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URBAN COMPENDIUM

Theory and Practice in Urban Morphology

Edited by Stefano Tornieri

Luleå University of Technology

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LULEÅ UNIVERSITY OF TECHNOLOGY

Pamphlet

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CONTENTS

This pamphlet explores urban form theories, patterns, urban planning, and development both theoretically and through practical exercises, concentrating on major Swedish coastal cities above the 64th parallel north along the Bothnia Gulf.

The goal is to produce a compendium that collects interesting texts on urban morphology, provides a theoretical summary, and then applies this knowledge through direct experimentation on a specific case study. We acknowledge that while innovative methods for studying cities as physical entities have emerged, the existing body of literature on urban morphology remains indispensable. Therefore, the compendium offers fundamental insights into urban development and clarifies the interconnections among various segments of urban settlements.

The pamphlet is organized into two sections. The first is theoretical, aimed at providing insights into urban morphology by exploring different viewpoints to understand its complexity. The second section focuses on Swedish cities along the Bothnia Gulf, including Haparanda, Luleå, Piteå, and Skellefteå. These cities are analyzed as case studies to apply urban morphology concepts such as historical development, figure-ground analysis, tissue study, examination of public spaces, and the landscape of production. The exercises aim to dissect the influences shaping these cities and to offer an initial understanding of the patterns that define the Swedish coastal Arctic region.

The field of urban morphology, traditionally focused on the geometric and structural analysis of cities, might seem overshadowed by the advent of sophisticated software capable of parsing complex datasets to unveil factors influencing urban form, such as climatic conditions, human movements, temperature variations, and street usability and traffic. However, the classic methodologies developed before the rise of digital tools retain significant value in urban analysis. Despite the detailed insights provided by modern software on various environmental and social dynamics, the foundational principles derived from the "pre-app era" still contribute substantially to our understanding of urban spaces. This introductory text aims to shed light on a range of scholarly works and theories that have evolved and enriched the study of urban morphology, transitioning from purely geometrical interpretations to a more nuanced conception that interweaves urban form with societal functions, historical evolution, aesthetics, and lifestyles.

This progression from an architectural to a holistic perspective not only preserves the core concepts of urban morphology but also strengthens its role as an indispensable resource for both theoretical exploration and practical application in urban studies. By delving into various articles and scholars' works, we emphasize the continued relevance of traditional urban morphology alongside modern analytical methods, highlighting the field's capacity to offer profound, contextually rich insights into the intricate aspects of urban life. While not exhaustive, the text aims to weave together diverse perspectives, rejuvenating foundational concepts of urban morphology. This approach reinforces their critical role as an essential framework for addressing the complex challenges and opportunities presented by urban development.

To start our overview, we look at Karl Kropf, who leads the urban design consultancy Built Form Resource and teaches as a Senior Lecturer at Oxford Brookes University. He works both in studying urban morphology academically and in applying these concepts to urban design. Accordingly to Kropf[1] Urban

1 Kropf, K. (2009). Aspects of urban form. Urban Morphology, 13(2), 105-120.

Morphology encompasses a broad spectrum of approaches and reference terms, including urban form, spatial analysis, space syntax, process typology, and historic-geographical approaches. It recognizes urban settlements like cities, towns, and villages as complex entities with unparalleled diversity. This field explores the richness and complexity of urban environments through various dimensions: social, economic, environmental, statistical, spatial, geographical, formal, historical, psychological, informational, and aesthetic. The analysis aims to synthesize key findings from different approaches to offer a comprehensive description of urban morphology. The term itself, dissected into 'urban' and 'morphology', refers to human settlements and the study of physical form, respectively, echoing Goethe's perspective on the correlation between outward forms and internal structures. Urban morphology examines concepts, ideas, and theories, suggesting its fundamental social nature within populations. Four distinct approaches emerge in the study of urban form: spatial analytical, configurational, process typological, and historic-geographical. The spatial analytical approach leverages GIS and cellular automata to understand urban complexities and dynamics, focusing on built-up areas and neighborhood functions. The configurational approach analyzes spatial structures within settlements to understand their relationship with movement patterns, emphasizing the spaces between buildings. Process typology informs architectural and urban design through historical and structural analysis, identifying types within a hierarchical structure of urban elements. Finally, the historic-geographical approach investigates towns' geographical structures and characteristics through time, considering aspects like site, function, townscape, and socio-economic context to understand urban development and function. In essence, urban morphology dissects and reconstructs urban form, emphasizing comparison and critical analysis to understand the function and diversity of physical forms and their interrelations.

Through comparative and critical methodologies, urban morphology elucidates how diverse urban features coalesce logically, enhancing our comprehension of urban environments.

Kropf[2] elucidates the utility of urban morphology, particularly emphasizing urban tissue as pivotal for grasping the built environment's structure and complexity. Kropf highlights that urban morphology is distinguished by three principal features: urban forms are outcomes of social and cultural processes rather than being predetermined, the significance of types or configurations such as streets or buildings characterized by shared traits, and the importance of hierarchical scale levels—street, plot, and building patterns, collectively known as urban grain. Kropf also delves into characterization within urban morphological analysis, vital for identifying unique settlement characteristics and evaluating new development proposals. He critiques the constraints historical interpretations impose on adapting urban structures to meet contemporary needs, arguing for the built environment's value beyond its historical significance. Further, Kropf discusses the impact of urban street patterns on movement, employing his classification method to analyze movement and area character, thereby aiding planners and designers in comprehending an area's functionality and predicting movement pattern changes. Urban tissue, as Kropf points out, symbolizes urban morphology, encapsulating culture and habits that shape urban form. It is a crucial element in the hierarchy of scale levels, contributing to the broader structure of settlements and comprising smaller-scale elements that create local identity and places. Kropf stresses the importance of critical inquiry, judgment, and openness to new urban design ideas, advocating that urban morphology offers essential tools for exploring and understanding the complexity of urban forms.

The field of urban morphology, which studies the structure, form, and creation of human settlements, remains highly relevant and robust even in the age of advanced technological tools and software designed for urban analysis. This endurance highlights the intrinsic value of understanding historical patterns, the evolution of urban forms, and the spatial dynamics that shape cities. Despite the leaps in technological capabilities, these foundational insights into

2 Kropf, K. (2011). Morphological investigations: Cutting into the substance of urban form. Built Environment, 37(4), 393-408.

urban morphology provide critical context and depth that software alone cannot replicate. Urban morphology's relevance is further underscored by its integration with contemporary analytical tools, bridging traditional concepts with modern analytical capabilities to offer nuanced understandings of urban environments. The use of advanced software and technologies for urban analysis allows planners, architects, and urban designers to simulate, visualize, and assess urban dynamics at unprecedented scales and complexities. These tools facilitate the analysis of vast datasets, enabling the study of urban patterns, growth trends, and the impact of various factors on urban form over time. We are referring here to software like CityEngine by Esri, a powerful software that provides users with the tools to create 3D city models and simulate urban environments; UrbanFootprint designed to streamline urban planning and mobility decision-making processes with data-driven insights; Space Syntax, a set of theories and tools for the analysis of spatial configurations or SimWalk, pecialized in pedestrian flow analysis. Indeed, despite the advancements in technology and the development of sophisticated tools for urban analysis, the work of theorists like Stephen Marshall[3] remains profoundly influential in the field of urban planning and design. His book, "Streets & Patterns: The Structure of Urban Geometry," published over two decades ago, continues to be a seminal text for understanding the intricate relationship between street patterns and the formation of modern cities. Marshall's analysis offers a comprehensive exploration of how streets not only facilitate movement and access but also shape the social, economic, and physical landscape of urban environments. Throughout history, a diverse array of professionals including architects, urban designers, planners, landscape architects, transport planners, and engineers have acknowledged the critical role of transportation in shaping urban landscapes. This recognition gained prominence during the Modernism era, heralding transportation efficiency as the primary architect of urban spaces. Influenced by the Athens Charter's principles, the design and flow

3 Marshall, Stephen (2005). Streets & Patterns: The Structure of Urban Geometry. Taylor & Francis Group / Books, Chapter 3: Street type and hierarchy pp 49-77, Chapter 4: Pattern type pp 78-107.

of traffic were seen as fundamental determinants of urban form, with the concept of a central transport spine embodying the essence of modernity. Paul Spreiregen posited that architects should view the circulation system as an integral urban concept, while Edmund Bacon explored the structuring of cities through “shafts of space,” “simultaneous movement systems,” and grand axes, demonstrating the profound impact of transportation on urban design. This focus on the street system as a key structural component of the city forms the core of Stephen Marshall’s discussion in “Street & Patterns: The Structure of Urban Morphology,” particularly in the examination of street and road classifications and their societal implications. Marshall’s analysis reveals a nuanced perspective on the hierarchical organization of roads and streets, underscoring the shift from simple, socially-ranked classifications to more complex, functional categorizations in contemporary urban design. Despite the abolition of social rank-based street classifications, modern urban planning still employs a variety of classification systems based on factors like traffic speed, trip length, and strategic role. These systems, which can be both flexible and rigid, are essential for understanding the dynamic nature of urban streets, which may retain their status despite changes in form or use. The book critiques the prevailing emphasis on traffic functionality in street classification, arguing that this approach marginalizes pedestrian and public transport considerations. Instead, Marshall suggests that the classification of urban roads should be contextualized within a broader national network, focusing on long-distance and car traffic at the expense of more sustainable modes of transport. Furthermore, Marshall addresses the challenge of categorizing street patterns based on shape, highlighting the arbitrary nature of such classifications due to the vast diversity of forms and the overlapping terminology used to describe them. To counteract these complexities, he advocates for a standardized approach to categorizing street patterns, emphasizing the importance of distinguishing between macrostructures and microstructures for accurate classification. Rather than proliferating new terms and categories, Marshall recommends simplifying the analysis of street

patterns by considering both their composition and configuration, taking into account the impact of terrain on the final urban form. This approach encourages a comprehensive examination of various patterns, moving beyond a singular focus on specific types such as "tree" or "grid," to foster a more holistic understanding of urban morphology.

When discussing patterns, it's essential to mention the influential work of Christopher Alexander. In "A Pattern Language"[4] an intriguing discussion focuses on the dynamics within neighborhoods, emphasizing the crucial role of household composition across various public-private zones, intertwined with the diversity of age groups. The essence of a neighborhood's identity hinges significantly on the mix of households it comprises, with the potential to both undermine and enrich its character. Life's journey, inherently interdependent, necessitates support networks that span across similar and differing life stages, highlighting the importance of a diverse community fabric. However, the aspiration for a mixed-age community often faces challenges from tendencies towards segregation. The intermingling of different households fosters opportunities for individuals to connect with others at various points in their life cycle, enriching their social experience. Achieving an ideal balance between a varied housing mix and the desire for age-similar cohorts requires careful planning, supported by demographic analysis, to anticipate and guide the evolution of household diversity within the neighborhood. Ensuring a proportional representation of each household type in a region contributes to a balanced community, where younger residents find playmates and older individuals enjoy accessible and welcoming environments. Beyond the composition of households, the level of publicness within a neighborhood plays a crucial role in its planning. Individual preferences for public engagement do not necessarily align with age or gender; they are more closely tied to one's personality. For instance, some individuals prefer the tranquility of secluded streets for privacy, others thrive in the

4 Alexander, Christopher, Ishikawa, Sara, Silverstein, Murray, Jacobson, Max, King, Ingrid F. & Angel, Shlomo (1977). A pattern language: towns, buildings, construction. New York: Oxford University Press.

vibrancy of public spaces, and some favor a balance between the two. This diversity reflects broader personality spectrums, such as the extrovert-introvert continuum or the preference between community engagement and solitude. To accommodate these varied preferences, neighborhoods should offer a range of housing options: homes near the bustling activity centers, those situated in quieter intermediate zones, and residences in more secluded areas. This ensures that every resident can find a living space that aligns with their personal needs and lifestyle choices. However, the functionality of these housing clusters also depends on the design of pathways connecting them. These should include wide, open paths designed for large groups and activities, narrow and winding paths that discourage through traffic and promote privacy, and pathways that seamlessly connect the bustling central areas with the tranquil peripheries of the neighborhood. Such thoughtful planning ensures that areas with a desire for liveliness have sufficient housing density to support vibrant street life, as outlined in "A Pattern Language" (p. 196). This holistic approach to neighborhood design not only caters to the diverse needs of its residents but also fosters a sense of community and belonging. Creating neighborhoods with diverse household compositions, density gradients, and varying degrees of public engagement is achievable through strategic clustering of houses with different densities and compositions. By organizing houses into clusters that share public lands, residents can enjoy a sense of community and comfort that isolated houses cannot provide. The space around a home is crucial for its occupants, offering a platform for expression and neighborly interaction, particularly in the spaces between the street and the home. In suburban neighborhoods, a common spatial arrangement involves houses being centrally located within their respective clusters, fostering a community where interactions are primarily with immediate neighbors to the front and sides. This spatial pattern, despite not always being supported by urban planning, naturally emerges, aligning with findings from Herbert Gans[5] where households tend to form clusters of 5-6 houses,

5 Gans, H.J (1965). The Levittowners. Ways of Life and Politics in a New Suburban Community. Columbia University Press

with a practical upper limit of 12 houses to facilitate communal gatherings. Clusters of 8 to 12 houses, while maintaining identifiable boundaries, should encircle common grounds and be interconnected by pathways that allow seamless passage without encroaching on private spaces. This layout is effective in lower-density settings but requires adaptation for higher densities, such as incorporating row houses or housing hills, to maintain the communal spirit. Ensuring the availability of common lands and diverse pathways enhances connectivity and supports a mix of households that reflects the expected demographic composition, utilizing small parking areas to minimize congestion. This approach to neighborhood design emphasizes inclusivity and community engagement, catering to the varied needs and preferences of its residents.

In the theoretical exploration towards adopting an integrated perspective in urban studies, it's crucial to emphasize the significance of heritage and the impact of contemporary interventions. Architecture that both draws attention and simultaneously reflects the identity of a place is increasingly important in an era characterized by globalization's influence on architectural aesthetics and composition. This dual role involves not only preserving and valuing the historical and cultural elements that define a city's character but also embracing innovative designs that contribute to the evolving urban landscape. Contemporary insertions into the urban fabric should not only respect and complement the existing heritage but also offer new dimensions of functionality and beauty, thus enriching the urban experience. This approach underlines the necessity of a balanced integration where new developments are harmoniously woven into the historical context, ensuring that urban growth enhances rather than dilutes the unique identity of each place. Through this lens, urban studies aim to foster environments that celebrate their past while boldly stepping into the future, creating spaces that are meaningful and resonant with both residents and visitors alike. In this direction, Gospodini[6] critically examines the evolving spatial identity of European cities amidst economic and cultural

6 Gospodini, A. (2004) 'Urban Morphology and Place Identity in European Cities: Built Heritage and Innovative Design', JOURNAL OF URBAN DESIGN, p. 225.

globalization, highlighting the challenge of maintaining distinct urban identities in the face of increasing heterogeneity due to migration. Gospodini posits that the preservation of built heritage and the incorporation of innovative design are pivotal strategies for sustaining a city's place identity. The text navigates the debate between conserving architectural heritage as a means of supporting national identity and tourism, and the argument that innovative design better addresses the needs and diversities of multi-ethnic, multicultural postmodern societies. The hypothesis tested in Bilbao suggests that innovative design, akin to built heritage, can act as a significant generator of place identity, offering new interpretative opportunities and fostering social cohesion among diverse urban populations. The case study in Bilbao, particularly the impact of the Guggenheim Museum, underscores innovative design's role in creating unique urban landscapes and enhancing economic development through tourism. The "Bilbao Effect" refers to the phenomenon where significant investment in a high-profile architectural project leads to widespread recognition, increased tourism, and economic revitalization of a city. This term originated from the transformation experienced by Bilbao, Spain, following the construction of the Guggenheim Museum Bilbao, designed by architect Frank Gehry and opened in 1997. Prior to the museum's construction, Bilbao was a post-industrial city struggling with the decline of its manufacturing sector, urban decay, and economic stagnation. The Guggenheim Museum not only became an iconic symbol of modern architecture but also acted as a catalyst for urban regeneration and economic revitalization. The museum attracted millions of visitors, spurred investments in other parts of the city, and transformed Bilbao into a cultural and tourist destination. The success of the project demonstrated how strategic cultural investments and innovative architecture could rebrand a city and stimulate its economy, leading to a renewed interest in urban design and planning as tools for economic development and urban renewal. In urban studies, the Bilbao Effect is studied as a case of how cultural and architectural projects can serve as engines for urban regeneration, highlighting the potential for

such projects to change perceptions of a city, attract tourists and investments, and contribute to the creation of new urban identities. However, it also raises questions about the replicability of such success, the impact on local communities, and the sustainability of development driven primarily by iconic architecture. The findings indicate a nuanced perspective on place identity generation: while innovative design appeals broadly, particularly to tourists, built heritage retains a critical role in representing urban spaces for residents with deep cultural and traditional ties. However, the overall conclusion drawn from the Bilbao study advocates for the symbiotic relationship between innovative design and built heritage in cultivating a multifaceted urban identity that resonates with both local and global narratives, promotes economic vitality, and fosters social solidarity within diverse urban communities.

In the exploration of different approaches to urban studies, the interplay between heritage and contemporary architectural insertions emerges as an interesting theme. This dynamic is crucial in understanding how modern architecture not only attracts attention but also engages with the identity of a place amid the homogenizing forces of globalization in architectural aesthetics and composition. The case of the "Bilbao Effect," illustrates the transformative power of cultural and architectural projects in urban regeneration. The museum has been a catalyst for changing perceptions of Bilbao, drawing tourists and investments, and fostering the creation of a new urban identity. The Guggenheim Museum serves as a striking counterpoint in the history of urban design, due to its profound impact on Bilbao's identity and its role in crafting a new city brand. Gehry's design, characterized by its aesthetic "weirdness" or "anomaly," acts as a disruptive element within the historic urban fabric, similar to the role played by the Porto School of Music by OMA along Avenida de Boavista in Porto.

The disruptive effect of architectural projects like the Guggenheim Museum in Bilbao is nuanced by the diverse perceptions of those who encounter it. Individual experiences with the museum vary widely—while some may admire its aesthetic innovation,

others may not. Nevertheless, these varied personal viewpoints collectively contribute to the formation of a new urban identity that, nearly three decades later, has become deeply embedded in the city's collective memory. This phenomenon challenges traditional normative approaches and notions of historical continuity, revealing alternative perspectives in urban studies and design. It illustrates how urban identities are not static but evolve through the interplay of different experiences and interpretations, leading to a richer understanding of the potential for architecture to shape and redefine the urban landscape. In this context, the contributions of Pierre Gauthier and Jason Gilliland[7] are significant as they illuminate diverse methodologies within a more holistic framework. Their work exemplifies the shift towards comprehensive approaches in urban studies, blending various disciplinary perspectives to achieve a deeper understanding of urban phenomena.

Pierre Gauthier and Jason Gilliland's work, "Mapping urban morphology: a classification scheme for interpreting contributions to the study of urban form," offers a systematic approach to navigating the diverse theoretical landscape of urban morphology. Recognizing the challenges posed by the wide range of linguistic, pedagogical, and cultural backgrounds among researchers, they propose a classification system that aims to clarify and categorize the various theoretical approaches within the field. This initiative addresses the confusion and misunderstanding stemming from the multiplicity of methods used to study urban form. The authors introduce a Cartesian grid as a visual tool to map and relate different theoretical perspectives, distinguishing between Cognitive and Normative approaches, as well as Internalist and Externalist viewpoints. The Cognitive approach focuses on the mental processes of understanding, learning, and theorizing about urban morphology, aiming to develop a comprehensive framework for the study. In contrast, the Normative approach is concerned with the societal 'rules' and visions of how cities should evolve, reflecting a prescriptive standpoint on urban development.

7 Gauthier, P. and Gilliland, J. (2006) 'Mapping urban morphology: a classification scheme for interpreting contributions to the study of urban form', Urban Morphology 10, 41–50.

Furthermore, the distinction between Internalist and Externalist approaches adds another layer of analysis. Internalist perspectives concentrate on intrinsic urban factors and the inherent rules and logic that drive city transformation, viewing the city as a system of interrelated elements. Externalists, however, examine urban form as the outcome of external forces such as economic, political, and historical influences. The classification grid enables researchers to identify similarities and differences between studies, facilitating a deeper understanding of the field's theoretical diversity. It helps to discern patterns and relationships among various approaches, contributing to a more nuanced interpretation of urban morphology research. The quadrants defined by the intersections of these approaches—Internalist/Cognitive, Externalist/Cognitive, Internalist/Normative, and Externalist/Normative—serve to categorize studies based on their focus and methodology, ranging from scientific analyses of urban systems to normative visions for future urban forms and practical considerations in urban development. In conclusion, Gauthier and Gilliland's mapping system offers a valuable framework for researchers to navigate the complex field of urban morphology, enhancing the understanding of diverse contributions and their collective impact on the urban environment we inhabit today. This systematic approach facilitates a clearer comprehension of the theoretical underpinnings of urban morphology and encourages a more cohesive and integrated study of urban form.

This classification intriguingly aligns with Ken Wilber's Integral Theory[8], despite not being explicitly referenced. Wilber's theory, which integrates insights from the arts, sciences, and humanities, could effectively categorize these diverse experiences using four core perspectives he outlines. At its foundation, Integral Theory organizes views on any issue into a matrix, depicted in a quadratic diagram. Wilber's AQAL (All Quadrants, All Levels) framework not only categorizes perspectives but also incorporates aspects such as developmental stages, lines of development, and personality types. Described by Wilber as a 'meta-theory,' it aims

8 Wilber, K. (2007) The Integral Vision: A Very Short Introduction to the Rivolutionary Integral Approach to life, God, the universe, and Everything. Shambhala publichers.

to offer a holistic approach to understanding reality, purporting to synthesize various knowledge forms and experiences into a coherent whole. The theory begins with the acknowledgment that each perspective, while contributing valuable insights, captures only a part of the entirety of any phenomenon, such as architecture. It acknowledges the validity of both subjective and objective experiences, considering the individual and collective dimensions. This yields four distinct viewpoints: 1) the Experiential Perspective, focusing on the internal experiences of consciousness, emotions, and thoughts of the individual, 2) the Behaviors Perspective, which applies scientific and engineering methods to quantify and observe empirical manifestations of subjective experiences, 3) the Cultural Perspective, which frames individual experiences within broader societal worldviews, narratives, and symbols, and 4) the Systems Perspective, which examines the intricate interactions, hierarchies, and spatial relationships within social, environmental, and urban systems. Despite its complexity, this framework proves invaluable in highlighting the strengths and limitations of each perspective. By employing diverse methodologies, each viewpoint both unveils and conceals certain elements of the whole. For instance, a building can be 'read' through its energy performance (Behaviors Perspective), with efficiency viewed as positive, or through its narrative role within an urban landscape (Cultural Perspective), where it may be critiqued for not harmonizing with its surroundings. Adopting a multi-perspective approach to urban morphology presents challenges due to its intrinsic connection with architectural concepts such as shape, formal patterns, and typologies. Christopher Alexander's development of an architectural language centered on patterns and structures aimed to illustrate how a limitless array of architectural 'phrases' or buildings could emerge from a limited set of elements (patterns), capturing the interplay between space and events. We revisit Alexander primarily due to the common belief that his work centers around patterns, a notion strongly reinforced by the success of his renowned book "A Pattern Language.". Alexander posited that 'pattern language' not only facilitates the creation of spatial configurations but also possesses the generative

capacity akin to natural languages. This approach, as theorized by Alexander, is evolutionary and incremental. It evolved into a more comprehensive and organic form with the publication of A New Theory of Urban Design[9] and was further elaborated in The Nature of Order[10]. However, Alexander's ability to overreach questions and the broader composition of buildings and urban forms stands out as crucial in bridging theoretical concepts with practical application. His work navigates through various scales of understanding, emphasizing the interconnectedness between the macro and micro aspects of urban and architectural design.

Alexander emphasized the potential of engaging at the neighborhood scale, where social dynamics become more visible and coherent. In this vein, we spotlight the theoretical perspective of American urbanist Brenda Case Scheer, who further explores these concepts, delving into how urban form and social dynamics intertwine at a community level, offering insights into the practical implications of urban morphology in shaping lived experiences. Scheer critically discusses the shift away from large-scale master plans towards a preference for smaller, more focused urban interventions. This perspective underscores a significant transformation in urban planning methodologies, suggesting a move towards strategies that are more adaptable, locally informed, and responsive to specific urban challenges. By advocating for this approach, Scheer's work contributes to a broader dialogue on the effectiveness of various planning scales in fostering sustainable and vibrant urban environments.

The term "master plan" is an important concept within the disciplines of urban studies and design, serving as the backbone for strategic, long-term urban development. Edward J. Jepson[11] defines a master plan as a dynamic long-term planning document that provides a conceptual layout to guide future growth and development. Master planning is about making the connection between buildings, social

9 Alexander, C., Neis, H., Anninou, A. and King, I. (1988), A New Theory of Urban Design, Oxford University Press, Oxford.

10 Alexander, C. (2001), The Nature of Order – An Essay on the Art of Building and the Nature of the Universe, Oxford University Press, Oxford.

11 Jepson, Ej. (2004) The adoption of sustainable development policies and techniques in US cities: How wide, how deep, and what role for planners?, Journal of planning education and research.

settings, and their surrounding environments. A master plan includes analysis, recommendations, and proposals for a site's population, economy, housing, transportation, community facilities, and land use. It is based on public input, surveys, planning initiatives, existing development, physical characteristics, and social and economic condition.

Brenda Case Scheer[12] discusses the dissolution of large-scale master plans in favor of small urban interventions. This change reflects shifting priorities, including resource constraints, democratic governance, sustainability requirements, and a shift from top-down approaches. The emergence of small-scale urbanism, characterized as repair, reuse, reveal, regionalization, and rupture, marks a departure from traditional urban planning paradigms. The discourse delves into various dimensions of transformation within the realm of urban planning, spanning from comprehensive master planning to nuanced small-scale urbanism and adaptive strategies that are responsive to their context. The narrative posits a shift away from the erstwhile dominance of grandiose master planning towards a burgeoning appreciation for micro-scale urban initiatives. This signifies a recalibration of priorities within urban planning, necessitating the formulation of innovative strategies to navigate the evolving landscape, while also delineating the ramifications of such a transition. Central to the Case Scheer's discussion are five urban design strategies, collectively referred to as the five R's: Repair, Reuse, Reveal, Regionalize, and Rupture. The Repair strategy is about mending disrupted urban fabric, such as rejuvenating spaces previously dominated by commercial developments and transforming them into revitalized gateways. The Reuse tactic advocates for the adaptation of existing urban elements to meet contemporary requirements, without compromising their inherent scale and character, exemplified by the transformation of traditional canal houses in Amsterdam into modern dwellings in the Borneo-Sporenburg area. Reveal strategy focuses on unearthing hidden or underappreciated facets of urban spaces to foster new public realms or developmental initiatives, with New York City's Highline serving as a prime example of this

12 Scheer, B.C. (2013) The masterplan is dead: long live urban morphology, UM.

strategy by repurposing an obsolete infrastructure into a vibrant public space. Regionalize strategy involves drawing inspiration from historical patterns to guide contemporary development, ensuring a seamless integration of past and present, as seen in Savannah's waterfront projects that echo the city's rich history.

Lastly, the Rupture strategy aims at intentionally breaking away from obsolete and environmentally detrimental patterns, exemplified by "road diets" which reduce road widths to enhance urban livability, particularly in suburban areas characterized by excessive energy consumption.

These strategies underscore a comprehensive approach to urban planning that emphasizes sustainability, historical continuity, and community-centric development, illustrating a nuanced understanding of urban transformation that is crucial for fostering resilient and vibrant urban spaces.

Urban studies traditionally examine cities in contrast to non-urban areas, identifying cities as central to human settlement, characterized by significant capital, economic activity, and complex infrastructure. According to Neil Brenner's work "Urban Theory Without an Outside" (2013), cities are essential to understanding urban forms and processes. Arctic and sub-Arctic cities, however, do not fit neatly into this urban-non-urban dichotomy. With populations ranging from 30,000 to 70,000 (Varentsov et al., 2018), these cities exhibit a level of heterogeneity (Nyseth,Christensen). The urbanization of these areas has been driven largely by industrialization and, more recently, by increased mobility and the demand for skilled labor related to industrial activities. This has led to a significant expansion of urban agglomerations in these regions. The article "Swedish Typo-Morphology - Morphological Conceptualizations and Implications for Urban Design" by Todor Stojanovski, published in the Iconarp International Journal of Architecture and Planning in December 2019, delves into the exploration of typo-morphology within the context of urban design and planning in Sweden. Typo-morphology, a branch of urban morphology, employs types and typologies to understand the formation and transformation of cities' physical forms. Stojanovski's work critically examines three Swedish typo-morphological approaches to illustrate their application in urban morphology, urban typologies, and their implications for urban design and planning practices. The first approach focuses on architectural styles and typical buildings across different historical periods, providing insights into the evolution of urban landscapes and architectural practices. The second approach categorizes neighborhood types based on their physical attributes, offering a framework for understanding urban development through the lens of neighborhood configurations. The third approach enriches the neighborhood typology by integrating social structures into the physical space analysis, suggesting a multifaceted understanding of urban spaces that encompasses both physical and social dimensions. Stojanovski's research presents a comprehensive examination of Swedish typo-morphology and its

significance for urban design and planning. This exploration into Swedish urban morphology reveals how these approaches have contributed to urban design and planning practices, highlighting their significance in the broader context of urban studies.

1. Historical Development and Geographic Classification: The foundation of Swedish typo-morphology can be traced back to early 20th-century efforts by geographers and architects who aimed to classify cities and neighborhoods according to their physical and social characteristics. Influenced by various international schools of thought, including French, German, British, and American traditions, these pioneers established a methodological framework for analyzing urban forms. For example, the Geographical Institute at Stockholm's University, under Professor Hans Ahlmann, conducted extensive studies on Stockholm's urban morphology, emphasizing the geographical differentiation within the city.

2. Building Types and Architectural Styles: This approach, deeply rooted in the study of architectural history, examines the evolution of building types and architectural styles over time. Focused on residential architecture, such as apartment buildings and villas, this methodology provides insights into the socio-economic and cultural factors influencing architectural practices. Books like "Så byggdes husen" (Thus were the houses built) illustrate typical Swedish architecture by decade, reflecting on how societal changes impact architectural styles and urban development.

3. Urban Typologies and Planning Paradigms: Inspired by historical analyses of urban form, this approach categorizes Swedish cities based on urban typologies that emerged from major planning doctrines, such as regularism, the Garden City movement, and functionalism. By identifying consistent patterns in density, floor space indexes, and building heights, researchers like Johan Rådberg have created detailed classifications of Swedish neighborhoods, offering a nuanced understanding of urban development across different eras.

4. Place Types and Urban Models: Building on the work of previous scholars, this more comprehensive approach considers the impact of technology and economic conditions on urban forms. Carl-

Johan Engström, for instance, introduced the concept of "place types" to describe typical neighborhoods that arise in response to shifts in transportation technology, economic specialization, and societal needs. This perspective underscores the dynamic interplay between physical urban forms and the socio-economic forces that shape them.

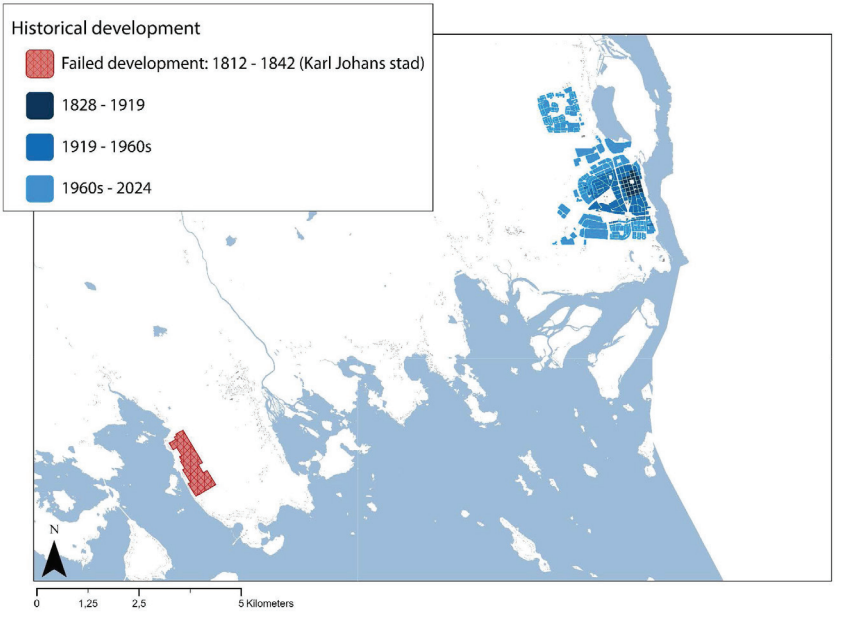
"The Study of Urban Form in Sweden" by Abdellah Abarkan, published in Urban Morphology in 2009, offers a comprehensive review of urban form research in Sweden from the early 20th century onwards, emphasizing the shifts towards recognizing the sociability of cities and the importance of historical urban spaces. Initially, urban form research in Sweden, like much of Europe post-World War II, grappled with modern movement critiques and the balance between preserving historical urban structures and embracing modern suburbanization and urban renewal strategies. Sweden's unique position, having avoided war damages, shifted critical urban discourse towards the late 1960s with a focus on preserving historical urban forms against the backdrop of rapid suburbanization and inner-city renewal. Research on urban form in Sweden gained academic stature with the establishment of urban history at Stockholm University in 1919, moving towards a more analytical approach that included the study of urban forms, building patterns, and their socio-economic implications. Early efforts by researchers like Sten De Geer and John Leighly paved the way for a typological classification of cities, focusing on urban settlements' morphological aspects and their rural interactions. A seminal contribution to the field was "Svensk stad" (Swedish City), led by Gregor Paulsson in the 1950s, representing a multidisciplinary approach to studying Swedish urban settlements. This work is notable for its depth, methodology, and introduction of concepts such as type and style, laying the groundwork for future urban morphology studies in Sweden.

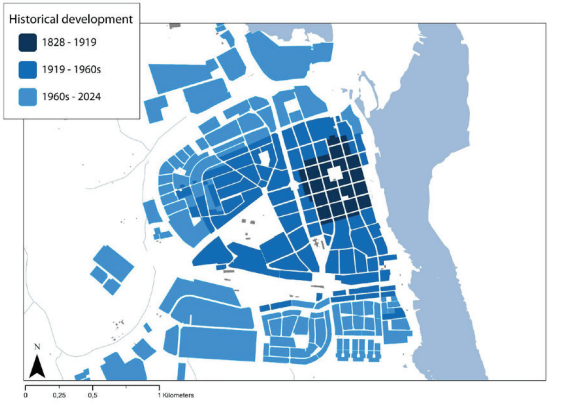
The paper also discusses the role of art historians Elias Cornell and Börje Hanssen in continuing this tradition, with Cornell notably addressing the dissolution of the town-country dichotomy. Furthermore, the study examines the morphological and land

ownership patterns approach by Lennart Améen, drawing parallels with international urban form research traditions. In addressing the concept of type, Abarkan traces its evolution in Swedish urban studies, highlighting the influence of Italian urban research and the work of Björn Linn at Chalmers University of Technology. Linn's emphasis on understanding historical urban structures and the importance of typology in urban design represented a significant shift towards integrating urban morphology with architectural practice. Recent developments in Swedish urban morphology research are marked by the establishment of research groups and networks, aiming to foster a multidisciplinary approach and address contemporary urban planning challenges. Abarkan's own contributions, along with the formation of the Nordic Network of Urban Morphology, illustrate the growing emphasis on collaborative research efforts to advance the field.

In the forthcoming chapters, we will delve into the application of traditional urban analysis tools to study the morphology of cities along the swedish coast of Bothnia Gulf. Despite the increasing complexity of urban development processes, these foundational tools and methods of representation remain relevant for understanding the spatial and functional dynamics of cities today. Our exploration will include case studies and theoretical discussions on urban development, figure-ground studies, tissue studies, and the elements of public space. We will start by mapping the urban development of cities, tracing their growth from the initial settlements to their current extents. By examining historical and contemporary examples of city relocation and expansion, we aim to uncover the underlying attitudes and responses that shape urban development in northern Sweden. The figure-ground study, a fundamental tool in urban planning, will be employed to examine the relationship between built forms and open spaces within urban contexts. Even if this analysis is used today only as a base map for other maps, the simple figure-ground map is still a powerful tool to understand the density of building fabric, the pattern of viability, topographical influences, and the connectivity of city centers to other urban areas. The tissue study, as explored in this

chapter, serves as a comparative analytical tool for understanding different parts of a city by overlaying aspects of one city or town onto another. This method facilitates a deeper understanding of urban similarities and differences, and it can also inspire creative designs for open spaces and configurations of building space. This chapter will particularly focus on the comparison between traditional church towns and modern church placements, as well as the campus structures typical of Swedish universities, to illustrate how tissue studies can enhance our comprehension of urban morphology. The last part doesn't introduce a traditional tool of urban analysis but instead adopts a theoretical lens to explore the impact of a specific economic activity—timber production and the transportation of logs through rivers—on land morphology. This historical economic practice has not only shaped the physical landscape but has also influenced the development and usage of buildings and infrastructure within cities, particularly in regions where timber production was a significant economic driver.





Haparanda historical development. Drawings by Abdirahman Maalin, Elia Nassif, Dag Nyberg, Elie Wehbi.

Relocate

In Northern Sweden, the practice of relocating cities, while unusual, has historical precedents that highlight the region's adaptability to changing circumstances. From Gammelstad in Luleå to the urban relocation of both Kiruna and Gällivare, Arctic Sweden has become accustomed to the creation, moving and shutting down of communities. The most famous now is Kiruna, located in the northern part of Sweden, is undergoing a significant relocation due to the expansion of mining operations. The town's center is being moved approximately two miles to the east to mitigate the risk posed by mining. This process involves the relocation of over 20 historically significant buildings to a new downtown area expected to be completed by 2035. The buildings are either being transported intact or dismantled and then reassembled at the new site. This present situation in Kiruna is not the first instance of a city relocation in the region. Even if the reasons are different, the historical movement of Torneå and Haparanda serves as an earlier example. The genesis of Haparanda's settlements can be traced back to the medieval period, a time when the area began to show signs of communal life and economic activity. The region's prosperity was largely attributed to its fertile land, which was highly suitable for agriculture, and its strategic location for fishing along the Torne River and Bothnian Bay. These natural resources laid the foundation for a thriving community long before the official establishment of Haparanda town. The original settlement, also bearing the name Haparanda, was a modest village with seven farms, dating back to the 17th century, indicating the area's long-standing human occupation and agricultural tradition. Haparanda's historical trajectory, however, was significantly shaped not by a gradual, internal urbanization process but by major international events and geopolitical shifts. The development of Haparanda is inextricably linked to Sweden's complex diplomatic relations and historical ties with its neighbors, particularly Finland and Russia, as well as other countries to the east. This relationship was deeply influenced by Finland's oscillating geopolitical position, swinging between the spheres of influence of the East and West. Historically, Finland was integrated into the Swedish kingdom in 1150, marking the beginning of a union that would last

approximately 650 years. This long-standing association came to an abrupt end in 1809 when Sweden was defeated by Russia in the Finnish War, leading to Finland becoming a Russian Grand Duchy. The loss of Finland had immediate repercussions for Sweden, particularly in terms of trade and strategic military positioning.

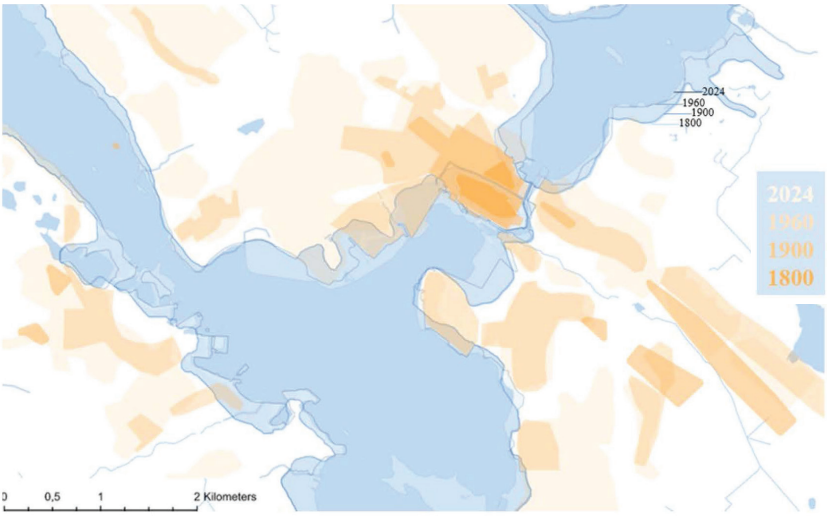
One significant event was the foundation of Tornio, a new city on the eastern side of the Torne River, in 1621. Tornio quickly rose to prominence as an important trading hub for Sweden, highlighting the economic and strategic importance of the region. However, the 1809 partition, which redrew the border between Finland and Sweden along the Torne and Muonio Rivers, resulted in Sweden losing control of Tornio. This loss underscored the necessity for Sweden to establish a new trade center in the vicinity to compensate for the economic and strategic void left by Tornio's loss. In response, Sweden founded Karl Johan's City in 1812 near Tornio, an effort aimed at recreating the trade dynamics that were lost. Yet, the new city faced challenges, notably in sustaining a viable population. It was against this backdrop that politician Johan Jakob Rutberg put forth a proposal in 1821, leading to the chartering of Haparanda as a market town. This strategic move was aimed at enhancing the area's appeal and fostering population growth. By 1828, efforts to establish Haparanda as a market town had begun to bear fruit, attracting residents and leading to noticeable urban development, including the adoption of a grid system with a central town square, accommodating a growing community. By 1842, the transition of city privileges from Karl Johan's City to Haparanda marked a significant turning point, effectively sidelining Karl Johan's City in favor of Haparanda. This moment allowed Haparanda to attract the necessary attention and investment to flourish and expand, transforming from a modest village into a bustling market town. Haparanda's ascendancy as a trading center was characterized by its vibrant trade in commodities such as tar, wood, salmon, reindeer hides, and butter, further bolstered by the agricultural potential of the surrounding fertile lands.

The outbreak of the First World War from 1914 to 1918 elevated Haparanda to a position of critical importance in Europe, given its strategic proximity to Finland. The town played a pivotal role in facilitating postal and communication links between the East

and West, contributing to its geopolitical significance. This period also saw the planning and construction of the Haparandabanan railway, enhancing Haparanda's connectivity and economic prospects, leading to population growth and urban development. Reflecting on Haparanda's urban evolution, the city's development can be segmented into three distinct periods: from its early beginnings up to 1919, the transformative years from 1919 to the 1960s, and the modern era from the 1960s to the present day. Each of these periods marks significant shifts in the city's architectural and urban landscape, adapting to changing economic, political, and social dynamics. The presence of unique features, such as the "World's most international IKEA," underscores Haparanda's strategic geographical advantage and its role as a commercial and cultural bridge between Scandinavia and the broader European continent.

Telluric movement

The coastline's dynamic morphology, a concept that describes the ongoing and often subtle shifts in the landscape where land meets sea, is a critical factor in understanding the development of coastal cities. Unlike the phenomena of sea-level rise, this process is attributed to telluric movements—natural alterations in the Earth's crust—that can lead to either the expansion or contraction of land over long periods. Such geological activity, while gradual and almost imperceptible in shorter time frames, becomes distinctly visible and tangible over centuries, significantly influencing urban landscapes and human settlements. Piteå, situated in the north of Sweden, offers an intriguing perspective on this phenomenon. The city's history and development provide insights into how natural land movements, a counterpoint to sea-level rise, have shaped its evolution and urban form.
Nestled in Norrbotten, Piteå is a vibrant municipality with approximately 42,300 residents, with the city itself home to about 23,900 individuals. Historical records trace the area's significance back to the 15th century when Öjebyn, now a part of Piteå, was established as a parish center, featuring a church that transitioned from wood to stone in the 16th century.



Piteå historical development. Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.

This church became a nucleus for trade, supported by the surrounding waterways that served as crucial transportation routes for people and goods alike, and a general coastal road that facilitated movement and commerce. The issuance of the City Law in 1619 marked a pivotal moment in Sweden's urban planning history, later superseded by the Law of Sweden in 1723. Piteå was officially granted city privileges in 1621, initiating a transformative period under the guidance of Dr. Olaus Bureus. Despite his medical background, Bureus's northern heritage provided him with the insight to oversee the development of several town plans, including that of Piteå. The town's design did not undergo significant alterations due to its pre-existing street network, which had naturally adapted to the terrain. However, Bureus's interventions aimed to introduce a sense of order through a grid system of straight roads.

A devastating fire in 1666 led to the relocation of Piteå to the island of Häggholmen, forming the city's contemporary center. The new town plan, crafted by surveyor Jonas Persson Gedda, featured a rectilinear grid pattern creating a clear urban hierarchy with Storgatan as the central artery. This layout, inspired by the architect Vitruvius and ancient Roman principles, is still largely intact today, reflecting a deliberate design ethos that emphasizes order and symmetry. Piteå's historical trajectory was also marked by conflicts such as the Great Northern War, which brought destruction and upheaval. Yet, the resilience of its people is evident in the reconstruction efforts that followed. The late 18th and 19th centuries saw significant land uplifts, reshaping the island's geography and necessitating new residential developments on Norrmalm to accommodate a growing population of craftsmen and fishermen.

Transformations in transportation infrastructures, such as the conversion of a canal into a main road for car traffic between 1898 and 1929, signify Piteå's adaptation to changing times. The establishment of Smurfit Kappa in 1934, now a major employer and a leader in Europe's rake liner industry, underscores the city's industrial significance and its role in the global market. The development of the port of Haraholmen in 1973 further cemented Piteå's position in Sweden's export and import sectors, accommodating larger ships and machinery to support its economic growth. The period between 1960 and 1975 witnessed a

rapid expansion of residential areas, reflecting Piteå's evolution into the modern city it is today. Despite this growth, Piteå continues to adapt and develop, albeit at a more gradual pace, showcasing a blend of historical resilience and forward-looking dynamism in the face of natural and human-induced changes.

Figure-ground diagrams serve as stark, yet insightful, visual representations akin to X-ray images, delineating the architectural landscape through a contrast of solid and void. These scale drawings depict the outlines of buildings in solid black, symbolizing the "figure" within the urban fabric. Conversely, the white spaces that weave through these structures represent the "ground," forming a minimalist yet profound analytical map. This map offers critical insights into the configuration, size, density, and pattern of buildings, along with the spatial relationships and voids they create. Such analysis, often a preliminary step in urban studies, prompts further exploration and questions to be addressed with additional analytical methods.

The distinction between solid and void is instrumental during the initial stages of spatial analysis, shedding light on aspects like spatial legibility, the degree of enclosure or exposure, overlooked spaces, and the overall urban demeanor. It further aids in refining architectural designs by guiding decisions regarding building patterns, dimensions, and orientations. A key observation from these diagrams is the ease of identifying primary pathways between buildings, which segment the area into distinct sections, thereby creating a legible network of main routes. This clarity in the main paths contrasts with the complexity and potential confusion found in the network of smaller alleys, reminiscent of the intricate layouts of historic city centers. Such nuances underscore the importance of deeper legibility studies to validate these initial findings. Figure-ground studies act as a springboard for deeper inquiry, urging a comprehensive urban analysis that encompasses land use, building heights, movements, and character studies, among others. This holistic approach can unravel the true nature of the space as indicated by the figure-ground portrayal. For instance, should a legibility issue arise in subsequent analyses that the figure-ground layout does not directly account for, the focus then shifts to exploring other factors—like landmarks, land use, and urban characteristics—that may contribute to spatial disorientation. This process ultimately informs and refines design strategies in later stages. Notably, figure-ground diagrams can highlight specific urban challenges, such as the division of space by imposing features like highways, which act as barriers and disrupt the continuity of the urban journey. Such divisions often lead to poorly

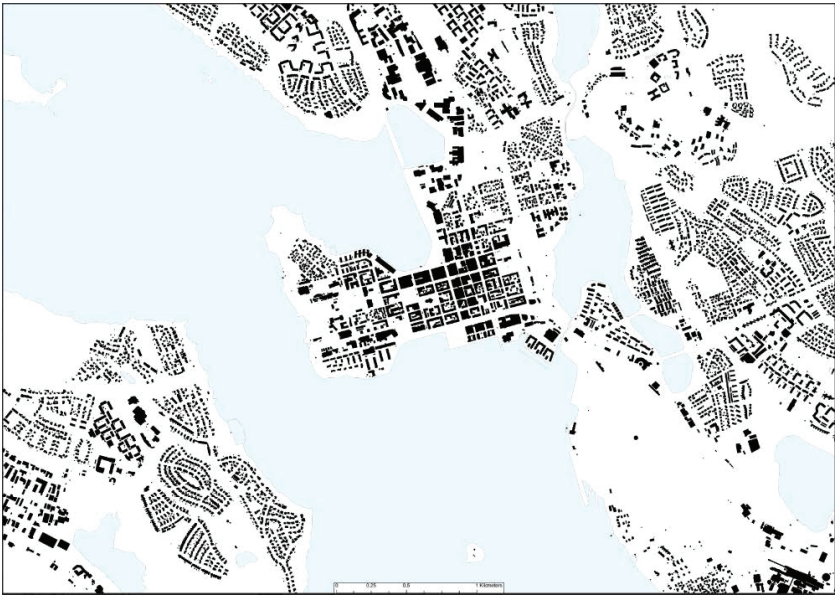
defined, “lost” spaces that contribute to a lack of spatial clarity and coherence. Additionally, the variation in building sizes within these diagrams can profoundly impact the urban experience, as the resulting spaces may lack a consistent or identifiable urban character.

In conclusion, while figure-ground diagrams offer an essential, simplified view of urban spaces, prompting critical questions for further analysis, they represent just the beginning of a thorough urban examination. Identifying issues like legibility and spatial division requires a full spectrum of urban analyses to truly understand and address the complexities of the urban environment.

Figure-ground analysis serves as a critical tool in urban studies, offering insights into the spatial layouts of cities such as Haparanda, Luleå, Piteå, and Skellefteå. This method simplifies the visualization of urban forms, highlighting the distinct patterns and structures of building blocks across these cities. Focusing on Luleå, the analysis facilitates a detailed exploration of its neighborhoods, revealing unique spatial characteristics and urban dynamics through the clear distinction between built forms and open spaces. This approach not only accentuates the architectural diversity and developmental patterns within Luleå but also provides a comparative lens to understand the varying urban narratives among the studied cities.

Bergnäset: it presents an irregular urban framework lacking in recognizable patterns, segmented into residential and industrial zones. The residential sector exhibits a primarily suburban, low-density fabric, with a notable pocket of higher density centrally located. In contrast, the industrial area is situated to the west. The area’s road network is characterized by local streets and cul-de-sacs, with arterial and collector roads identifiable in the figure-ground analysis as open spaces meandering through the built environment.

Centrumhalvön: demonstrates a diverse mix of uses including residential, commercial, and recreational open spaces. The urban design is predominantly a grid layout, showcasing logical geometry with rectangular blocks devoid of any focal points. Residential neighborhoods within Centrumhalvön, such as Gültzauudden, Charlottendal, and Östermalm, adhere to this grid system but feature buildings on a smaller scale.



Luleå, Figure ground study of Bergnäset and Centrumhalvön
Drawing by Karin Blom, Matilda Frejd, Simon Melin, Hanna Tönnesson Stefors, Albin Vågsäter

Svartöstaden emerges as an older residential quarter, originating in the late 19th century primarily to accommodate dockworkers. Its urban fabric is marked by narrow streets and a lack of uniform alignment of buildings along these pathways, making it challenging to discern any distinct patterns. This area's historical context and development for a specific workforce imbue it with a unique character, distinct from more modern or planned sections of the city.

Luleå Harbor, situated on the Svartön half-island, serves as an industrial zone. When observed in Figure 3, it stands in contrast to Svartöstaden due to its different scale of blocks and structures. The harbor area's layout and design cater to industrial and logistical needs, differing significantly from the residential and somewhat haphazard organization of Svartöstaden.

Hertsön is a product of the 1970s Miljonprogrammet, identifiable by its uniform residential building designs. The presence of a central hub within the residential area suggests a thoughtful spatial organization, with a hierarchical street system that likely transitions from an arterial road encircling the area to smaller collector roads within. This design implies a consideration for both accessibility and community centrality.

Kronan presents an irregular layout, characterized by a diverse mix of buildings varying in scale and architectural style, predominantly large apartment complexes. The arrangement of these buildings suggests a cul-de-sac road design, interspersed with significant green spaces, indicating a blend of privacy and communal outdoor areas.

Lerbäcken is a villa-dominated area where homes align closely with the streets, facilitating direct vehicular access to properties. Its traffic network, marked by loops and cul-de-sacs, along with generous spacing between buildings, integrates Lerbäcken seamlessly with the broader urban fabric of Luleå.

Skurholmen exhibits variability in its district pattern, with all buildings radiating from a central green space. A major road bifurcates the area, leading to a denser housing arrangement on the waterfront side, while the opposite side features smaller homes alongside larger dwellings, all connected by a curvilinear road network that includes loops, enhancing the district's connectivity and visual appeal.

Figure ground study of Svartöstaden and Luleå harbor.

Figure ground study of Hertsön, Kronan, Lerbäcken, Skurholmen and Örnäset.

Drawings by Karin Blom, Matilda Frejd, Simon Melin, Hanna Tönnesson Stefors, Albin Vågsäter

Örnäset reflects a gradual and mixed development pattern, incorporating villas, apartment complexes, flats, and commercial spaces. The aggregation of different building types creates a vibrant community fabric, supported by a road network that features curves and loops, clearly delineating larger roads that facilitate movement between varied urban zones. Large open spaces interspersed among the buildings suggest the prevalence of green areas.

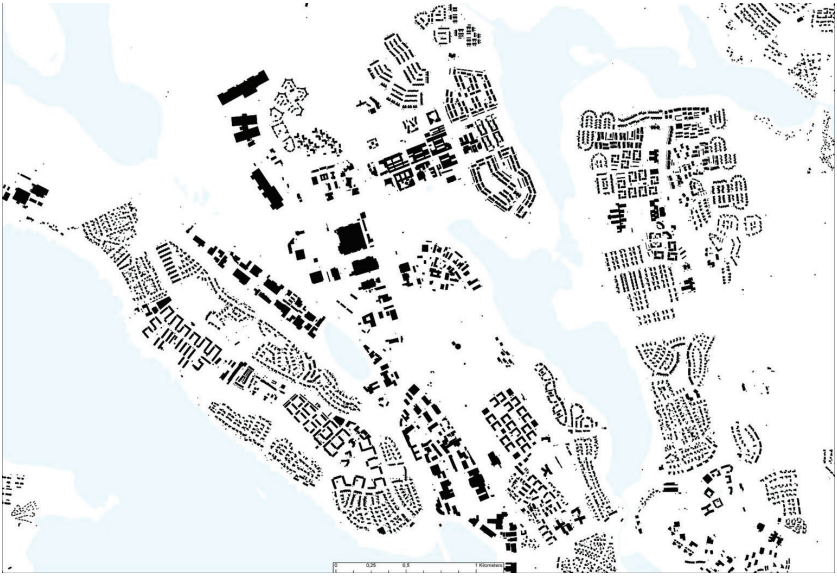
Mjölkudden and Notviken are located in the western part of the map, characterized by a diverse mix of buildings. This area features a blend of detached houses and larger apartment buildings at its core, bordered by industrial structures further from the waterfront. The layout showcases ample green spaces among the residential areas, with a road network that combines curves, loops, and cul-de-sacs, reflecting a balanced approach to urban design that caters to both residential and industrial needs.

Porsön sits in the northern section, distinguished by its mix of institutional, residential, and industrial buildings. The area's road network is clearly segmented, reflecting a hierarchical structure that efficiently connects the different zones. Green spaces are prevalent among the residential and institutional buildings, while the industrial areas are accompanied by storage spaces.

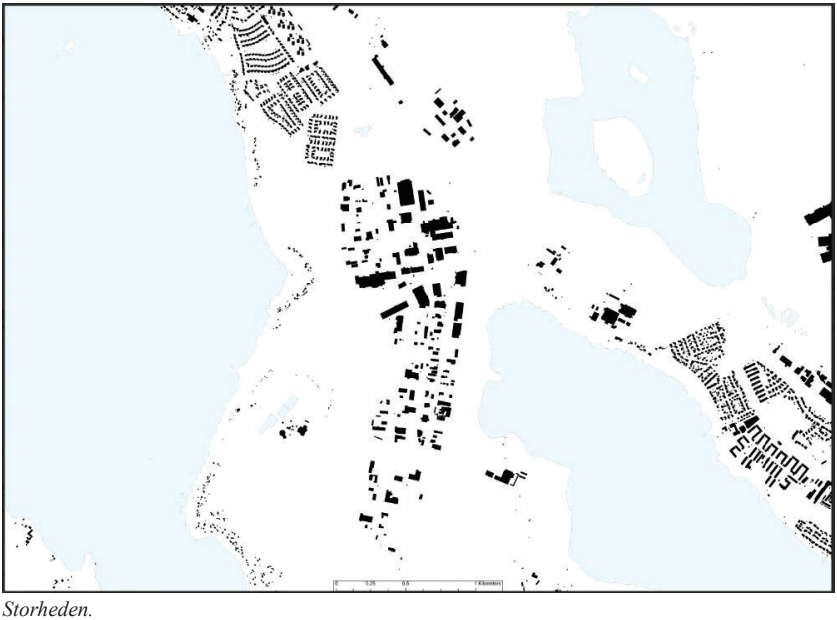
Björkskatan and Lulsundet also feature a mix of building scales, with Lulsundet offering a residential setting marked by a diverse street pattern. In contrast, Björkskatan comprises villas, terraced houses, and apartment buildings, alongside larger businesses and institutional structures. The varied road network, including rows, curves, and loops, intersects the area, providing access and connectivity.

Kallkällan and Bergviken present a mixed-use environment with apartments, villas, and terraced houses. The road layouts differ across the area, transitioning from a grid pattern around apartment complexes to linear and curved formations near villas and townhouses, respectively. Green spaces are a significant feature, enriching the living environment and contributing to the areas' overall charm and livability.

Storheden is a commercial area with the same type of buildings consisting of larger premises.The major road runs along the outer edge of the area. The spaces around the buildings indicate a high proportion of forest.



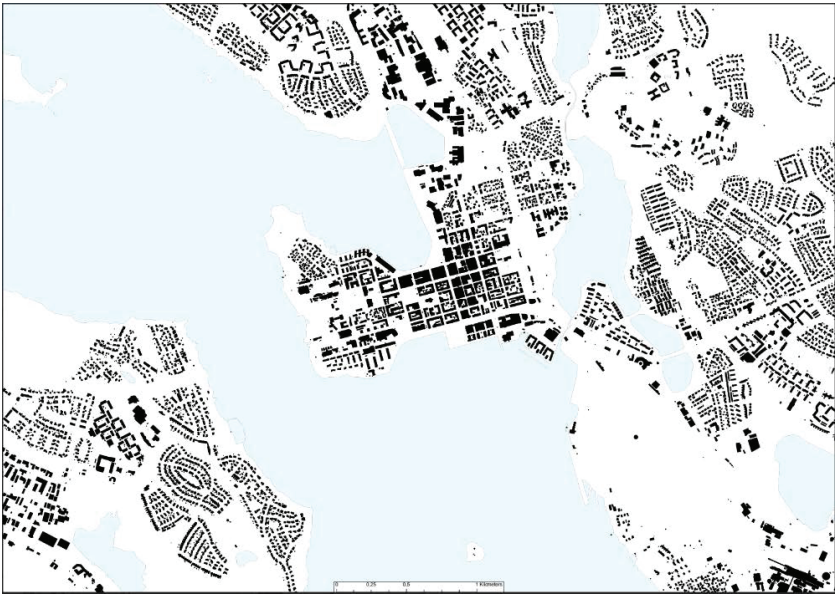
Mjölkudden, Notviken, Porsön, Björkskatan, Lulsundet, Kallkällan and Bergviken.



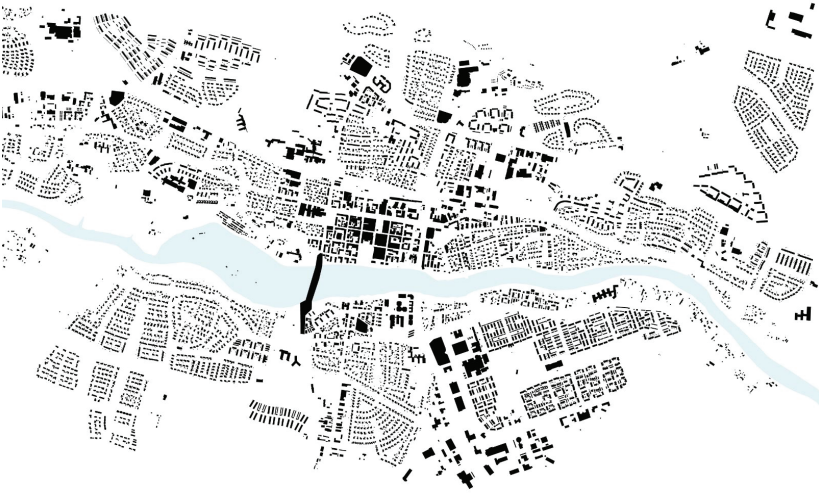
Storheden.

Drawings by Karin Blom, Matilda Frejd, Simon Melin,
Hanna Tönnesson Stefors, Albin Vågsäter

Piteå, Figure ground study



Luleå, Figure ground study



Skellefteå, Figure ground study

Haparanda, Figure ground study

Urban tissue comparison, Puteå and Luleå. Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.

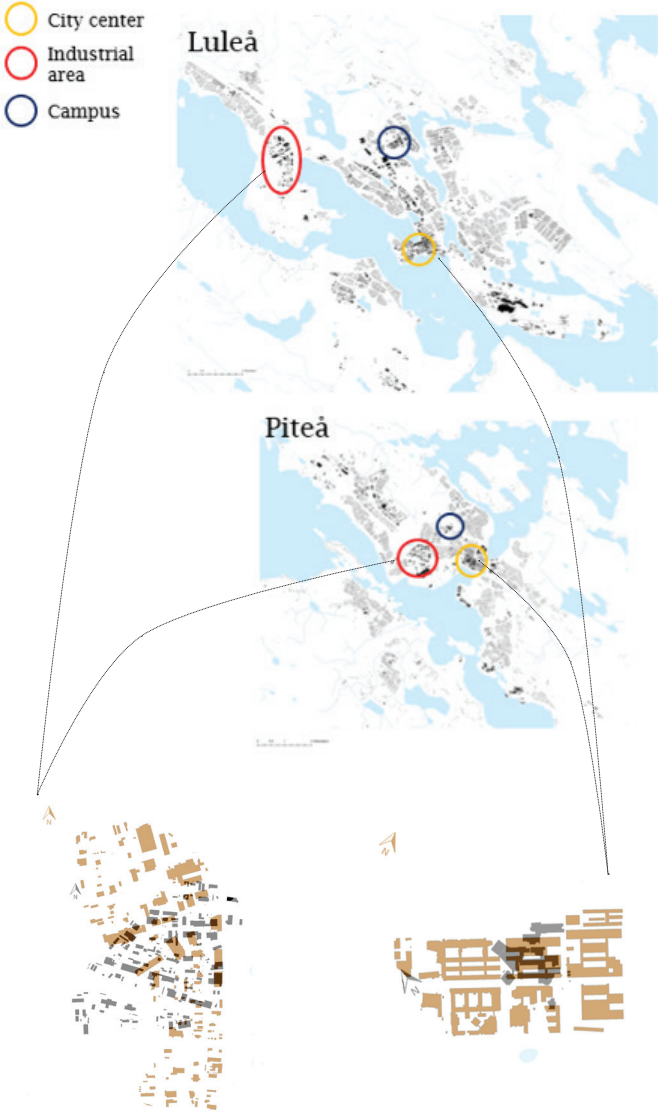
Urban tissue forms a cohesive entity that can be analyzed through various degrees of detail. Different layers of analysis reveal distinct components of urban structure. As the depth of examination increases, so does the detail and precision of the morphological insights gained. At its most basic, the urban fabric encompasses merely the streets and blocks. However, a more detailed exploration can uncover specifics, including the materials used in constructing spaces or buildings.

The city centers of Luleå and Piteå exhibit similar architectural styles and structures, with both employing grid layouts that reflect a degree of uniformity in building size and structure. Despite these similarities, Luleå's city center boasts a greater density, outpacing Piteå in terms of both scale and the abundance of buildings dedicated to commercial use. When examining the availability of green and open spaces within these city centers, it is observed that both Luleå and Piteå feature a limited number of such spaces, with each city center containing only three designated open areas. In both cities, the primary pedestrian thoroughfare serves as the main communal open space.

The industrial areas of Piteå and Luleå are again quite similar. Both areas feature a (semi)irregular layout with ample spaces between the buildings accommodating vehicular traffic. However, the buildings in Piteå are slightly smaller in scale compared to those in Luleå, mirroring the overall size differential between the two areas as well as the cities.

The campuses of Piteå and Luleå present a striking difference in the scale of their buildings. Buildings on Luleå's campus are notably larger than those on Piteå's campus, a distinction that extends to the overall campus sizes as well. Furthermore, the arrangement of campus buildings diverges between the two cities. Luleå's campus benefits from a grid layout, offering a sense of order and ease of navigation. On the other hand, Piteå's campus does not adhere to a specific layout, primarily due to its smaller size, which precludes a structured organization.

Comparison of the City center in Piteå (gray) and Luleå (yellow).
Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.

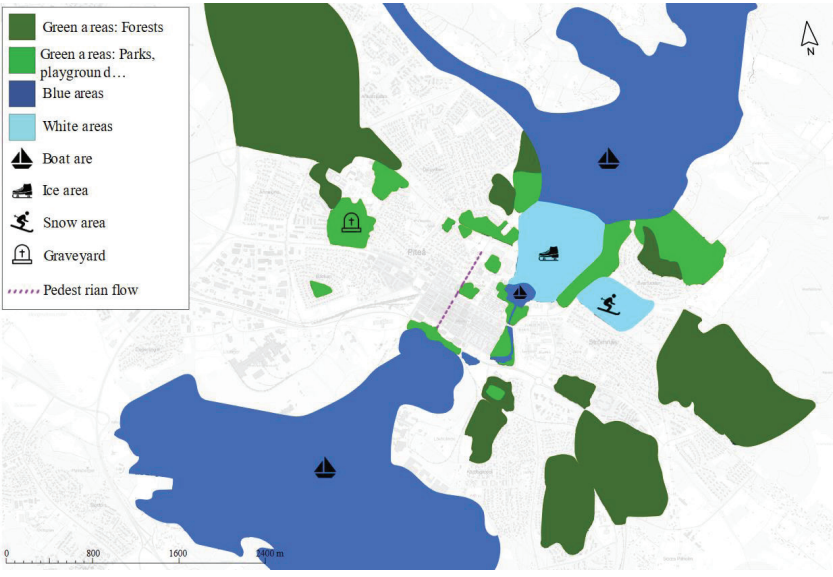


City center, Commercial/Industrial area and Campus area in the context of their cities, Luleå, Piteå. Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.

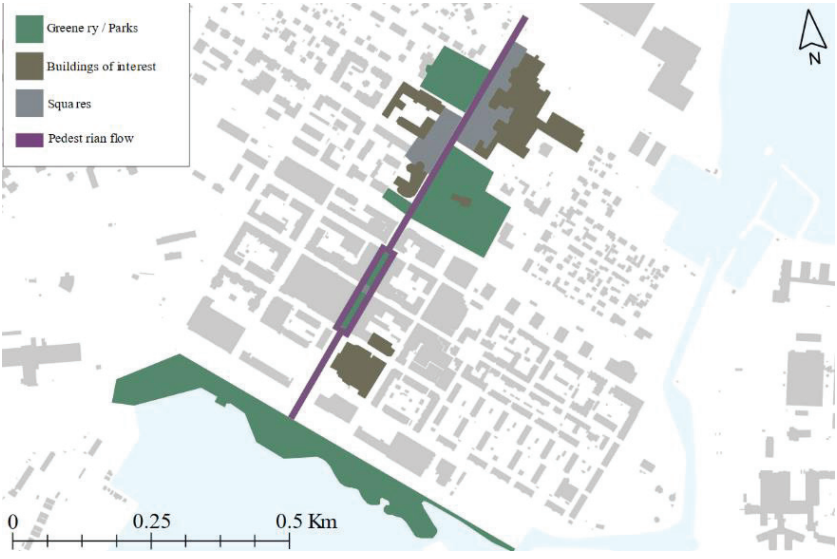
Public spaces play a vital role in shaping a city's functionality, beauty, and social interactions. They incorporate essential features aimed at improving city life through better accessibility, connectivity, functionality, design, identity, and adaptability, ultimately creating more livable environments. These features should be accessible to the entire community and mirror the city's identity and spirit, weaving in its history, culture, and values. Predominantly, these are pedestrian areas designed to be open to everyone, well-integrated into the urban fabric, functional, surrounded by a variety of buildings, and devoid of vehicular traffic. The aesthetic appeal of these spaces, enhanced by historical structures, architecture, art, and street furniture, is also a defining characteristic of their importance. Identifying these key elements involves examining several factors: the primary movement patterns along the main streets and roads, the open spaces, the diverse segments that constitute the city, and finally, the significant buildings and structures that contribute to the appeal of outdoor spaces.

Piteå for example is characterized by its diverse range of outdoor spaces, adding to the city's vibrant atmosphere. These spaces fall into three categories: green, blue, and white. The green areas encompass walkable forests, various parks of different sizes, other green spaces, and cemeteries. Blue spaces include the sea, rivers, and marinas, contributing to the city's scenic waterfront. The unique white zones, typical of colder regions, feature ski slopes and areas that become walkable when frozen. According to the Piteå municipality website, the extent of white areas usually matches that of the blue ones, though only specific ice areas are cleared and maintained during winter, as illustrated in a figure. Ski runs, which are white in winter, transform into green zones during the summer. Despite this rich variety of outdoor spaces, the city center of Piteå experiences a notable dearth of greenery, with minimal green spaces directly within it.

A few trees dot the bustling city streets, while parks are located on the periphery or further from the center. This layout generates a pedestrian flow through the city center, connecting the northern and southern regions, but it also highlights a disconnect between the city center and surrounding green spaces. A central thoroughfare plays an important role in directing pedestrian traffic through the city, as



Piteå's outdoor areas by colour.
Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.



Piteå's pedestrian flow within the city center.
Drawings by Sebastian Boisard, Ellinor Hjärne, Hanna Huber, Thèotime Lallemand, Linn Rydenstam.

depicted in the map. This vital path traverses the town center, presenting a long, straight route that intersects with just one vehicular road. Along its length, public transport stops are conveniently positioned, and it is flanked by various significant buildings. Originating from multiple parks and squares that host key facilities (like a school, sports complex, and a church to the north), this vertical street stretches down through the bustling main pedestrian area, culminating at a verdant seaside space. This layout intriguingly connects two critical pedestrian zones of the city. On one end, Uddmansgatan, a pedestrian boulevard abundant with green spaces, retail outlets, quaint squares, and urban furniture, serves as a bridge between the city's northern and southern sections. To the north lies Piteå's cultural heart, home to a cinema, library, educational and sports facilities, nestled amidst greenery, public squares, and the city church. To the south, a sprawling park adorns the waterfront, and further eastward, a bridge spans the river, facilitating access to another segment of Piteå. This strategic route not only enhances connectivity within the city but also enriches the urban landscape by linking areas of cultural, recreational, and natural interest.

The town is woven together by several crucial roads that connect to a variety of places and buildings, vital to its vibrancy and cultural life. For instance, the main thoroughfare for cars links significant locations like the bus station, ski slopes, shopping districts, industrial areas, the hospital, ice roads, sports arena, church, town hall, and the city center's pedestrian zones, all encircled by various parking facilities. The university campus stands out as a notable hub, hosting the university, student housing, a supermarket, and a small park. At the heart of the city, the downtown area clusters the most critical elements and structures, as illustrated in figure 10. This includes commercial buildings with retail spaces on the ground floor and residences above, alongside cafés, street furniture, restaurants, green spaces, theatres, cinemas, and a historic, somewhat touristic square. This square is home to the Piteå Museum, a bar, and a hotel, adding to the area's allure.

In Luleå, the urban layout's vital component for public life unfolds along a bustling commercial street. This street hosts key landmarks such as Domkyrkan, educational institutions, Residenset, the City Hall, Pontusbadet, Kulturens Hus, Hälsans Hus, and several

city malls. The train and bus stations, crucial for commuting, are situated in the center's eastern part. Other significant buildings for the city's residents flank this Main Street and are denoted in dark gray on the map. Storgatan, marked in red, stands out as a pivotal pedestrian pathway, brimming with activity and movement.

The city's public spaces are categorized into open, green, blue, and white spaces. Notable squares like Södra Hamnplan and Köpmantorget are indicated in gray on the map, with Storgatan itself acting as an expansive open area. Parks such as Hermelinsparken, Stadsparken, Floras Kulle, Järnvägsparken, Skurholmsberget, and Gültzauudden constitute the green spaces, with lighter green marking open parks and darker green indicating areas with dense vegetation. Blue spaces include the waterfronts of Gültauudden, Södra Hamn, and Norra Hamn. Additionally, during winter, Luleå embraces white spaces, notably the ice road that forms over the frozen Bottenviken, offering a unique pedestrian path also used for skating.

Key entry points for pedestrians, cyclists, and motorists into the city converge via Bodenvägen, Hertsövägen, and Bergnäsbron, enhancing access to the city center. Local streets also play an essential role in facilitating movement to various urban destinations. Predominantly, Storgatan is where daily travel congregates, leading from Residenset to the bus station and past many of the city's critical landmarks.

Key elements of public space in Luleå center.
Drawings by Karin Blom, Matilda Frejd, Simon Melin,
Hanna Tönnesson Stefors, Albin Vågsäter

Key route Storgatan in Luleå center.
Drawings by Karin Blom, Matilda Frejd, Simon Melin,
Hanna Tönnesson Stefors, Albin Vågsäter

The town ports of Piteå, Haparanda, Luleå, and Skellefteå were significant for their role in the economic development and expansion of trade in northern Sweden. Studying their evolution since the Middle Ages highlights the impact of natural phenomena such as land uplift, as well as human interventions, in shaping their maritime activities and trade networks. Here's a synthesized overview of information relevant to each location:

Piteå changed waterfront configurations over time, reflecting adjustments to commercial and industrial needs against a backdrop of geographical challenges like land uplift .

Haparanda was important for its geographical positioning and its evolution in response to political and environmental changes, especially in the context of its relation with Torneå and the impacts of land uplift and silting, which influenced the town port's development and outports.

Luleå's settlement history, characterized by the significant impacts of land uplift and silting, necessitated the relocation and adaptation of its harbors to sustain maritime trade. This history includes the strategic shift of port activities to new locations as a countermeasure against natural silting, ensuring the maintenance of navigable waterways. Skellefteå's development is similarly contextualized within the challenges posed by natural processes and the strategic responses that shaped its port facilities and industrial growth. It highlights the migration of port activities to areas less affected by silting, underscoring the dynamic interplay between geography and human economic activities.

The evolution of these ports from medieval times through industrialization illustrates a complex history of adaptation to environmental challenges and the strategic reorientation of economic activities to leverage geographical advantages.

In his comprehensive study, Lars Karlman delves into the history and evolution of timber floating in Norrland, Sweden, shedding light on the significant role this industry played from its origins to its eventual decline. The practice of timber floating, which has its earliest recorded inception with the formation of the Wästerdala-Wede Compani in 1648, was initially geared towards supplying vital resources such as wood to pivotal Swedish industries including the Falu copper mine. As sawmills began to proliferate towards the end of the

18th century, the demand for timber sourced from inland forests surged, necessitating an efficient means of transportation to the coast. Rivers and waterways naturally became the arteries of this burgeoning timber industry. The mid-19th century marked a notable expansion in timber floating, coinciding with the advent of steam-powered sawmills. This period saw the length of public floating routes extend dramatically from approximately 5,000 km in 1880 to around 20,000 km by the turn of the century, peaking at over 34,000 km by 1952. Despite this growth, the zenith of timber volume floated was reached in 1937, after which the industry began to witness a gradual decline. By the 1950s, the advent of road transportation and advancements in forestry machinery started to eclipse timber floating as the predominant method of timber transportation. The transition was rapid; by the early 1980s, floating had ceased in most of the major rivers, marking the end of an era for towns such as Piteå, Haparanda, Luleå, and Skellefteå. The cessation of timber floating not only heralded a shift in industrial practices but also represented a significant cultural loss for the rural communities in Norrland. At its peak in 1930, the industry employed nearly 50,000 workers, the majority of whom were based in Norrland. This workforce was integral to the social and economic fabric of these communities, and the decline of timber floating signaled a profound change in their way of life. The conclusion of the floating season was traditionally a period of community gathering and celebration in Norrland's towns, marking the end of another arduous season. Although the practice of timber floating has ceased, its memory persists, highlighting the complex legacy of an industry that shaped the economic and cultural landscape of Norrland. This legacy, characterized by the dichotomy between the industry's harsh realities and its moments of communal solidarity and celebration, continues to echo in the collective memory of communities across Piteå, Haparanda, Luleå, and Skellefteå, serving as a poignant reminder of a bygone era in Swedish industrial and cultural history.

The document "Skogen, flottningen och Norrbottens människor" by Bosse Johansson explores the intertwined history of forestry, log driving, and the lives of the people in Norrbotten, with a focus on the evolution of timber floating practices and their socio-economic impact. Initially, timber was bound into rafts (fastflottning)

for transportation, a method prevalent up to the 1920s in rivers like Torneälven. This involved creating bundles of timber tied together, navigating through a landscape rich in forests and waterways, with Norrbotten being a prime example where rivers facilitated the movement of timber and tar barrels to coastal areas. The inception of organized log driving in Sweden dates back to the 14th century, initially serving the mining industry. Over time, especially by the end of the 17th century, this practice became more common in the north, dealing with products like tar barrels and ship timber, which were tied into rafts. The surge in demand for timber, coupled with legislative changes in the 19th century, saw a transition to the construction of floatways and modifications to rivers to accommodate the growing needs of the timber industry. In Norrbotten, towns like Piteå, Haparanda, Luleå, and Skellefteå were integral to the timber floating economy, each with its unique challenges and contributions. The evolution from bound to loose log driving is noted, reflecting shifts in techniques and the impact of these changes on local economies and landscapes.

The emergence of sophisticated, fine-bladed sawmills marked a transformation in the method of transporting timber, particularly evidenced by the initiation of timber floating along the river with the establishment of the Lejonström sawmill in the 1780s. This period heralded the construction of additional sawmills along the coast, necessitating the development of new timber-floating routes. A significant portion of the Skellefteå River, particularly adjacent to the city center's right, became instrumental in these operations.

In regions abundant with forests, the timber industry emerged as a critical economic pillar, demanding considerable labor for the felling, processing, and transportation of timber. Rivers, central to the floating of timber towards mills or ports, naturally fostered the growth of settlements along their banks, serving the dual purpose of facilitating the industry and providing residences for the workforce and their families. By 1955, mappings underscored that these communities, albeit modest in size, were strategically located in proximity to vast timber reserves. This arrangement underscores the timber industry's direct influence on the placement of settlements, with the lack of other significant economic activities in these secluded regions reinforcing

Skellefteå, historical overview of the locations of floating timber areas in 1955-1967
Drawings by Frida Dahlbäck, Tyra Fagerström, Alexandra Stende Eriksson, Emil Tedeholm Larsson

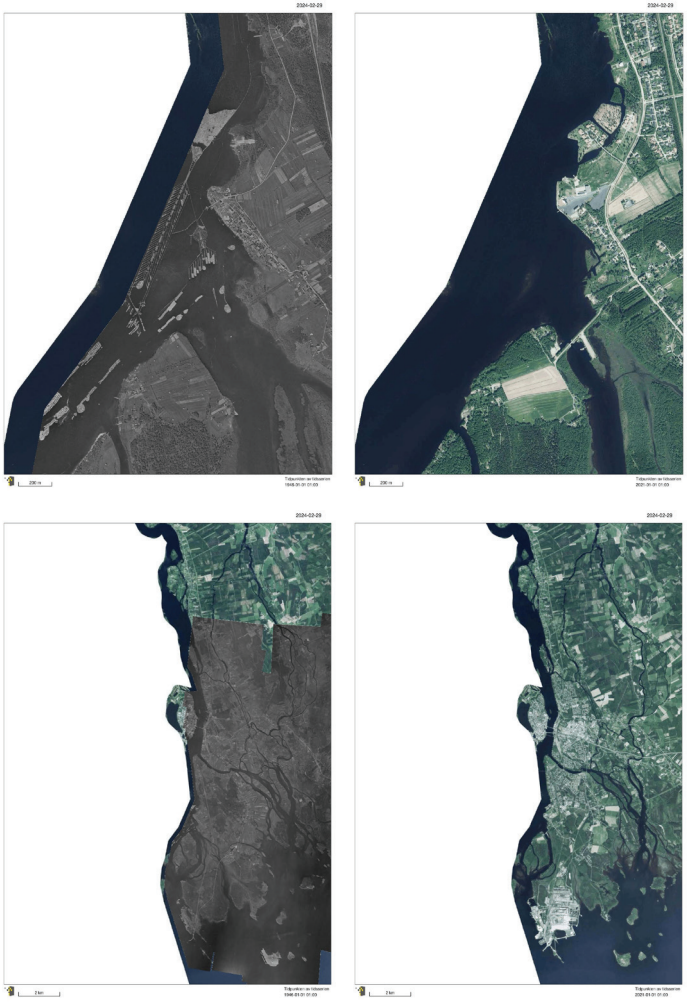
the notion that their existence was primarily due to the timber trade. Positioned away from the hustle and bustle of Skellefteå's urban life, these settlements demonstrate the intertwining of economic necessities and geographical realities in dictating human settlement patterns. At the heart of this narrative is the manner in which specific industry demands and geographical attributes guided the development of communities. The imperative for a labor force to buttress the timber industry, married with the logistical benefits of river-based transportation, spurred the emergence of settlements in locales that might have otherwise remained unpopulated. This historical nexus of natural resources, economic endeavors, and human geography provides a window into the determinants of settlement formation and expansion in distinct areas.

The Lejonström Sawmill, the most significant establishment of the timber floating era, initiated construction in 1780, heralding the era of industrial expansion in Skellefteå. Accompanying the sawmill were various infrastructural developments, including a sawhouse, inspector's dwelling, and additional facilities critical for the sawmill's operation. The establishment of the Örviken Sawmill in 1893 marked another pivotal moment for the industry, although its operation ceased after a decade, repurposing the facility for alternative productions. The twilight years of the 1970s saw the decline of timber floating as a mode of transportation, primarily due to the advent of road networks and the expansion of hydroelectric power projects. Following its cessation in 1905, the Lejonström Sawmill, along with its associated structures, was dismantled. Presently, the Örviken Sawmill serves varied purposes, with the era's tangible remnants erased from the river's landscape. Today, the enduring legacy of this period is manifested in the riverine settlements, which have only grown since the operational inception and subsequent discontinuation of the sawmills.

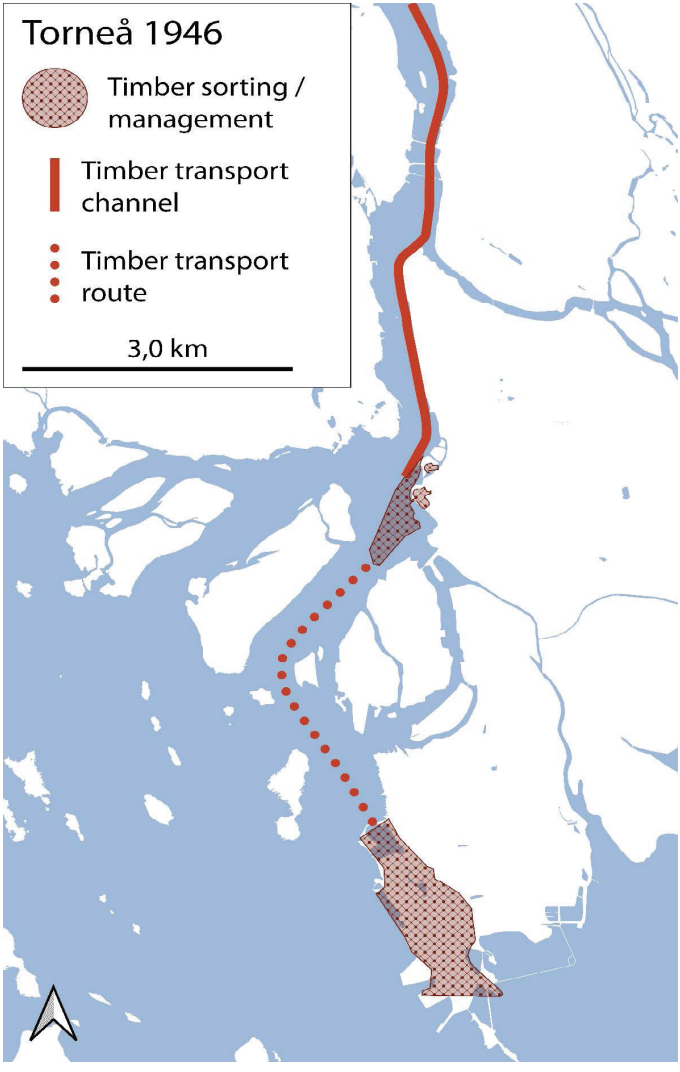
Haparanda has long been recognized for its timber production, leveraging its proximity to expansive forests. Although the methods of production have evolved, the region retains its importance in the timber industry. Traces of historical timber activities, such as lumber yards and transport roads, still exist. An area once occupied by a sorting plant has now been repurposed as a bustling port area, surrounded by restaurants, transforming into a vibrant dockyard and harbour. In the southern region,

what used to be a collection point has been converted into industrial facilities.Settlements associated with the timber rafting industry typically exhibit a rural character, focusing predominantly on timber processing. The main activities and structures in these areas revolve around the timber industry, including housing for workers and industrial infrastructure like docks and piers for wood loading and unloading. The infrastructure essential to the timber rafting industries primarily comprised docks for gathering transported timber. These docks housed facilities for sorting timber and preparing it for shipment. Consequently, roads were developed to facilitate efficient timber transport across the area. This industry has profoundly influenced urban development in the surrounding areas, particularly reflected in the housing for workers, the emergence of company towns, and industry-specific infrastructure. The expansion of worker housing and logging operations led to the growth of the timber rafting industry, potentially contributing to the economic prosperity of Haparanda and Tornio and attracting more people to the area for employment opportunities. As a result, infrastructure like roads, tailored to urban settlement needs, facilitated the rapid expansion of the area due to improved transportation routes.Timber rafting operations along the Torne River were managed from the Finnish side, necessitating the use of Finnish sources for comprehensive analysis. Historical aerial photographs from a Finnish website (Paikkatietoikkuna, n.d.) enabled a comparison of infrastructure related to timber rafting activities between 1946 and 2021. This comparison revealed significant transformations in the infrastructure, with former timber management areas evolving into modern industrial and residential zones, showcasing the adaptability of land use over time to meet contemporary needs.

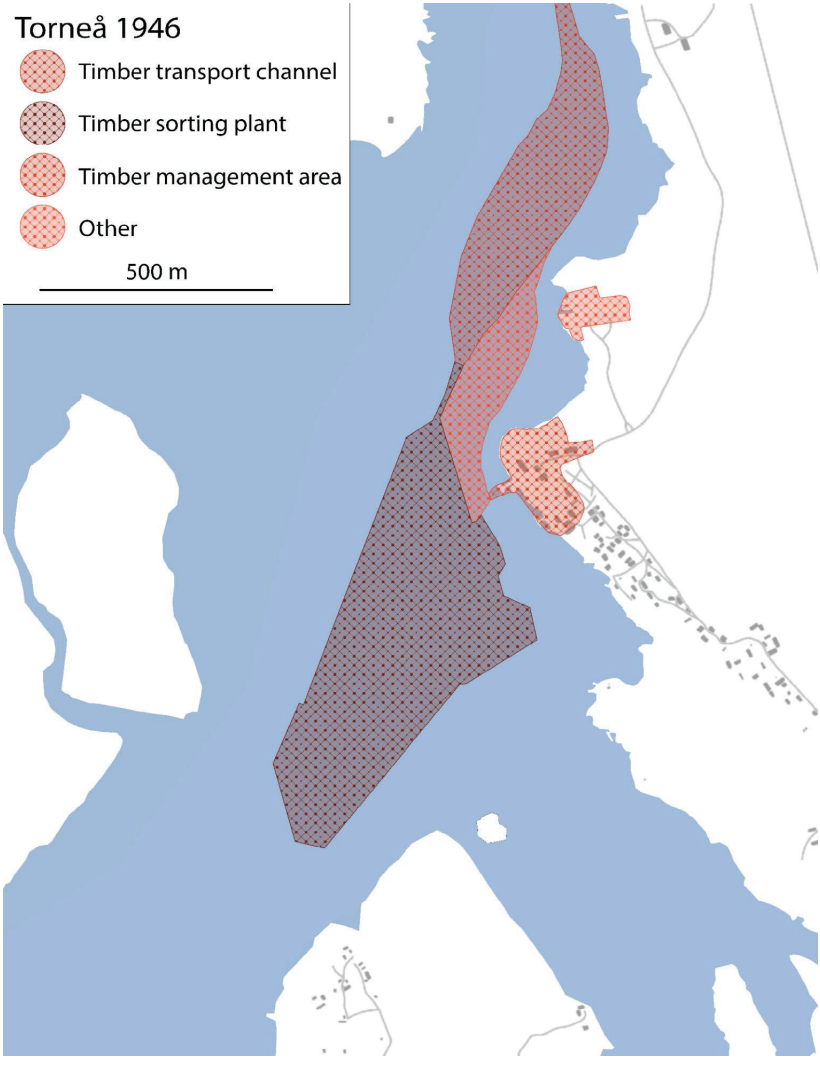
Bergnäset was home to the largest log driving facilities in Luleå, strategically situated at the southernmost point of the Lule River. This prime location played a pivotal role in aggregating logs before their journey into the Bothnian Bay. The coastal stretch in this area was predominantly equipped with waterside structures designed for the gathering and sorting of logs on the river. An aerial photograph capturing Bergnäset, taken during the period between 1955 and 1963, illustrates the exact positioning of these log driving structures. The layout and organization of the collecting and sorting facilities, offering a clearer



Haparanda timber sorting plant, 1946 and 2021 (image above)
Overview of the Torne River and Tornio, 1946 and 2021 (image below).
Drawings by Abdirahman Maalin, Elia Nassif, Dag Nyberg, Elie Wehbi.



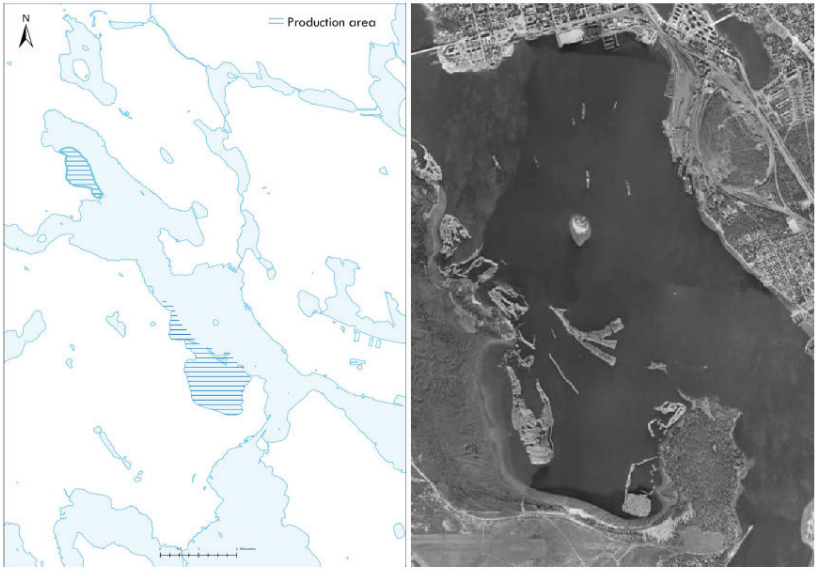
Haparanda overview, timber transportation system and sorting plant in 1946.
Drawings by Abdirahman Maalin, Elia Nassif, Dag Nyberg, Elie Wehbi.



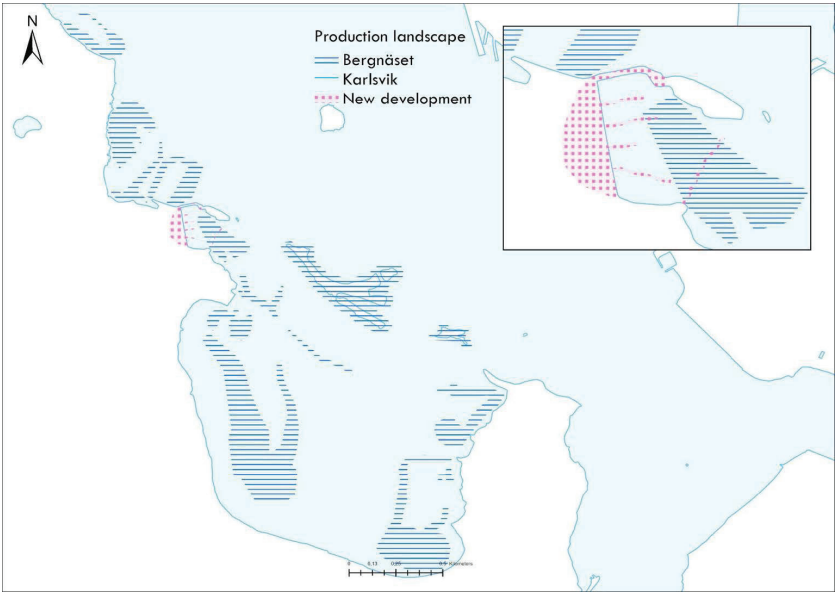
Haparanda timber transportation system and sorting plant in 1946.
Drawings by Abdirahman Maalin, Elia Nassif, Dag Nyberg, Elie Wehbi.

depiction of their arrangement. Utilizing the comparison tool between the views from 1955-1967 and the present day reveals that none of the buildings from that era are identifiable in Bergnäset's current landscape. Nevertheless, it appears that some of the old roads have played a role in shaping the contemporary development of the area. The coastline itself shows minimal alteration, except for one significant change. An island has been linked to the mainland, resulting in the formation of a bay where none existed before 1967. Following this transformation, the connecting coastline has been revamped to accommodate jetties, and the area is now utilized as a marina with new constructions emerging around the harbor.

In Karlsvik, the Karshäll wood mill initiated wood pulp production in 1911, a precursor to paper manufacturing. This operation necessitated the construction of a substantial log driving facility in the northern region. The aerial photo from the period between 1955-1967 showcases the waterside log driving structure. Alongside the mill and the waterside structure, two significant buildings were erected for log storage, and housing was provided for workers in the vicinity. The wood pulp production persisted until 1962 but ceased due to advancements in paper mass production elsewhere. By 1973, all the facilities, excluding the storage buildings, were demolished. Unfortunately, a fire in 2016 destroyed the remaining storage facilities, leaving no physical remnants of the industry in the area. Despite the absence of tangible structures from the industrial period, the legacy of the production process endures through environmental impact. The use of mercury in the production method led to the release of toxic waste into the Lule River, contaminating the riverbed and surrounding ecosystems. Luleå municipality, in collaboration with the County Administrative Board and the Swedish Environmental Protection Agency, is engaged in efforts to remediate the mercury pollution, aiming to extract the remaining toxic waste from the area, marking an ongoing process to address the environmental ramifications of the region's industrial history.



Luleå Bergnäset 1955-1967, timber production areas
Drawings by Karin Blom, Matilda Frejd, Simon Melin,
Hanna Tönnesson Stefors, Albin Vågsäter



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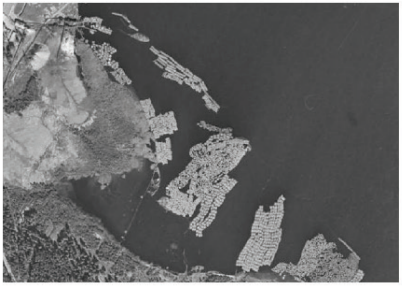

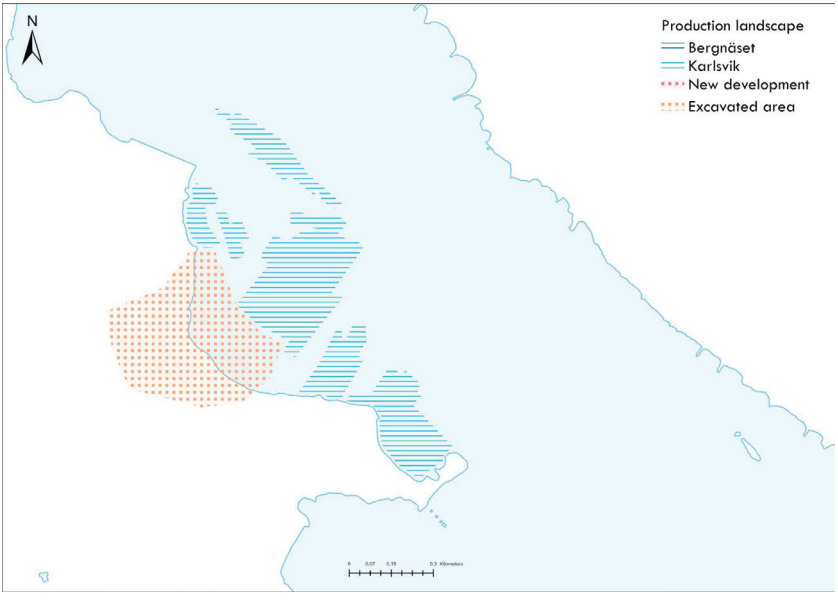

Luleå Karlsvik production landscape, timber production areas
Drawings by Karin Blom, Matilda Frejd, Simon Melin, Hanna Tönnesson Stefors, Albin Vågsäter

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