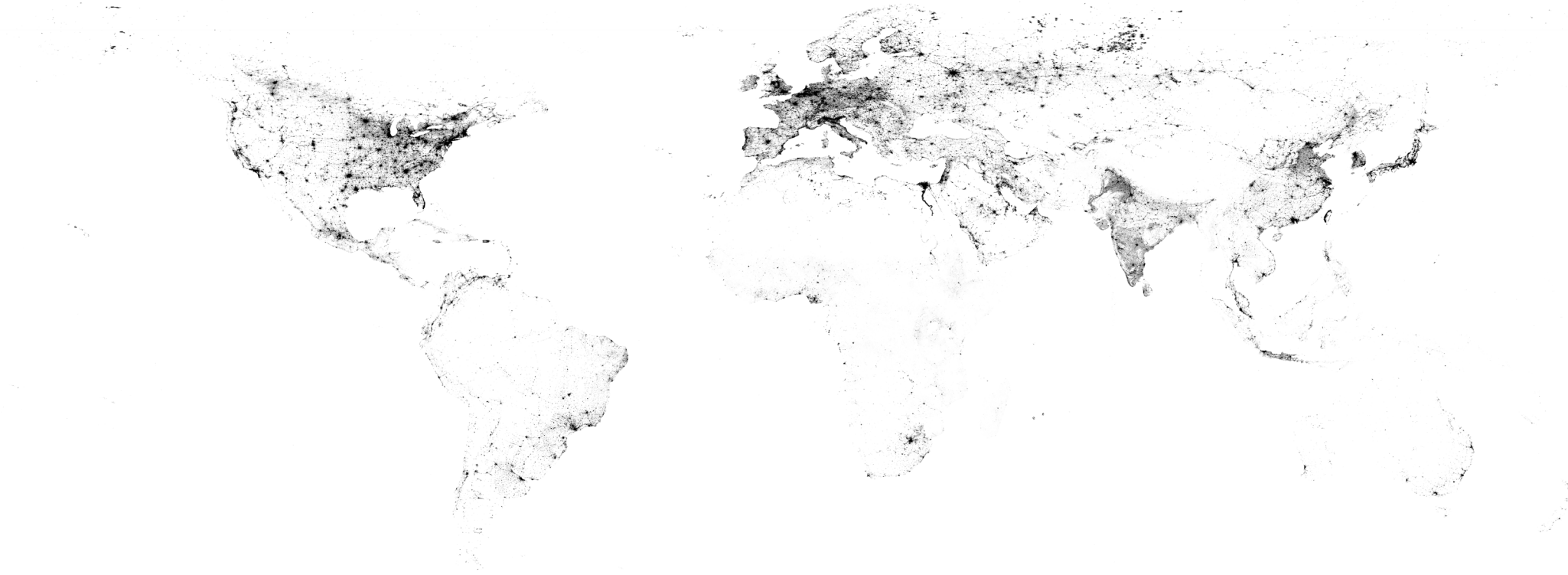


Figure 05: Global Fabric of Artificial Surfaces around the World. The map represents the distribution and density of impervious surfaces ranging from 0% (light) to 100% (dark). Cartography: Nikos Katsikis, Urban Theory Lab, Harvard GSD, 2014. Based on the Global Distribution and Density of Constructed Impervious Surfaces dataset. Source: National Geophysical Data Center (NGDC) of the National Oceanic and Atmospheric Administration (NOAA).

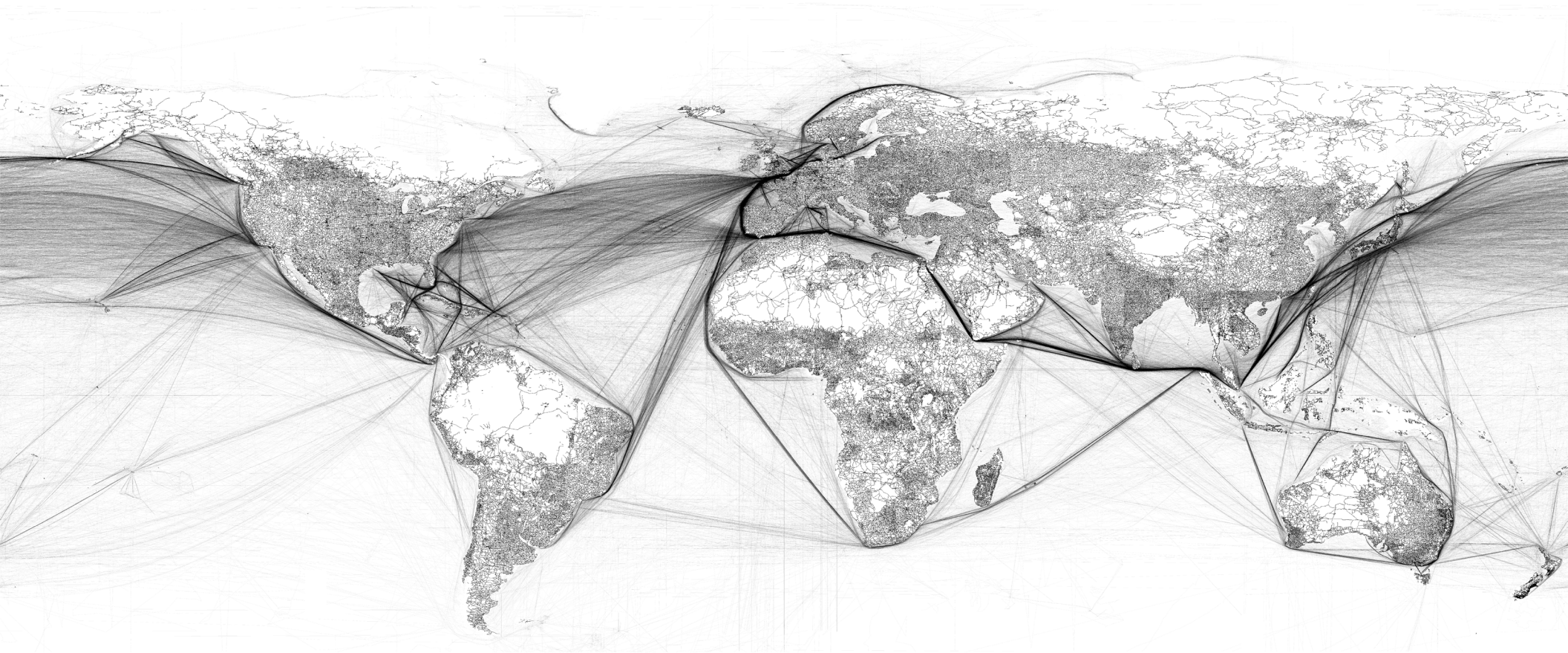


Figure 06: Global Fabric of Ground and Marine Transportation Networks.
Cartography: Nikos Katsikis, Urban Theory Lab, Harvard GSD, 2014. Based on the Vector Map Level 0 (VMap0) dataset released by the National Imagery and Mapping Agency (NIMA) in 1997 and on the global commercial activity (shipping) dataset compiled by The National Center for Ecological Analysis and Synthesis.

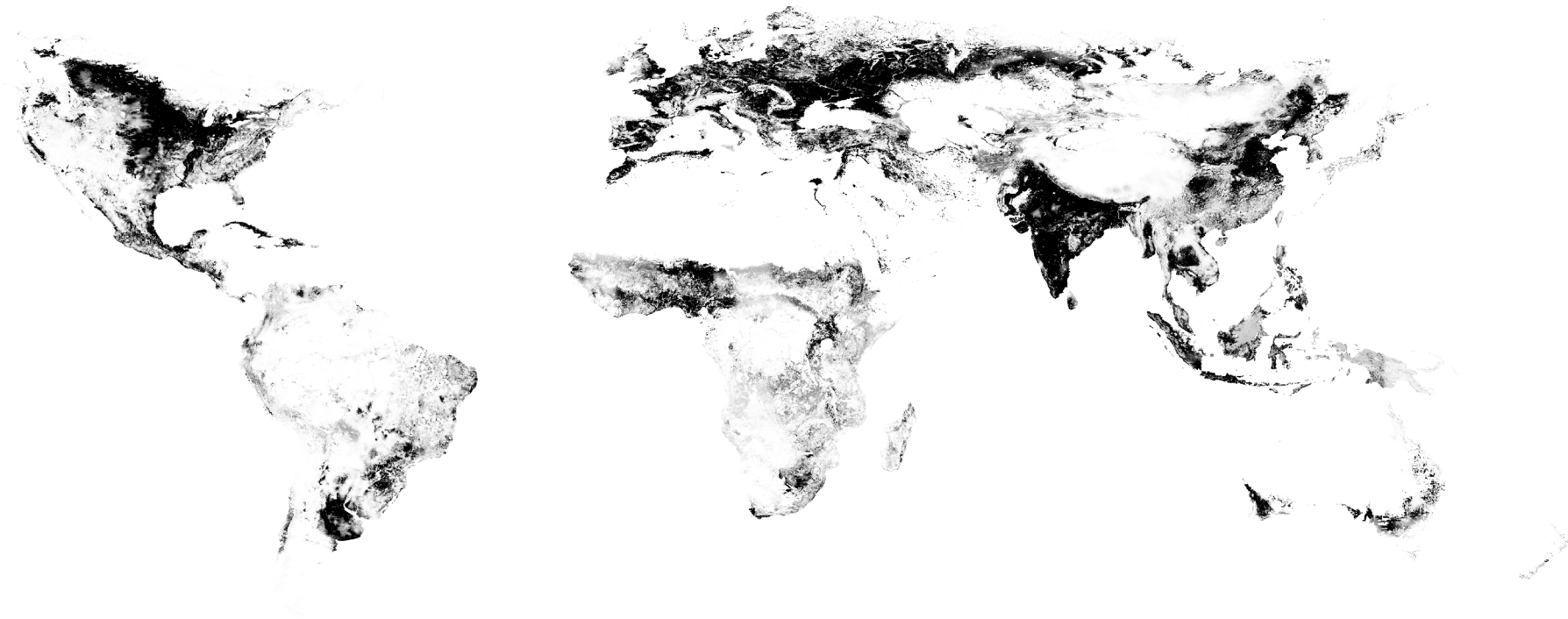


Figure 07: Global Fabric of Agricultural Production around the World. The map represents the distribution and density of areas used for agriculture (cropland) ranging from 0% (light) to 100% (dark). Cartography: Nikos Katsikis, Urban Theory Lab, Harvard GSD, 2014. Based on: Navin Ramankutty, et al. "Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000." *Global Biogeochemical Cycles* 22.1 (2008).

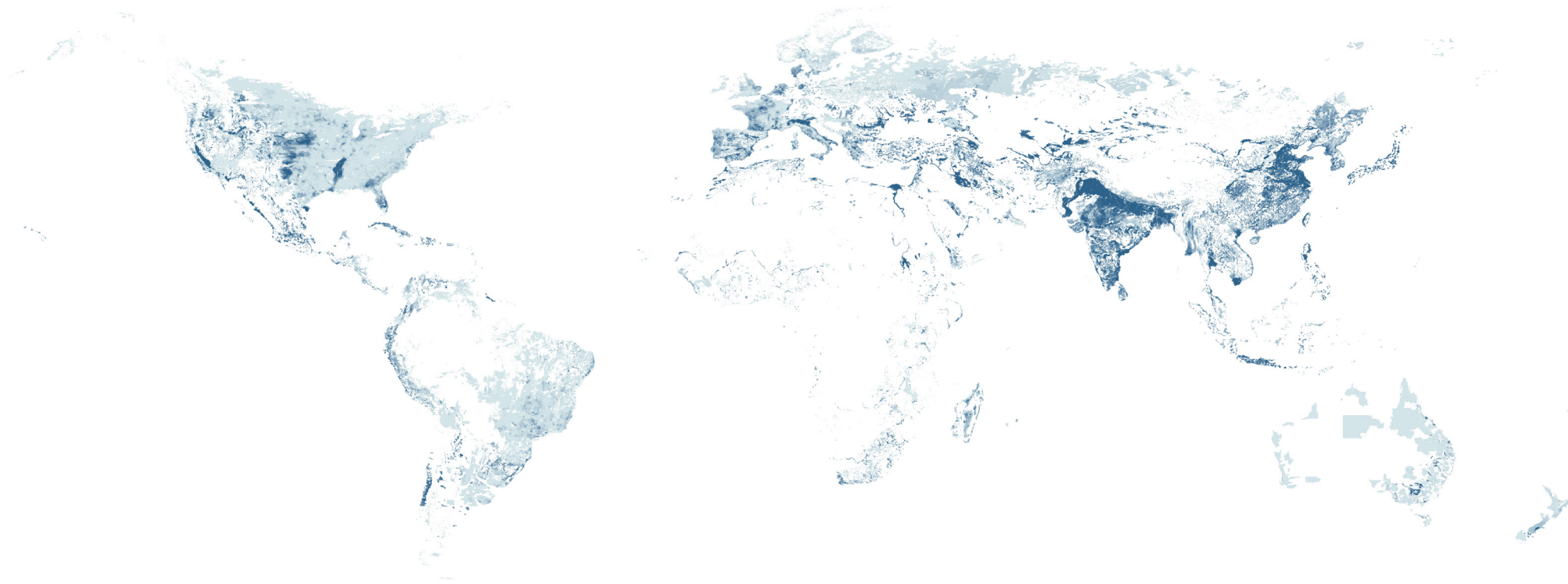


Figure 08: Global Fabric of Artificially Irrigated Areas around the World. The map represents the distribution and density of areas artificially equipped for irrigation ranging from 0% (light) to 100% (dark). Cartography: Nikos Katsikis, Urban Theory Lab, Harvard GSD, 2014. Based on: Stefan Siebert et al. "Global map of irrigation areas version 4.0.1." Food and Agriculture Organization of the United Nations, Rome, Italy (2007).

A first interpretation of these layers could easily foster a series of observations of potential geographical principles, approximating those that Doxiadis was trying to systematically address and plot on his composite habitability map: they illustrate vividly the stretching of agglomerations across coastal zones, the infilling of valleys, the alignment of agricultural landscapes with certain topographic and climatic conditions, the densification of transportation networks along natural passages. But, while these maps certainly offer an extended and radically alternative view of the elements that are suggested to comprise the contemporary urbanization fabric, they remain largely descriptive layers waiting to be synthesized. A geohistorical and geotechnical interpretation is arguably required to facilitate the synthesis of these elements in a way that would allow for an alternative conceptualization of the urbanization fabric.

Discussing the early development of mercantile centers along the Rhine during the 16th century, Fernand Braudel stressed the importance of the landmass of the Alps, the location of the mountain passages and the construction of trade routes out of the manipulation of the hydrological potential north of the mountain barrier as elements that equally co-produced the German isthmus (figure 09)¹⁸. For Braudel, the German isthmus exemplified the lengthy historical merging of natural and human geographies. The directionality, equipment, inhabitation patterns, but also the instrumentalization of space through the various economic regimes, were all parts of a geohistorically emergent process that shaped the urbanization fabric north of the Alps, a path-dependent process that is still reflected upon the contemporary condition shown in figure 10. In a similar way, in his seminal historical exploration of the co-development of Chicago and its hinterland, William Cronon emphasized the blurry limits between urbanization and natural geography as “first nature” (“pure” nature) merged with “second nature” (man-made structures, infrastructures and establishments).¹⁹



Figure 09: The German Isthmus 16th Century. Source: Fernand Braudel, *The Mediterranean and The Mediterranean World in the Age of Philip II*, Volume I. Berkeley and Los Angeles: University of California Press, 1995, p. 204.

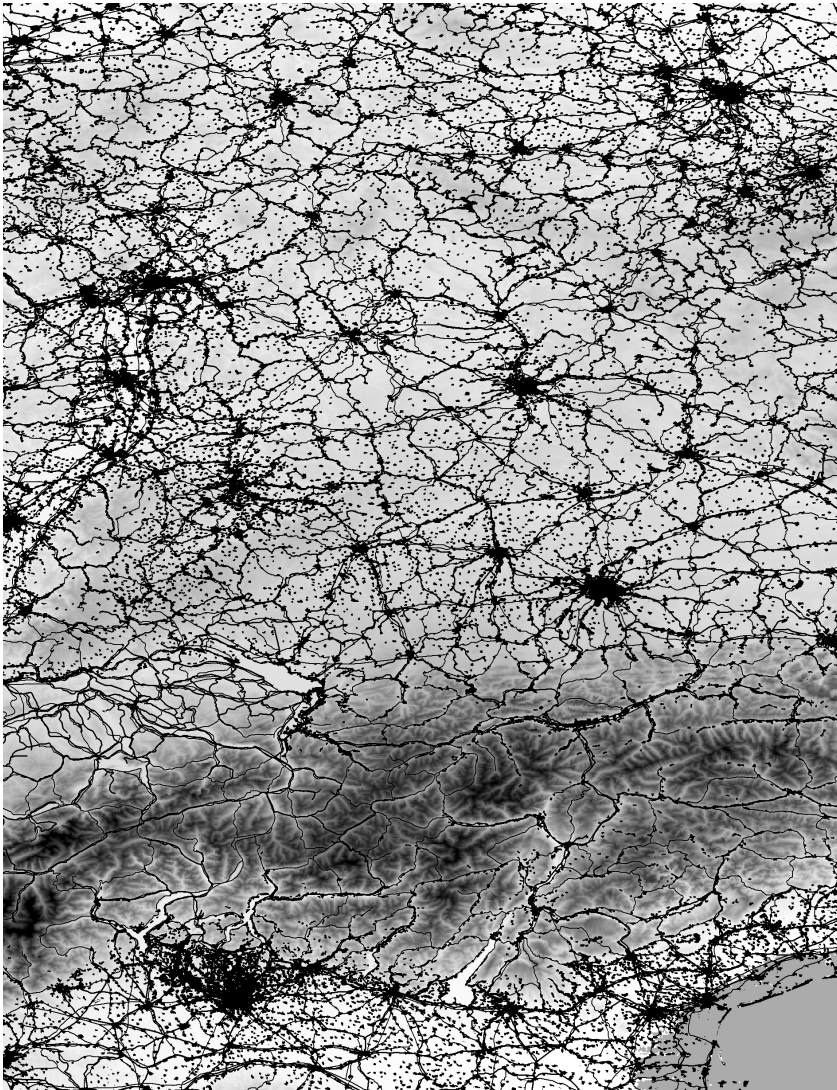


Figure 10: The German Isthmus 20th Century. Cartography: Nikos Katsikis, Urban Theory Lab, Harvard Graduate School of Design, 2014. Based on the Vector Map Level 0 (VMap0) dataset released by the National Imagery and Mapping Agency (NIMA) in 1997 and on the 2006 Urban Morphological Zones dataset released by the European Environmental Agency.

This allows for an important clarification. While the urban fabric can be easily interpreted as the artificial geography of structures and infrastructures (second nature), superimposed over the natural geography (first nature), the urbanization fabric should be actually conceptualized as the crystallization of artificial geography merging with natural geography. The appreciation of this crystallization process however, requires a careful geohistorical and geotechnical excavation that questions not only the material immutability of its physical engraving in space, but also the obduracy and rigidity associated with its social embeddedness.

As urbanization becomes a generalized phenomenon of planetary dimensions, its organizational principles become increasingly interwoven with, and not independent from, the climatic, topographic, geologic, hydrologic and resource asymmetries of the earth. These elements can no longer be considered as distinct attributes of an external natural geography, as they are now being internalized into the extensive, complex and thickening urbanization fabric that extends beyond dense agglomerations to include the operational landscapes that sustain them and make them possible. It is the increasingly hybrid and sclerotic nature of the urbanization fabric – both physical and sociotechnical – that defines the geographical organization of world urbanization.

- 1 Le Corbusier, *The Three Human Establishments*. Punjab Government, Department of Town & Country Planning (1979, first published in French 1943): 148-149. For a recent appreciation of Le Corbusier's engagement with geography see: Hashim Sarkis. "Geo-Architecture: A Prehistory for an Emerging Aesthetic". *Harvard Design Magazine*, 37 (2014)
- 2 For a critical review see: Richard Hartshorne, *The Nature Of Geography: A Critical Survey Of Current Thought In The Light Of The Past*. The Association Lancaster (1939); Peter Hall, "Geography and Planning: A New Version of an Old Story?" In Stephen Ramos and Neyran Turan (eds.) *New Geographies 1: After Zero*. Cambridge MA, Harvard University Press, (2009): 146-154
- 3 See for example: Lewis Mumford, *The city in history: Its origins, its transformations, and its prospects*. Houghton Mifflin Harcourt, (1961)
- 4 See for example: Mark Luccarelli, *Lewis Mumford and the ecological region: The politics of planning*. Guilford Press, (1997); Volker Welter and Iain Boyd Whyte. *Biopolis: Patrick Geddes and the city of life*. MIT Press, (2003)
- 5 John Friedmann and Clyde Weaver. *Territory and function: The evolution of regional planning*. University of California Press, (1979)
- 6 For a critical review see: Eric Sheppard, "Quantitative geography: representations, practices, and possibilities." *Environment and Planning D* 19.5 (2001): 535-554; Ron Johnston, «Sixty years of change in Human Geography.» *History of Postwar Social Science Seminars*, London School of Economics. Vol. 25. 2006; Trevor Barnes "Geography's underworld: The military-industrial complex, mathematical modeling and the quantitative revolution." *Geoforum* 39.1 (2008): 3-16
- 7 Allen Philbrick, "Principles of areal functional organization in regional human geography." *Economic Geography* (1957): 300
- 8 Jean Gottmann, *Megalopolis: the urbanized northeastern seaboard of the United States*. Cambridge: MIT Press, (1964)
- 9 Constantinos Doxiadis and John Papaioanou, *Ecumenopolis: the inevitable city of the future*. New York: Norton, (1974)
- 10 For a critical appreciation of the influence of technoscientific ideologies on large scale planning and development models see: Nikos Katsikis, "Two Approaches to World Management". In Neil Brenner (ed.) *Implosions/explosions: towards a study of planetary urbanization*. Berlin: Jovis (2013): 480-504
- 11 While recent developments of geospatial analysis and remote sensing are offering an increasingly fine-grained monitoring of socioenvironmental processes they have also recycled the weaknesses of technoscientific interpretations. See for example: William Solecki et al. "It's Time for an Urbanization Science." *Environment: Science and Policy for Sustainable Development* 55.1 (2013): 12-17; Seitzinger, Sybil P., et al. "Planetary stewardship in an urbanizing world: Beyond city limits." *Ambio* 41.8 (2012): 787-794.
- 12 William Rees and Mathis Wackernagel. "Urban ecological footprints: why cities cannot be sustainable and why they are a key to sustainability", *Environmental impact assessment review* 16.4 (1996): 223-248; Paul Crutzen. "Geology of mankind." *Nature* 415.6867 (2002): 23-23. Timothy Luke has recently coined the term Urbanthropocene to highlight the influence of urbanization processes and has also developed a critique of the concepts and their influence. Timothy W. Luke. "Urbanism as Cyborganicity: Tracking the Materialities of the Anthropocene", in Nikos Katsikis and Daniel Ibanez (eds.). *New Geographies 6: Grounding Metabolism*. Cambridge MA: Harvard University Press, (2014)
- 13 Elaborating upon Henri Lefebvre's original hypothesis of complete urbanization of society, Brenner and Schmid have embarked upon an investigation of planetary urbanization stressing the need to connect analytically the dynamic interrelations between concentrated agglomerations and their extended operational landscapes. This contribution stems from, and aspires to contribute to, this growing discourse, especially as it has been elaborated through the Urban Theory Lab at Harvard GSD (director: Neil Brenner, www.urbantheorylab.net), where also the series of accompanying visualizations was developed. The author would like to thank Prof. Neil Brenner for his continuous support and for the licensing of this material. For an initial framing of the problematique of planetary urbanization see: Neil Brenner and Christian Schmid, "Planetary urbanization." *Urban constellations* (2012): 10-13;

Neil Brenner, "Theses on urbanization." *Public Culture* 25.1 69 (2013): 85-114; Neil Brenner (ed.) *Implosions/explosions: towards a study of planetary urbanization*. Berlin: Jovis (2013)

14 Neil Brenner, "Theses on urbanization." *Public Culture* 25.1 69 (2013): 103

15 Christopher Elvidge et al. "Global distribution and density of constructed impervious surfaces." *Sensors* 7.9 (2007): 1962-1979.

16 Center for International Earth Science Information Network - CIESIN - Columbia University, and Information Technology Outreach Services - ITOS - University of Georgia. 2013. *Global Roads Open Access Data Set, Version 1 (gROADSv1)*. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC).

17 Stefan Siebert, et al. "Global map of irrigation areas version 4.0.1." Johann Wolfgang Goethe University, Frankfurt am Main, Germany/Food and Agriculture Organization of the United Nations, Rome, Italy (2007); Navin Ramankutty, et al. "Farming the planet: Geographic distribution of global agricultural lands in the year 2000." *Global Biogeochemical Cycles* 22.1 (2008)

18 Fernand Braudel, *The Mediterranean and The Mediterranean World in the Age of Philip II*, Volume I. Berkeley and Los Angeles: University of California Press, (1995)

19 William Cronon,. *Nature's metropolis: Chicago and the Great West*. Norton & Company (1992).