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ICBE 2026

MAY 08th-09th, 2026
POLIS University, Tiranë

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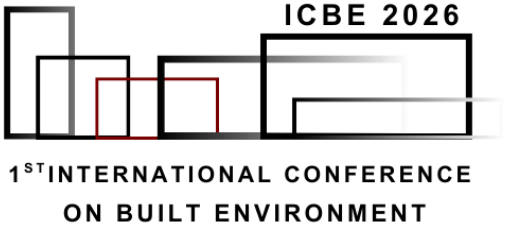
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1st International Conference on Built Environment

ICBE 2026

Conference Theme and Rationale

The 1st International Conference on Built Environment (ICBE 2026) was conceived as an international and interdisciplinary forum for advancing knowledge, critical discussion, and innovation across architecture, urban planning, engineering, construction, materials, design, and the wider built environment. Organized by POLIS University in collaboration with the National Agency for Scientific Research and Innovation in Albania (AKKSHI), the Academy of Sciences of Albania and the University of Ferrara in Italy, the conference brought together academics, researchers, practitioners, students, and industry representatives to exchange research findings, professional experience, and emerging perspectives on the transformation of contemporary cities and territories.

The conference theme reflected the increasingly complex challenges shaping the built environment, with particular attention to sustainability, resilience, technological innovation, heritage preservation, and socially responsive design. Contributions addressed sustainable architecture and green building, innovative construction technologies and materials, climate-responsive and energy-efficient design, disaster risk reduction, circular approaches to construction, and the integration of renewable energy. Equal emphasis was placed on digital transformation through Building Information Modeling, Geographic Information Systems, artificial intelligence, data analytics, automated solutions, digital fabrication, and advanced manufacturing.

ICBE 2026 also recognized that the future of the built environment cannot be approached through technological innovation alone. Urban transformation, cultural heritage, adaptive reuse, inclusive design, ecological thinking, art, and interdisciplinary research were therefore integral to the conference rationale. The scientific sessions examined topics ranging from seismic resilience, geotechnical engineering, and structural safety to urban fragmentation, public space, heritage conservation, adaptive environments, and new relationships between human and non-human systems.

Through keynote lectures, scientific presentations, case studies, and interdisciplinary debate, the conference encouraged connections between research and practice while promoting approaches capable of responding to environmental, social, cultural, and technological change. The breadth of contributions demonstrated the value of bringing engineering, architecture, urbanism, design, heritage, and emerging technologies into a shared academic framework for more resilient, sustainable, adaptive, and human-centered environments.

Held on 8-9 May 2026 at POLIS University in Tirana, with in-person and online participation, ICBE 2026 welcomed guest speakers and participants from Albanian and international universities, research institutions, professional organizations, and industry. Its sessions established a platform for presenting current research, exchanging expertise, strengthening meaningful collaboration, and identifying future directions for the built environment.

The event

The **1st International Conference on Built Environment (ICBE 2026)** is an interdisciplinary academic and professional forum dedicated to exploring contemporary challenges, emerging research, and innovative approaches shaping the future of the built environment. Bringing together researchers, academics, architects, engineers, urban planners, designers, practitioners, and industry professionals, the conference promotes the exchange of knowledge and encourages collaboration across traditionally interconnected disciplines. Its thematic scope encompasses sustainable and resilient construction, technological innovation, advanced building materials, urban transformation, cultural heritage, and interdisciplinary design approaches. Particular attention is given to the growing role of digital technologies, data-driven methodologies, intelligent design processes, and advanced analytical tools in supporting more informed and responsive approaches to architecture, engineering, and urban development. At the same time, ICBE 2026 recognizes the importance of environmental responsibility, cultural identity, social needs, and human-centered design in shaping contemporary cities and territories. Through keynote lectures, scientific sessions, case studies, and interdisciplinary exchange, the conference provides a platform for presenting current research, discussing professional experiences, and developing new perspectives capable of contributing to **safer, more sustainable, adaptive, inclusive, and resilient built environments**.

Objectives

- Promote interdisciplinary collaboration among researchers, academics, practitioners, and professionals in architecture, engineering, urban planning, construction, design, heritage, and related fields of the built environment.
- Advance the use of digital technologies and innovative methodologies, including BIM, GIS, artificial intelligence, data analytics, digital fabrication, and parametric approaches, in research and professional practice.
- Encourage sustainable, resilient, and climate-responsive approaches to architecture, construction, and urban development through innovative materials, energy-efficient strategies, and environmentally responsible design.
- Address contemporary challenges affecting cities, buildings, and infrastructure through scientific research, applied case studies, evidence-based approaches, and innovative design solutions.
- Promote the conservation, transformation, and adaptive reuse of cultural heritage, balancing cultural identity, contemporary needs, structural safety, and responsible urban development.
- Support human-centered and socially responsive urban transformation, considering public space, mobility, ecological systems, community needs, and the wider social and economic impacts of the built environment.
- Provide a platform for knowledge exchange and emerging research, enabling scholars, young researchers, professionals, and students to present innovative ideas, strengthen international collaboration, and contribute to future directions in the built environment.

Main Conference Themes

- Sustainable architecture and green building practices.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Digital tools and smart technologies in architecture and construction (e.g., BIM, GIS).
- Climate-responsive and energy-efficient design.
- Disaster risk reduction and resilience in the built environment.
- Circular economy approaches in construction and material usage.
- Integration of AI and data analytics in building design.
- Acoustic and thermal performance in building design.
- Renewable energy integration in building systems.
- Advanced manufacturing techniques in construction, such as 3D printing.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Disaster risk reduction and resilience in the built environment.
- Digital tools and smart technologies in architecture and construction.
- Advanced manufacturing techniques in construction.
- Geotechnical Engineering for Sustainable Development.
- Cartography and Geographic Information System.
- Computer Automated Solutions for Built Environment.
- Reliability in Civil Engineering.
- Urban planning strategies for resilient cities.
- Climate-responsive and energy-efficient design.
- Regulatory frameworks and policies impacting construction and urban development.
- Design in the Era of Anthropocene (Rethinking the Relation between Human and Non-Human Species)
- Speculative Design (with Attention to “Discursive” and “Critical” Design)
- Design and Cross-Disciplinarity (with Emphasis on Processes rather than Design Outputs)
- Inclusive Design
- Art and Urban Regeneration (Focus on Participatory, Collaborative, and Research-Based Practice)
- Relational Art and Architecture
- Monuments and ‘Anti-Monuments’ (Particular Attention to the Process of Designing and Building the City)

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The conference is structured around six thematic sessions, each addressing a specific area of research and practice within the built environment.
Each session is coordinated by experts in the relevant disciplinary field and is open to professors, researchers, PhD candidates, and other scholars and professionals contributing to the conference themes.

SESSION I
Urban Planning and Societal Impact

Chair: Dr. Gent Avdija

This session examines the relationship between urban transformation, spatial development, and their social implications within contemporary cities. Contributions address rapid urbanization, urban fragmentation, the transformation and loss of public space, informal and spontaneous development, and the challenges associated with balancing growth and modernization with human-scale urban environments. Particular attention is given to the evolving conditions of Albanian cities and to planning approaches capable of supporting more inclusive, sustainable, socially responsive, and livable urban environments.

SESSION II
Sustainable Materials, Resilient Construction & Smart Design

Chair: Dr. Endri Duro

This session explores innovative approaches to sustainable construction, resilient structural systems, and environmentally responsive design. Particular attention is given to sustainable materials, energy-efficient and climate-responsive strategies, prefabricated and lightweight construction technologies, and human-centered approaches to structural and architectural design. The session investigates how material innovation, technological development, and responsible design practices can contribute to safer, more efficient, adaptable, and environmentally sustainable built environments.

SESSION III
Technological Advancements and Seismic Design for Resilient Places

Chairs: Dr. Seyyed Behrad Emadi & Dr. Ornela Şen

This session examines the role of technological innovation and advanced engineering methodologies in developing safer, more resilient, and adaptable built environments. Contributions address seismic hazard and risk assessment, digital fabrication, parametric and computational approaches, transformations of building envelopes and prefabricated housing systems, and emerging concepts for future urban mobility. The session highlights how the integration of engineering knowledge, digital technologies, and resilience-oriented design can strengthen the capacity of buildings, infrastructure, and urban environments to respond to contemporary and future challenges.

SESSION IV

Cultural Heritage

Chairs: Dr. Nikolla Vesho & Dr. Marsela Demaj

This session addresses the preservation, interpretation, and transformation of cultural heritage within contemporary architectural and urban contexts. Contributions explore conservation strategies for historic buildings and sacred architecture, seismic assessment and strengthening of heritage structures, adaptive reuse, and the social implications of urban regeneration and heritage loss. Particular emphasis is placed on achieving a responsible balance between conservation ethics, cultural identity, structural safety, and the evolving functional requirements of historic buildings and urban environments.

SESSION V

Spaces of Connection: Art and Design for an Interspecies and Interdisciplinary Environment

Chair: Dr. Francesco Scasciamacchia

This session explores the intersections of art, architecture, design, technology, and the built environment through interdisciplinary and experimental perspectives. It investigates changing relationships between human and non-human systems, spatial perception, adaptive reuse, post-industrial landscapes, urban representation, digital heritage, and environmentally and socially engaged design practices. Through critical, speculative, participatory, and research-based approaches, the session examines how art and design can generate new forms of connection, reinterpret existing environments, and contribute to emerging cultural and spatial narratives within contemporary cities.

SESSION VI

Next-Generation Pioneers of the Built Environment

Chair: Dr. Flogerta Krosi

This session provides a dedicated platform for emerging researchers and students to present innovative, experimental, and forward-looking approaches to the built environment. Contributions span architecture, engineering, urban planning, environmental resilience, design, and related creative disciplines, reflecting the interdisciplinary character of a new generation of researchers and practitioners. Through projects addressing topics such as bioclimatic design, flood-risk management, structural technologies, architecture-inspired design, and critical interpretations of objects and social space, the session encourages critical inquiry, experimentation, and new perspectives on the future of the built environment.

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SESSION I

Urban Planning and Societal Impact

Urban transformation and growth: Rapid urbanization / Urban expansion / Contemporary city transformation / Growth and modernization.

Urban form and spatial quality: Urban fragmentation / Human-scale development / Public-space transformation / Spatial continuity and connectivity.

Society and the city: Social impact of urban development / Community needs / Inclusive urban environments / Quality of urban life.

Planning challenges in changing cities: Spontaneous architecture / Informal development / Sustainable urban planning / Transformation of Albanian cities.

Urban Blueprint and Compatible Growth:
A Multi-Scalar Morphological Method for Sustainable Transformation in Erseke, Albania

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Abstract

Urban transformation can weaken a town when expansion interrupts the spatial relationships that support its identity, accessibility, and everyday functioning. This paper develops a multi-scalar morphological method for Erseke, Albania, aimed at converting inherited urban structure into generative rules for compatible growth. The study reads the town through network hierarchy, public and functional systems, landscape edges, and building grain. These layers are interpreted through urban granularity, morphological continuity, and bounded fractal diagnostics. Fractal analysis is used only where scaling or self-similar tendencies can be identified; other differences are treated as changes in grain, density, hierarchy, or aggregation. The extracted relations are organized as a morphological grammar composed of nodal hierarchy, connective lines, grid alignments, proportional fields, and seed structures. Rhino and Grasshopper are used to implement the rules and generate alternative scenarios of urban growth. The scenarios are compared through morphological continuity, connectivity, accessibility, and functional balance. The results suggest that the method is strongest when it acts as a translation framework between urban analysis and design rather than as a universal mathematical model. It allows future growth to remain connected to the inherited spatial structure while admitting variation, programmatic change, and controlled densification.

Key words: *Urban Morphology, Urban Blueprint, Granularity, Morphological Grammar, Compatible Growth, Spatial Accessibility*

1. INTRODUCTION

Urban change is not problematic because cities transform. It becomes problematic when transformation breaks the spatial relationships that allow a settlement to remain legible, accessible, and functionally balanced. This problem is especially visible in smaller towns, where inherited street structures, plot rhythms, public spaces, landscape edges, and built grain are still readable as a coherent system. In these contexts, even modest expansion can produce rupture if it ignores the logic of the existing urban fabric.

Erseke, Albania, offers a useful case for this question. The town has a recognizable relation between street hierarchy, block structure, public-space distribution, building grain, and surrounding landscape. These components are not isolated features. They operate together as an urban structure that has accumulated through time. The issue is therefore not only how to describe the town, but how to translate the observed structure into design rules that can guide future growth.

This paper uses the term urban blueprint to describe a documented set of recurrent spatial relationships within the settlement. The term is used operationally: it refers to the measurable and interpretable relations among streets, plots, public spaces, landscape edges, and built fabric. It does

not imply a fixed essence. The aim is to identify which morphological relations support continuity and can be extended, transformed, or recombined in future scenarios.

The research is positioned between urban morphology, scale-sensitive analysis, and rule-based design. Urban morphology provides the basis for reading inherited form as an active structure rather than a passive background [1]–[4]. Granularity and urban grain provide a clearer vocabulary for describing differences of size, density, texture, and aggregation across scales [5], [6]. Fractal analysis is used more narrowly as a diagnostic method for identifying scaling behaviour and possible self-similarity where such properties are actually present [7]–[10]. Shape grammar and procedural modelling then provide a way to translate the reading into generative rules [11]–[13].

The central research question is: how can the inherited morphological structure of Erseke be translated into a rule-based framework for compatible and sustainability-oriented urban transformation? Three supporting questions organize the paper: which multi-scalar morphological relations define the town's urban blueprint; which of these relations can be read through grain, hierarchy, and bounded scaling; and whether scenarios generated from the extracted rules perform better than unguided expansion in terms of continuity, connectivity, accessibility, and functional balance.

The contribution of the paper is methodological. It does not argue that urban form is mathematically fractal in a strict sense. Following the caution that cities can be treated, at

most, as pre-fractal systems within limited scaling ranges [10], the paper uses fractal diagnostics only as one layer of interpretation. The main contribution is the translation of multi-scalar morphological reading into a computational grammar that can generate and compare alternative growth scenarios.

2. LITERATURE REVIEW

2.1 Urban morphology, urban grain, and granularity

Urban morphology offers the most direct foundation for this study because it treats urban form as an accumulated structure composed of streets, plots, buildings, blocks, and open spaces. Conzen's town- plan analysis showed that the plan of a town can be read through the relationship among streets, plots, and building arrangements, and that earlier frameworks continue to influence later change [1]. Moudon extended this view by defining urban morphology as the study of the form of human settlements and the formation and transformation of their components across time and scale [2].

The concept of urban grain is important because it describes the texture and resolution of the built fabric. Fine grain, coarse grain, parcel rhythm, block size, building spacing, and street spacing all influence how a city can absorb new programs. Granularity is therefore a more accurate term for many of the phenomena examined in this paper: it refers to how urban elements are distributed and differentiated at different levels of resolution. It is not simply a visual attribute. It affects walkability, adaptability, access, density, and the capacity of the urban fabric to change without losing coherence [4]–[6].

Kropf and Oliveira show that morphological analysis becomes operational when it moves from visual description to structured comparison of urban tissues, types, and scales [5], [6]. This supports a method in which Erseke is not treated as a single outline or image, but as a layered system. The relevant units are the street network, plot and block structure, built grain, functional nodes, green spaces, and landscape edges. Their relationships provide the material from which the urban blueprint is constructed. Recent morphometric work further supports this shift from description to measurement, showing how street-network complexity and urban tissue characteristics can be compared through computational indicators [21], [22].

Urban continuity in this framework does not mean formal imitation. It means preserving or extending the hierarchy, grain, access structure, and spatial relationships that allow the town to function as an integrated whole. Lynch adds a perceptual dimension to this argument through paths, edges, nodes, districts, and landmarks [3]. Jacobs adds a functional dimension through mixture, short blocks, fine grain, and distributed activity [4]. Together, these works show that compatible growth must be evaluated through spatial relations rather than visual resemblance alone.

2.2 Scaling and bounded fractal diagnostics in urban form

Fractal geometry entered urban studies because cities often contain irregular yet organized

spatial patterns. Mandelbrot introduced fractal geometry as a way to describe forms that are complex, nested, and resistant to simple Euclidean measurement [7]. Batty and Longley applied this reasoning to urban form and argued that settlement structures can show measurable scaling properties in their physical and functional distributions [8]. Frankhauser further developed the use of fractal approaches for analysing the spatial organization of urban agglomerations and the distribution of activities across scales [9].

The relevance of fractal analysis is therefore diagnostic, not rhetorical. It can help identify whether certain layers of urban form show scaling behaviour, hierarchy, clustering, or self-similarity within a specified range. It should not be used as a general label for all multi-scalar analysis. A change from the town scale to the block scale, by itself, is a question of granularity. It becomes a fractal question only when there is evidence of self-similar or scale-related structure across levels.

This distinction is central to the present method. Tannier et al. use fractal approaches to identify urban boundaries and to compare fractal and non-fractal urbanization scenarios in terms of accessibility [14], [15]. Their work is valuable not because it treats all urban space as fractal, but because it tests what fractal organization can and cannot improve. Their accessibility study shows that fractal scenarios may improve access to open spaces while producing different outcomes for shops and services depending on land-use configuration [15]. This supports a cautious interpretation: fractal logic can be useful where it is linked to explicit spatial performance, but it does not automatically produce better urban design.

Chen similarly argues that urban form should be treated as pre-fractal rather than perfectly fractal, and that fractal properties are valid only within certain scaling ranges [10]. This paper follows that position. Fractal dimension is used as a bounded diagnostic indicator for scaling and complexity; it is not treated as a score for urban quality. Where self-similarity is not demonstrated, the paper uses the more appropriate concepts of grain, hierarchy, aggregation, density, and spatial resolution.

2.3 Morphological grammars and rule-based design

The step from analysis to design requires a rule system. Alexander's pattern language framed spatial knowledge as recurring relations that can guide design without prescribing a single form [11]. Stiny's shape grammar formalized a related logic through rule-based transformations of shapes [12]. In both cases, the important point is that design knowledge can be expressed through relations and operations rather than copied forms.

Procedural modelling extends this logic computationally. Parish and Müller's work on procedural city modelling shows how streets, parcels, and buildings can be generated through rule systems that combine global goals and local constraints [13]. In urban design, this is useful because growth rarely depends on one rule. It depends on multiple constraints: topography, inherited roads, access, density, public space, functional distribution, and development priorities. Duarte's study of Siza's Malagueira housing further demonstrates that continuity in a large project can be achieved through a consistent grammar of relations rather than

repeated formal copying [20].

For Erseke, the grammar is not imported from an external model. It is derived from the town's own morphological reading. The extracted relations become point rules, line rules, grid rules, and seed rules. Point rules define nodal hierarchy and intensity. Line rules define continuity, connection, and movement. Grid rules define proportional fields and orientation. Seed rules define local growth structures that can be expanded, rotated, and recombined. This makes the grammar testable and adjustable rather than merely descriptive.

2.4 Spatial sustainability, accessibility, and functional balance

Sustainability in this paper is addressed through spatial organization. This does not replace environmental simulation, but it provides a relevant set of proxies for early urban design scenarios. Hillier and Hanson showed that spatial configuration shapes movement, encounter, and social use [16]. Sevtsuk and Mekonnen developed Urban Network Analysis measures such as reach, gravity, closeness, straightness, and betweenness, which make it possible to compare accessibility and connectivity across design alternatives [17].

Transport and land-use research also supports the use of spatial criteria. Cervero and Kockelman showed that density, diversity, and design influence travel behaviour [18]. Ewing and Cervero's meta- analysis confirmed that the built environment affects walking, vehicle travel, and accessibility outcomes [19]. In the present study, scenario performance is therefore assessed through morphological continuity, connectivity, accessibility to public and green functions, and balance among residential, collective, commercial, and open-space uses.

The literature suggests a clear methodological position. Urban morphology provides the base reading; granularity explains differences of grain and aggregation; fractal diagnostics are used only where scaling or self-similarity can be supported; and rule-based modelling translates these readings into design alternatives. This is the framework used for Erseke.

Table 1. Conceptual position of the method

Concept	Role in the paper	Main use	Risk if misused
Urban morphology	Base analytical framework	Reads streets, plots, blocks, public spaces, and building grain	Can remain only descriptive if not translated into rules
Granularity / urban grain	Primary vocabulary for scale differences	Describes grain, density, aggregation, and spatial resolution	Can become vague if not tied to observable elements
Fractal diagnostics	Bounded analytical layer	Tests scaling, hierarchy, and possible self-similarity within limits	Can become overclaim if used as a universal metaphor
Morphological grammar	Generative translation tool	Converts observations into point, line, grid, and seed rules	Can become arbitrary if rules are not derived from site evidence

3. METHODOLOGY

3.1 Research design

The research is case-based and mixed-method. It combines qualitative morphological reading, scale- sensitive interpretation, bounded fractal diagnostics, and computational scenario generation. The purpose is not to prove that the town is fractal. The purpose is to test whether a structured reading of inherited morphology can be translated into a rule system for compatible growth.

The work follows four stages. First, the urban structure of Erseke is read across network, system, landscape, and building-grain layers. Second, the relationships among these layers are interpreted through granularity, hierarchy, and bounded scaling. Third, the extracted relations are translated into a morphological grammar. Fourth, alternative scenarios are generated in Rhino and Grasshopper and compared through spatial-performance criteria.

3.2 Case study selection: Erseke

Erseke was selected because its urban structure remains legible. The settlement is small enough for street hierarchy, block structure, public-space distribution, building grain, and landscape edges to be read together. At the same time, the town is not static. It faces the same planning problem common to many smaller settlements: how to accommodate growth and functional change without weakening the inherited spatial structure.

The case is useful because inappropriate expansion in such contexts becomes visible quickly. When the existing grain is clear, a rupture in hierarchy, block rhythm, access, or landscape relation can be identified directly. This makes Erseke an appropriate setting for testing a method based on compatibility rather than maximum expansion.

3.3 Data sources and base mapping

The study uses historical maps, current cartographic information, satellite imagery, field-based observations, and project-based drawing material. The base mapping is organized into four analytical layers: network structure, public and functional systems, landscape and green-space relations, and building grain. Each layer is read separately and then compared with the others to identify overlaps, discontinuities, and structural dependencies.

The network layer includes primary and secondary routes, local access streets, directional continuities, and points of convergence. The public and functional layer includes civic spaces, activity nodes, commercial concentrations, collective uses, and public-space hierarchy. The landscape layer includes topographic edges, green spaces, and the relation between built fabric and open territory. The building-grain layer includes parcel rhythm, building spacing, block size, and density concentration.

3.4 Urban blueprint extraction

The urban blueprint is extracted from recurrent spatial relations rather than from visual appearance. At the network level, the analysis identifies branching tendencies, connective hierarchy, and directional continuities. At the public-system level, it identifies the distribution of activity nodes and the relation between public spaces and movement. At the landscape level, it identifies edges, thresholds, and green continuities. At the building-grain level, it identifies parcel rhythm, block size, density clusters, and changes in spatial resolution.

The purpose of extraction is selective. Not every existing condition should be preserved. Some inherited relations may support continuity, while others may restrict future accessibility or functional balance. The method therefore distinguishes between relations to extend, relations to adapt, and relations to correct.

3.5 Granularity and bounded fractal diagnostics

Granularity is used to describe how the town changes in resolution across scales. This includes the shift from territorial landscape to urban block, from block to parcel, from parcel to building, and from street hierarchy to local access. These shifts are evaluated through grain, spacing, clustering, and aggregation.

Fractal diagnostics are used only after the granular reading has identified candidate relations that may display scaling or self-similar behaviour. The diagnostic layer tests whether certain patterns repeat, transform, or cluster across scale ranges. Fractal dimension is treated as a calibration aid for spatial complexity and not as an independent measure of urban quality. A high or low value does not automatically validate a design scenario. It only helps interpret how intricacy and occupation are distributed across the mapped field.

3.6 Translation into morphological grammar

The extracted relations are translated into a morphological grammar composed of four rule families. Point rules define nodal hierarchy and programmatic intensity. Line rules define connectivity, movement continuation, and edge relation. Grid rules define base organizational matrices, orientation, and proportional fields. Seed rules define local growth structures that can be expanded, repeated, rotated, or combined.

The grammar is not a fixed design. It is a set of operations. The same grammar can produce different outcomes depending on the priority assigned to continuity, accessibility, density, public space, or functional mix. This is important because a compatible planning method should not produce only one future. It should produce a controlled field of alternatives that remain tied to the same inherited structure.

3.7 Computational execution

The grammar is implemented in Rhino and Grasshopper. Base grids and proportional fields are aligned with the town's existing orientations and landscape conditions. Selected grids are rotated, scaled, and overlapped to locate point concentrations and latent connective structures. These point concentrations are interpreted as possible hierarchy: civic nodes,

green nodes, mixed-use anchors, or transition points between old and new fabric.

Line structures are then generated from the point hierarchy and tested against the existing network. The model does not deliver an optimized masterplan. It produces a set of spatial frameworks in which the same morphological rules can be weighted differently. This allows the design process to compare alternatives rather than defend a single predetermined result.

3.8 Scenario construction

Three scenarios are constructed from the same rule base. Scenario A, continuity-first growth, prioritizes extension of inherited hierarchy and grain with minimal disruption. Scenario B, accessibility-first growth, prioritizes redistribution of public, green, and civic nodes to improve reach across the settlement. Scenario C, balanced mixed-use expansion, combines continuity, functional diversification, controlled densification, and public-space distribution.

Using the same grammar for all three scenarios makes the comparison more meaningful. The difference among scenarios is not the source of the rules, but the weighting of priorities. This allows the study to test whether the method can support different planning choices while preserving morphological compatibility.

3.9 Evaluation criteria

The scenarios are evaluated through four criteria. Morphological continuity assesses how well inherited hierarchy, grain, landscape relation, and settlement logic are preserved or extended. Connectivity assesses whether the generated network strengthens movement structure without producing isolated fragments. Accessibility assesses the reach and distribution of public, green, and mixed-use functions. Functional balance assesses the relationship among housing, collective uses, commercial activities, civic functions, and green spaces.

These criteria are spatial proxies for sustainability. They do not measure energy performance, carbon impact, or environmental comfort. They evaluate whether the spatial structure of growth supports walkable access, coherent movement, functional distribution, and continuity of urban fabric.

3.10 Methodological limits

The method has three limits. First, extracting an urban blueprint involves interpretation; another analyst might select or weight the relations differently. Second, fractal diagnostics are bounded and cannot replace morphological analysis. Third, sustainability is addressed through spatial performance, not through full environmental simulation. These limits define the scope of the paper and prevent the method from claiming more than it can demonstrate.

4. RESULTS AND DISCUSSIONS

4.1 Reading Erseke's inherited spatial logic

The analysis identifies Erseke as a settlement with a clear inherited spatial order. At the

network level, the town is organized by a branching and partly radial connective logic rather than by an orthogonal grid. Primary routes structure access and orientation, while secondary and local streets form a finer layer of distribution. The hierarchy is visible enough to guide expansion, but vulnerable to disruption if new growth is imposed without reference to existing movement patterns.

At the public and functional level, activity is not evenly distributed. Civic, commercial, and public- space functions concentrate around recognizable nodes and corridors. This produces a readable structure, but it also creates areas where access to collective functions can be improved. At the building-grain level, parcel rhythm and built density show enough consistency to define a recognizable urban fabric. Changes in grain are present, but they occur as transitions rather than random breaks.

The landscape relation is also significant. Erseke's built fabric is not detached from its topographic and open-space context. Edges, views, green spaces, and the surrounding terrain influence how the town can expand. Growth scenarios that ignore these relations risk producing spatial rupture even if they preserve street alignment.

4.2 Granularity, hierarchy, and bounded scaling

The granular reading clarifies which aspects of the town should be understood as differences of resolution rather than as fractal properties. The shift from main routes to local streets is primarily a hierarchy of movement. The shift from large blocks to smaller parcels is a question of grain. The distribution of public nodes is a question of clustering and accessibility. These elements are multi- scalar, but they are not automatically fractal.

Bounded fractal diagnostics are most relevant where repeating tendencies and proportional relations appear across different layers. For example, branching network tendencies, nested node structures, and repeated transitions between built density and open space can be tested as scaling phenomena. Where such evidence is weak, the analysis remains within the vocabulary of granularity and morphology. This distinction improves conceptual clarity and makes the method easier to defend academically.

4.3 Translation into a generative system

The translation from reading to generation is the main methodological step. The morphological blueprint is converted into a grammar composed of points, lines, grids, proportional fields, and seeds. Points define possible centres of intensity. Lines define connection, continuation, and movement. Grids define orientation and proportional structure without imposing a rigid external order. Seeds define local growth units that can be adjusted according to site conditions.

In computational terms, overlapping and rotated fields generate differentiated point concentrations. These are not treated as automatic design answers. They are interpreted through the existing hierarchy, landscape relation, and functional needs of the town. The resulting grammar acts as a controlled design scaffold: it limits arbitrary expansion while still

allowing multiple futures to be generated.

4.4 Scenario generation and spatial outcomes

Scenario A, continuity-first growth, extends the inherited movement structure and protects the existing grain. It performs strongly in morphological continuity because new growth follows recognizable alignments, edge conditions, and hierarchical relations. Its limitation is that it does not sufficiently redistribute public and green functions toward underserved areas.

Scenario B, accessibility-first growth, reorganizes the public-space and green-space system through a more distributed nodal structure. It improves reach to civic and open-space functions and creates a stronger network of public anchors. Its limitation is that some new connections create tension with the inherited grain and require careful design to avoid fragmentation.

Scenario C, balanced mixed-use expansion, combines continuity, accessibility, functional diversification, and controlled densification. It does not produce the highest performance in every single criterion, but it performs consistently across all four. Housing, public functions, commercial activity, and green infrastructure are distributed in a way that remains connected to the inherited town while increasing programmatic intensity.

Table 2. Comparative reading of the three scenarios

Scenario	Morphological continuity	Connectivity	Accessibility	Functional balance
A. Continuity-first growth	Strong. Extends inherited hierarchy and grain.	Medium to strong. Follows existing movement logic.	Medium. Limited redistribution of public and green functions.	Medium. Conservative growth limits programmatic diversity.
B. Accessibility-first growth	Medium. Some friction with inherited grain.	Strong. Creates new links and nodal reach.	Strong. Improves access to civic and green nodes.	Medium to strong. Depends on land-use calibration.
C. Balanced mixed-use expansion	Strong. Maintains main inherited relations.	Strong. Reinforces network without major rupture.	Strong. Distributes public, green, and mixed-use anchors.	Strong. Combines housing, collective uses, commerce, and open space.

4.5 Comparative discussion of performance

The comparative reading shows that the value of the method is not the identification of a single best form. Its value is the capacity to generate different alternatives from the same inherited logic. Scenario A demonstrates how continuity can be protected. Scenario B demonstrates how accessibility can be improved. Scenario C demonstrates how continuity and functional performance can be combined through balanced weighting.

The results also show why methodological caution is necessary. The scenarios cannot be justified by a fractal value alone. Their performance depends on how network continuity, grain, access, public- space distribution, and land-use balance interact. Fractal diagnostics help identify scaling tendencies and structural hierarchy, but the design argument is ultimately morphological and spatial- performance-based.

This position aligns with the literature. Tannier et al. show that fractal scenarios can improve some forms of accessibility while producing trade-offs in others [15]. Similarly, the Erseke scenarios suggest that spatial structure must be evaluated through multiple criteria. A scenario can be coherent morphologically and still weak in functional distribution. Another can improve access while creating tension with inherited grain. Compatible growth requires the balancing of these criteria rather than the maximization of one.

4.6 Discussion in relation to the research questions

The first research question asked which morphological relations define Erseke's urban blueprint. The answer is a combination of branching network hierarchy, public and functional clustering, building grain, landscape edges, and transitions between dense and open structures. These relations form the basic structure that any compatible growth scenario should address.

The second research question asked how these relations can be translated into rules. The method translates them into point, line, grid, and seed rules. These rules make the reading operational. They allow morphological observations to become design instructions that can be tested, adjusted, and recombined.

The third research question asked whether the generated scenarios perform better than unguided expansion. Within the limits of spatial proxy evaluation, the scenarios show stronger coherence than an externally imposed or arbitrary growth pattern. They maintain a relation to inherited hierarchy, improve or preserve connectivity, and make functional distribution explicit. The results therefore support the method as a planning framework for compatible transformation.

5. CONCLUSIONS AND RECOMMENDATIONS

This paper developed a multi-scalar morphological method for sustainable transformation in Erseke, Albania. The study began from the problem of compatible growth: how a town can accept new

programs, densities, and spatial demands without breaking the structure that makes it legible and functional. The answer proposed here is not formal imitation, but rule-based continuity.

The analysis showed that Erseke has a recognizable urban blueprint composed of network hierarchy, public-space distribution, building grain, landscape relation, and functional clustering. These relations can be read through urban morphology and granularity. Bounded fractal diagnostics can add value where scaling, hierarchy, or self-similar tendencies are observable, but they should not replace the morphological reading or be used as a universal explanation.

The main contribution is the translation of the reading into a morphological grammar. By converting observed relations into point, line, grid, and seed rules, the method creates a bridge between analysis and design. The resulting scenarios are not copies of the existing

town. They are variations generated from its spatial logic. This allows growth to be structured from within the inherited system while still allowing new functional and spatial possibilities.

The scenario comparison suggests that compatible transformation depends on balancing four criteria: morphological continuity, connectivity, accessibility, and functional balance. Continuity-first growth protects inherited structure but may underperform in functional redistribution. Accessibility-first growth improves public reach but can create tension with inherited grain. Balanced mixed-use expansion performs most consistently across the criteria because it combines continuity with programmatic and public-space distribution.

The research has clear limits. The extraction of an urban blueprint includes interpretation. Fractal diagnostics are partial and bounded. Sustainability is addressed through spatial proxies rather than full environmental simulation. Future research should therefore add quantitative network analysis, comparative testing against non-rule-based expansion models, and environmental performance evaluation. The framework could also be tested in other Albanian towns to understand whether similar methods can support growth in settlements with different histories, landscapes, and urban grains.

The broader conclusion is that small-town growth does not need to be treated as a choice between preservation and rupture. A carefully interpreted morphological structure can become a generative framework. In Erseke, compatible growth can emerge as controlled variation within inherited spatial logic.

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