# Eco-systemic restoration: a model community at Salton Sea, California, USA

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## Abstract

Two years ago when we entered RIBA's competition on sustainability, we were given the option of picking any site in the world to address issues of sustainability as it relates to architecture. As we tried to find the right site, we understood early on that the issue of sustainability was far more complex in scope than a single building or neighborhood, but necessitated the approach of a global initiative.

Our perspective on the competition was that it involved more than architecture, and saw it as a prime opportunity to gain research testing our theories on a "dead site", as well as exploring how these findings might be applicable to other sites in the world. Taking a risk, we chose Salton Sea (in Southern California, USA), and strove to go beyond the scripted parameters of the competition to really understand the problem as a whole instead of a single solution.

Our team consisted not just of designers and architects, but of an experimental farmer, a biologist, engineers, planners, and a scientist all of whom have a similar passion towards global sustainability in their own profession. Incidentally, not only was our approach global, but our team was global as well. The following excerpts relate the intrinsic pertinence of our competition research to the theme of the conference.

The paper will focus on the illustration of the model community as case study of not only sustainable architecture but as example of a biomimetic approach to design inspired by natural eco-systems.

# 1. Introduction

The traditional model of growth is a 'zero sum' game with discrete land use typologies, where growth in one can only happen at the expense of another. Our primary motivation in developing a systemic community is to provide a paradigm shift in accommodating growth – by capturing and integrating systems that are cyclical in nature and time, with each cycle rejuvenating and healing the surrounding ecology rather than eroding it over time.

The approach is holistic, in that we consider interrelationships between all processes fundamental to sustaining life and preserving nature – water and energy cycles, agriculture and seasonality, production and the exchange economy, as well as social needs of a multi-generational community. Our strategy, however, is hinged on the notion of restoring scarred landscapes, making them givers of life, and enhancing their integration into the surrounding ecology and life.

# 2. The site

Our project site is located on the northern bank of the Salton Sea (figure 1). Contrary to its name, the Salton Sea is the largest lake in California, USA and is located approximately 130 miles southeast of Downtown Los Angeles, and about 35 miles southeast of Palm Springs. It is 35 miles by 15 miles across with an average depth of 29.9 feet and 51 feet at its deepest, and has over 100 miles of shoreline; it is located 228 feet below sea level. It is essentially a basin that had filled up with occasional flooding of the Colorado River, but now gets constantly replenished by the agricultural runoff from the area surrounding it. The lack of any outlets makes it a very unstable ecosystem with rising salinity and increasing toxicity (figure 2).

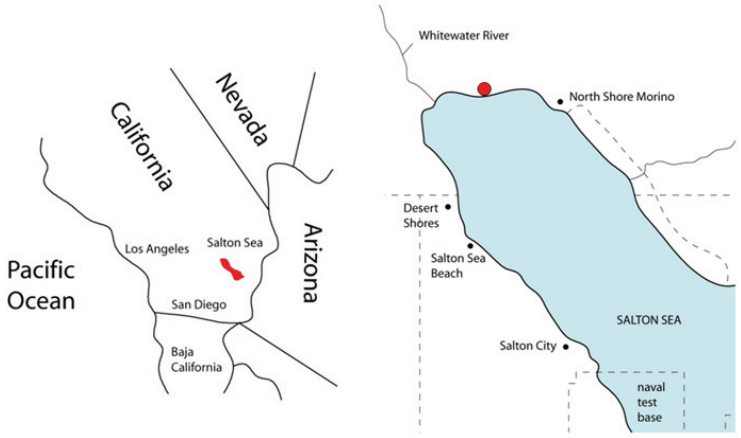



Figure 1: Map of Salton Sea




Figure 2: Salton Sea, aquatic eco-systems

## 3. Strategy of occupation

The process of healing is emphasized by a symbiotic relationship between the community and the natural environment in and around Salton Sea. Key objectives are to reduce the Sea's salinity levels, provide alternative models of agriculture, and maintain the ecosystem it supports. We have incorporated a number of strategies that emphasize this symbiotic relationship such as biofuel producing algae farms, which have a dual role as an energy source as well as an environmental cleanser. Nature sensitive agricultural practices and crop types provide food provide a food source and economic benefits to the community while eliminating chemical runoffs into the Sea. Passive energy strategies such as the heat sink and solar ponds use the Sea's mass and salinity to the advantage of the community.

The 3200 acres of land considered in this project is part of an ecological restoration effort to heal the site and create life-sustaining conditions, appropriate for the desert environment. The chosen site is already occupied and developed. We are re-occupying it with the smallest possible building footprint, creating clusters of buildings organized around public spaces and productive areas, using nature as our mentor (figure 3). The goal is to create a community that does have a net 0 impact on emission, waste, energy and water.

We feel that our approach can be a model in the adjacent desert communities that have practiced unsustainable living and agriculture for more than 50 years; and possibly, over the next 25 years Salton Sea's North Bank could be renewed by:

a) Rehabilitation of agricultural land, and conversion to "slow" agriculture.

b) "Zero Impact" growth with additional housing as an expansion to our

community or in creation of similar ones in the region.

c) Clean production and creative factories attracting people to the area and incubating innovative environment sensitive industries.

d) Increasing 0 impact energy production as conventional agricultural uses are replaced by the suggested agricultural practices and crops.




Figure 3: Site plan of a 1000 people model community

## 4. Community design

We think that the process of architecture is a plan to manage a built object's life, and we address architecture as a process for construction as well as dismantling.

We re-occupy the site and inject infrastructure to support production as we feel that the picture of a sustainable community is incomplete if all aspects of the community living not taken into account. Besides "dwelling", fulfilling a community's productivity and economic needs, and social needs, within a sustainable framework is of utmost importance.

The land is reconfigured with uses within its carrying capacity, in a way that it is engaged and not exploited. The residential component includes a variety of unit sizes and types allowing a multigenerational community to flourish (figure 4). Several communal spaces are linked to the residential dwellings, and others to the entire community allowing for multiple public activities. Each design element serves multiple community objectives - similar to any living organism where all of the specialized parts collaborate for communal well being.



Figure 4: Cluster of model community

The community's current capacity is for 1000 people as designed, but it allows for future growth, in response to local and regional pressures.

Solar energy, water conservation strategies, non-emissive materials and earth embankments are introduced as design considerations, to reduce the energy input of the inhabitable space, and provide energy conservation in residential housing (figures 5-8).

The earth houses and water towers are characterized by their thermal stability and energy efficiency. Several passive strategies, integrated with low consuming active systems described below are implemented:

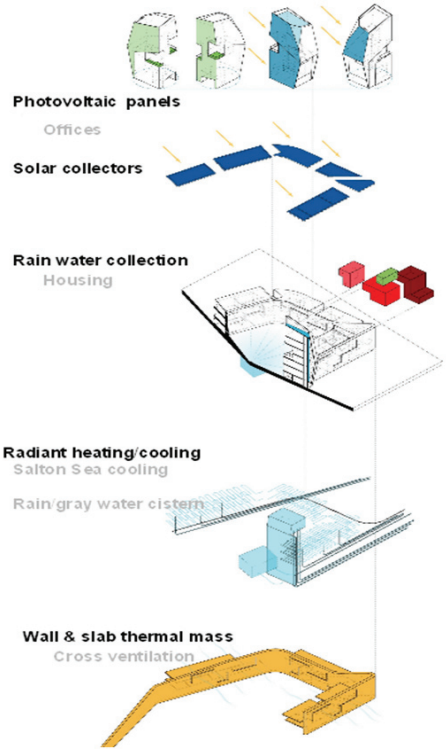



Figure 5: Building systems breakdown

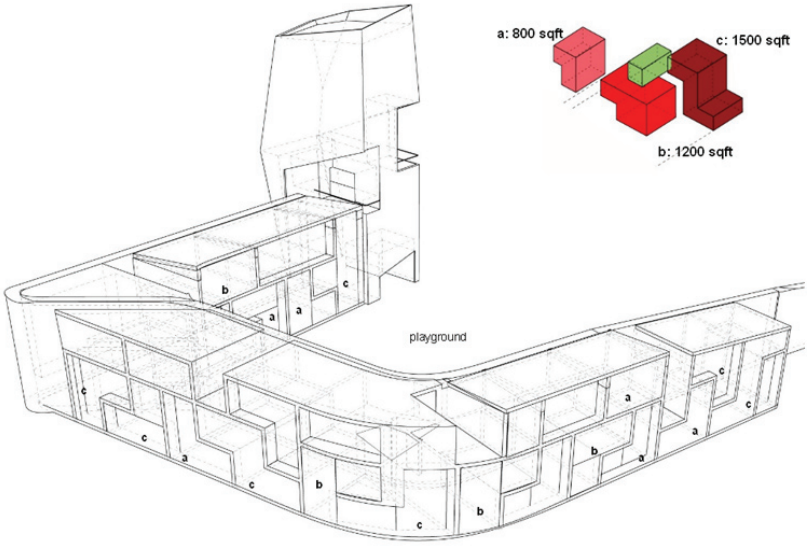



Figure 6: Housing units variation and office tower

## 5. Passive systems

The key to reducing building energy consumption is to take advantage of

the benefits that can be provided by the sites natural environment. Creating a synergy between the systems, building and the site recreates the potential to eliminate active systems in some cases and significantly reduce the size of active systems in others.

The key to the Salton Sea climate is to minimize the impact of the high summer temperatures and solar heat gains, take advantage of natural wind currents, and harness what rain is available on the site (what about harnessing solar heat?). Fortunately for the Salton Sea, there is limited humidity to be controlled so natural ventilation can be utilized during most of the year.

The narrow profile of the building is conducive to creating cross flow natural ventilation during temperate days, and cool evenings and nights (figure 7). On the single buried levels, a high space provides for high level openings to create a cross flow of air providing natural ventilation to all levels.

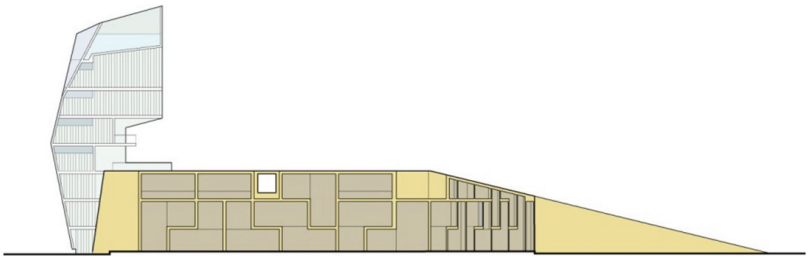


Figure 7: Elevation of housing unit and office tower

The passive systems of the building buffer the interior from the extreme summer heat. This is accomplished by adding additional mass to the building in the form of earth walls, and water columns. The mass walls on the lower portion of the building protect the south orientation, and then dives through the building to protect the west orientation where necessary. The mass on the south and west sides provide a shield to absorb heat to be rejected in the cooler evenings. This strategy also works in cold climates where the heat from the day is absorbed and rejected to the interiors during the colder nights. The towers are wrapped with a skin of water, both recycled grey water, and rejected water from the cooling system for usage inside the buildings. Grey water captured from rain fall, showers, and sinks to be used later for irrigation (figure 9), flushing toilets and washing machines. Cooling water stored in the towers is sprayed across the roof tops and cooled using night sky radiation to reduce the temperature. The mass from the water serves the same purpose as the rammed earth walls to absorb heat to be reject to the outside during cooler periods.

Openings on the south and west orientations are limited to reduce direct solar radiation during peak summer months, while the openings on the north and

east elevations provide diffuse natural daylight reducing the need for artificial lighting. Glazing will provide solar protection while still allowing sufficient levels of daylight to enter into the space.

While passive strategies gain much to reduce the heat gain (or heat loss) into the space, in all but the most temperate of climates active cooling or heating is required to maintain the space temperatures within acceptable comfort levels.

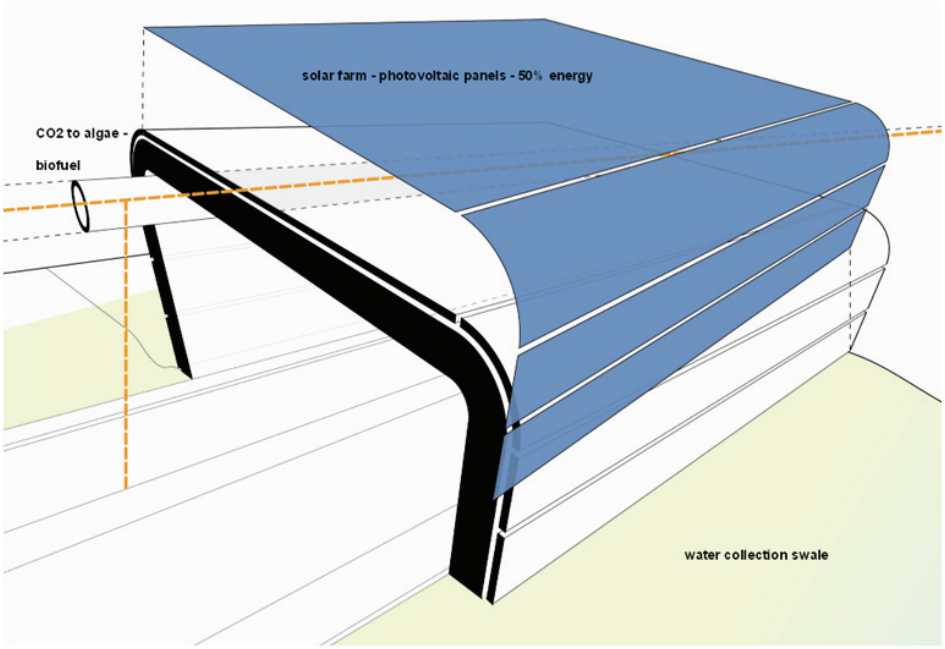



Figure 8: $CO_2$ collection and Solar Farm

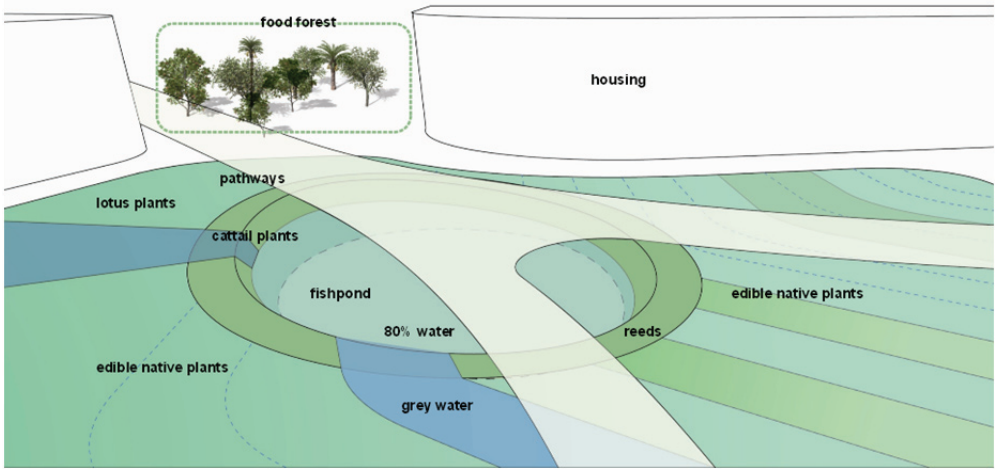



Figure 9: Community and grey water treatment garden

## 6. Active and generative systems

While water is an increasingly scarce resource around the world, the use of hydronic systems to directly provide cooling to the space are significantly

more efficient in reducing space conditioning systems while at the same time improve the quality of occupant comfort. Hydronic radiant systems are located in the building slabs as well as portions of the thermal mass wall. The radiant systems located in the slabs are exposed not only to the spaces above, but also those below improving the overall efficiency of the system. The radiant tubes located in the mass wall not only serve to cool the space, but also provide a means of cooling the mass at night via night sky radiation.

The central heating and cooling system utilizes a system of roof-mounted tubes to absorb solar radiation during the day to generate hot water, and uses the cold night sky to reject heat at night.

The central cooling system provides cooled water to the radiant systems via a dual service night sky radiation system, and the heat reservoir provided by the Salton Sea. Exposing water to the very low temperature of the night sky cools the water to a temperature that is usable by the radiant floor system. For this particular location, the size of the Salton Sea serves as a sufficiently large heat sink to reject heat without endangering the sea's ecosystem.

The central heating system operates off of gas extracted from the algae farms to operate boilers which circulate water through the building. To supplement heating demands, the solar collectors used for night sky radiation are used during the day to meet the demands of domestic hot water systems.

All energy needed by the community will be generated within the community. Solar and wind technologies will provide all required electricity for residential consumption. The residential energy system design includes significant over capacity. The extra capacity will be used to charge emergency batteries. The extra energy will be sold into the grid to export emissions free electricity for consumption outside the community.

## 7.The systemic community

The site in Salton Sea transcends its limits, acting as a geographical attractor of regional interest. The existing highway 111, connects manufacturing centers along the Mexican border not only to the Los Angeles region but also to a transportation network serving the entire United States. This existing infrastructure is considered to be a means of regional access for all visitors. An inter-modal parking lot will allow the exchange to a non-emittive transportation system to travel within the community.

The new community will integrate several uses (figure 10): from the creative offices located in the towers, an eco-lodge to support the Salton Sea lost

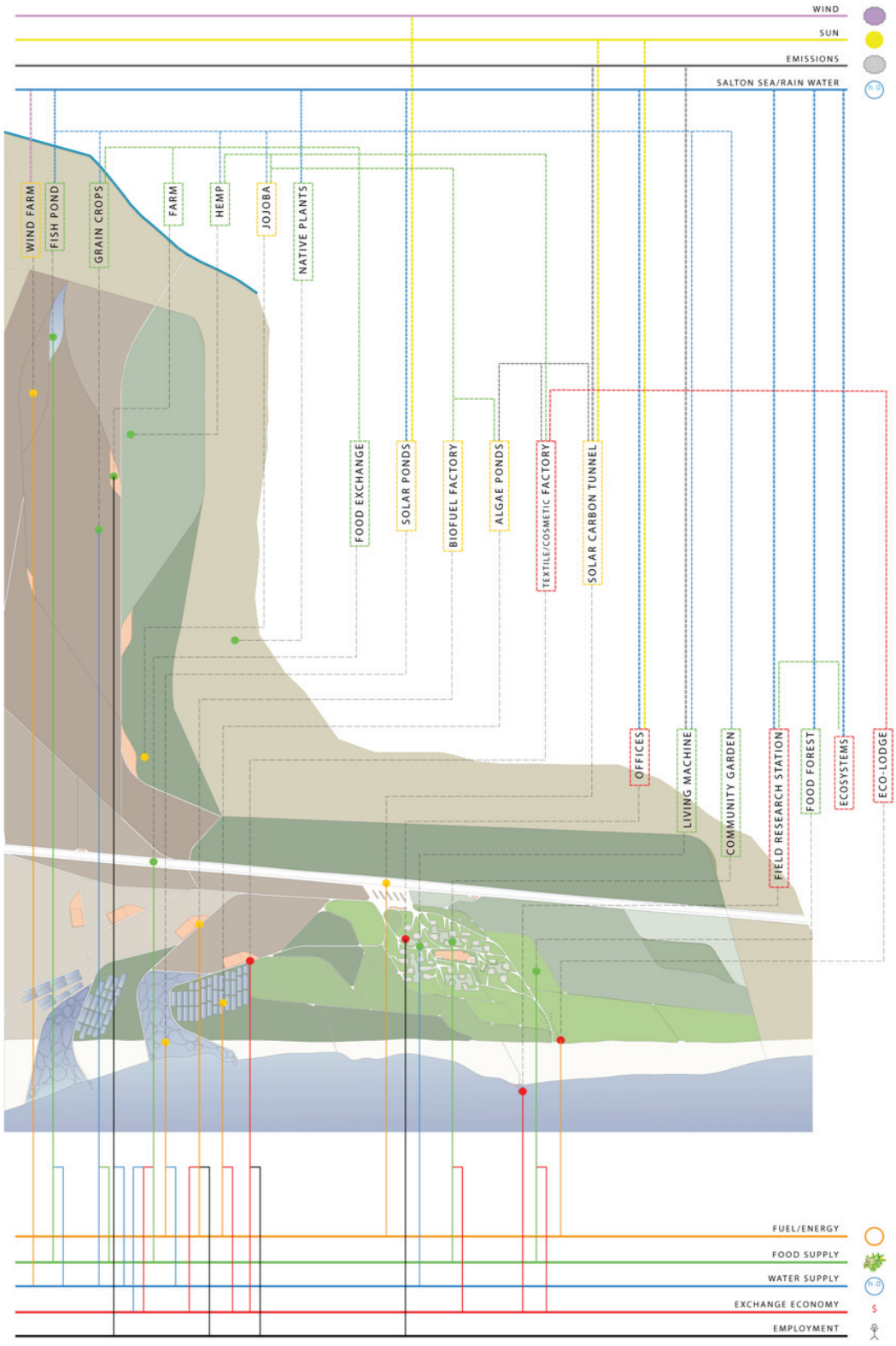



Figure 10: Integrated System

tourist nature, to the research field station. The town center includes services integral to community life: a school, sport center, multipurpose open theater,

markets and public offices. Growth over time will integrate additional uses - avoiding mono-functionality- and additional visitors.

The beach park connects to the existing state park south of our site, protecting the natural lake edge. The food forest provides a food source as well as a recreational area of the community.

The community is organized in 6 clusters, which rotate around a community garden. Each individual building has a central playground to allow children and adults to meet, interact and play.

The office towers are the center of activities and provide a vivid exchanging environment, which contribute to create a higher intensity of social relations.

Eliminating the commuting to the not far Los Angeles and San Diego areas while providing a rich and vibrant cultural end entrepreneurial environment is the aim of this community based on innovation and research inspired by nature.

## 8 .Conclusions

The paper illustrates how our individual ecological footprint is much larger then we are aware off. The project designs a community not only composed of the housing and the public spaces around it, but that incorporates all the other elements necessary to feed, employ and create an exchange economy with the surrounding communities. This interconnectivity does not produce waste, but creates a chain of usage. This phenomenon although common in nature is still a novelty in architecture and exploring its potentials has been the team's challenge.

In Working with constant feed back loops nature has learned how to adapt and survive. This community similarly learns and evolves based on the interaction between all entities. The farmlands, clean factories, algae farms, solar ponds, are a productive eco-system that uses land, air, sun, and water as fundamental elements of life without exploiting but allowing the natural cycles to function in balance. With this process the scarred land of Salton Sea will have a chance to produce a new healthy life for all its inhabitants: flora, fauna and human kind and finally synchronize with nature's rhythm of life.

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# إعادة احياء نظام بيئي:
# مجتمع نموذجي في سالتون، كاليفورنيا بالولايات المتحدة

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**الملخص:**

عندما شاركنا في مسابقة المعهد الملكي للمعماريين البريطانيين (RIBA) في موضوع الاستدامة منذ عامين، كان لنا خيار اختيار اي موقع في العالم لمناقشة قضايا الاستدامة وعلاقتها بالعمارة. وخلال بحثنا عن الموقع المناسب، وصلنا لقناعة منذ البداية بان قضية الاستدامة اكثر تعقيدا في مجالها من المبنى الواحد أو الحي الواحد ويلزم لها اتخاذ منهجية متعددة الجوانب. بالتالي كان فهمنا للمسابقة انها تشمل اكثر من مجرد العمارة واتخذناها وسيلة للبحث والتحقق من نظرياتنا حول "الموقع الميت" (dead site) في اذا ما كانت نتائج بحثنا تنطبق على المواقع الاخرى في العالم. وكان اختيارنا لسلتون سي بجنوب كاليفورنيا بالولايات المتحدة فيه نوع من المغامرة، وبذلنا جهدنا بالتطلع الى قضايا تفوق الاطار المحدد للمسابقة حتى يكون لدينا الفهم الكامل بمجمل مسألة الاستدامة بدلا عن التركيز على حل واحد.

وقد شمل فريقنا بالاضافة الى المصممين والمعماريين على مزارع يمارس التجارب وعلى متخصصين في علم الاحياء والهندسة والتخطيط والعلوم، وكل منهم له شغف مماثل بقضايا الاستدامة العامة في مجاله. وبالتالي لم تكن فقط منهجيتنا شاملة بل الفريق ايضا. ومقتطفات البحث التالية توضح العلاقة بين طبيعة بحثنا للمسابقة وموضوع المؤتمر الراهن. وسيركز البحث على توضيح المجتمع النموذجي كحالة دراسية ليس فقط للعمارة المستدامة بل ايضا كمثال لاتجاه دراسة البيئة الحيوية المستوطنة (biomimetic) للتصميم المتوافق مع الانظمة البيئية الطبيعية (natural eco-systems).

# Climax in the Human Built Environment

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## Abstract

In ecology, climax community is a biological community of plants and animals which has reached a steady state. These types of environmental equilibria are sometimes called mature or old-growth communities. The issue is, whether the notion of climax, or environmental equilibrium, can also act as a model for the traditional, human built environment that contain the four elements: people, their social culture, their buildings, and the biological community of plants and animals they shape and care. The objective is to answer the questions, whether and how the traditional, human built environment can reach the state of equilibrium. The next question to answer is, which elements of the climax environment can be applied to create modern settlement patterns that meet the needs of urban environmental sustainability.

Methodology. The three different types of the human built environment that used to exist until the 1950s in north-eastern Poland and the southern part of Byelorussia, have been analyzed and compared. The first one was a traditional swamp village in Polesie marshland, southern Byelorussia, the second one was an old, regular row-shaped village in the east part of Podlasie region, north-eastern Poland, the third one was a specific settlement pattern that included the extremely fine-grained, chequered field patchwork, on areas settled by poor gentry in Poland. Their features, similarities and differences are listed, and their role in reaching the climax state, are explained.

Results. The main finding is that the common and indispensable feature of those environments used to be the subordination of all aspects of space and life, to the intangible, social culture, i.e. to the system of habits and beliefs. The resulted system was stable enough to make the environment balanced, immutable and permanent. It opposed changes.

None of these built environments was spatially and economically efficient; none of them could meet the contemporary demands. None of them could be accepted nowadays. But the strength and complexity of their intangible folk cultures, were the reasons these cultures lasted unchanged until the half of the 20th century.

Conclusions. Nowadays, we have the chance to develop the contemporary social culture on the basis of our knowledge of indigenous, local folk cultures. The system of dependencies between social cultures and the corresponding built environments, is believed to consolidate space, maintaining its elements balanced, immutable and permanent. It provides sustainability.

While supporting cultural and technological development, the mechanisms which will oppose the negative changes, should be created and supported. Our study has proved that these mechanisms are most efficient if based on the system of habits, beliefs and feasts. They should tax the resources of intangible culture.

## 1. Background

The twentieth century has brought the change of the development paradigm from the initial one, based on the model of rapid growth, to the paradigm of sustainable existence and harmony with energy, resources and the natural environment. The new paradigm entails the need for designing new patterns of human settlement and new ways of social and private life. This implies the question about where the likely models or patterns can be found or how they should be developed. Among many answers and models proposed, none has been absolutely satisfactory and versatile. Therefore, research into the sustainability issue can still be creative and fertile.

## 2. Objectives

The final objective of our study is to explore the tenable theoretical models of sustainable human milieu in order to implement them in practice and to apply them as exemplars. Trying to contribute to this objective, we neither aspire to complete such a vast undertaking, nor we claim our work utterly comprehensive. But we believe our contribution has some scientific and practical merit as a step towards the achievement of the target objective in the future.

Apart of the primary target objective, the more precise and definite aims can be defined. The first one is to recognize the factors of spatial and cultural durability of human milieu, and to answer the following questions: Which features are essential to achieve such durability and constancy? What provides the permanence of human environment and all its main components, like nature, culture and architectural space? What fixes and preserves settlement and agricultural systems, and what maintains them unchanged for amazingly long periods? Thus, the aim is to answer the questions, *how the traditional human built environment can reach the state of equilibrium, or climax*.

In ecology, *climax community* is a biological community of plants and animals which has reached a steady state. These types of environmental equilibria are sometimes called mature or old-growth communities. The issue is, whether the notion of *climax*, or *environmental equilibrium*, can also act as a model for the traditional, human built environment that contain the four elements: people, their social culture, their buildings, and the biological community of plants and animals they shape and care. Therefore, as it has been said, the objective is to answer the questions, whether and how the traditional, human built environment can reach the climax state.

The second resultant working aim is to answer the question on *which elements of the "climax environments" can be applied to create modern settlement*

*patterns that meet the needs of urban environmental sustainability*. Or in other words, how to plan, design, develop and support sustainable, human "climax environment" with all its essential elements: technology, culture and nature.

## 3. Methodology

To achieve the objectives, three different exemplary types of the human built environment have been analyzed and compared. The types used to exist until the 1950s in north-eastern Poland and the southern part of Byelorussia. The first one was a traditional swamp village in the Polesie marshland, the southern part of Byelorussia. The second one was an old, regular row-shaped village in the eastern part of the Podlasie region, which is in the north-eastern part of Poland. The third one was a specific *open settlement pattern* that included the extremely fine-grained chequered field patchwork and was developed on areas settled by poor *petty gentry* in the Podlasie region.

The features, similarities and differences of the exemplary settlement systems and their built environments are listed, and their role in reaching the climax state, are explained. The analysis and reasoning have been made on the basis of the 19th and 20th century literature citations which reveal the past stable state of the human built environment in the analysed regions. The complementary study of the present relics of past vernacular space and open landscapes was also done.

The terminology should be also explained, especially concerning the meaning of the notions: "the environment" and "environmental". *The environment* may refer to, inter alia, *the built environment* – "man-made surroundings that provide the setting for human activity" (Wikipedia), or *social environment,* i.e. the culture that one was educated and lives in, or *natural environment*, i.e. all living and non-living things occurring naturally in a territory. All these notions together meet with the most general definition of *the environment* as "circumstances, objects, or conditions by which a human, animal, plant or object is surrounded" (Webster's Online Dictionary). This definition is applied in the paper as the most universal and encompassing not only physical surroundings, but also intangible realms (culture, recollection of posterity, etc.) and the whole sphere of their mutual dependencies. Therefore, while *the human built environment* (*hbe*) is the key notion in the paper in order to stress the topic of tangible human influence on material millieu, it should be taken into account that *hbe* tangible realms depend on wider, deeper and more complex intangible milieu, being influenced by traditional beliefs and other relevant manifestations of social culture, and mutually connected with natural living ecosystem.

## 4. Theoretical Background

The methodological framework for studies on sustainability issues related to the built environment as both disciplinary and interdisciplinary in an epistemological sense, has been developed only recently, as stated by Paul Chynoweth who "noted the lack of a recognized theoretical disciplinary base for the Built Environment subject area" (Chynoweth, 2006). This statement remains also true in relation to the general idea of the paper, i.e. whether the notion of *climax*, or *environmental equilibrium*, can act as a model for traditional, human built environments that contain the four elements: people, their social culture, their buildings, and the biological community of plants and animals; and secondly, whether this model can be applicable to assess the modern examples of complex built environments, to achieve their long-term durability and immutability.

Whilst not discussing the range of atomised studies related to the field of sustainability here, the authors define the basic terms as follows:

- the notion of *sustainability* is meant as "the capacity to endure";

- the notion of *climax* or *equilibrium* is implicitly applied in the paper to "the human built environment which has reached a steady state".

- the notion of *human built environment* has been described above and is meant as "tangible objects and related intangible circumstances by which a human is surrounded, with special focus on architectural, or built objects".

These notions are applied to the analyses of the single exemplary cases such as the territories of Polesie and Podlasie. The cases have been well studied by scholars of various disciplines. The characteristic features of those regions have been recognized, including the following key factors for the immutability or, on the opposite, for the changeability of their built milieu:

- *vernacular architecture* of Polesie and Podlasie was studied by a number of Polish, Byelorussian and Russian researchers; amongst them there were scholars who started their studies in the nineteenth century (Jelenska, 1892); others were proceeding onsite research until the 1960s (Czajkowski, 1961); the mainstream of onsite research was done between 1890 and 1960, resulting with the conviction of the utmost conservatism of the built environment of Podlasie and Polesie;

- *social aspects of folk life* in Polesie and Podlasie were studied concurrently with architectural studies since about 1860s (Kolberg, 1968; Jelenska; 1892) and resulted in recognising, *inter alia*, the social traditions of communal work and pre-capitalist communal country life, as stated by Jerzy Tomaszewski, who wrote: "[The eastern provinces of Poland] were known as having a strong

tradition of pre-capitalist social relations. The traditional social differencies between small gentry (*szlachta zagrodowa*) and peasants were maintained in spite of the constitutional equality of civil rights for all the citizens, contrary to the real economic situation of villagers" (Tomaszewski, 2001, p.343).

Historical, environmental and economic analyses were also done in the past, as well as the exhaustive military studies on the regions, done in the inter-war period and believed to be really interdisciplinary (Niezbrzycki, 1930). The mainstream of those studies and research works were published in Polish and Russian, and for this reason most of them were not known to foreign scholars.

## 5. A Case Study: A Traditional Swamp Village in Polesie

Polesie is one of the largest European swampy areas, located along the Byelorussia and Ukraine borderland, and spread from western Russia to eastern Poland. Before the WWII this territory with pre-capitalist, barter economy used to be sparsely populated and backward.

The studied case is Komarowicze, a village in the Mozyr district in the central part of Polesie. The analysis is based on the 19-th century description of the village, written by Emma Jelenska and published in 1892. The reason for this choice was the fact that the described village was typical for that territory and many of its characteristic features continued to be unchanged for hundreds of years. In a number of other nearby villages they lasted until about the 1950s.

What did Mrs. Jelenska write about Komarowicze? Firstly, "its roads are so bad, covered with sand in summer and muddy in spring and autumn, that villagers are isolated from strangers and cut off from external influences. They live for themselves exclusively and meet their close neighbours only. They just ignore the exterior. Thus, the mentality of a local peasant is shaped by its closest surroundings (...), so he perceives the rest of the world as sort of distant miraculous fairyland. (...) There are lots of peasants who never ventured to explore their surroundings and haven't travelled farther that half a dozen miles away from their place" (Jelenska, 1892, p.2-5). Therefore the first distinguishing mark, *isolation,* can be defined.

Jelenska continues: "*Poleszuk* [a peasant from *Polesie*] builds his house by his own, from the groundwork to the roof, with exception of a stove and a chimney (...); one produces all benches, tables and beds for himself, as well as all his personal utensils and primitive farm equipment" (*ibid.*, p.8). Consequently two following distinguishing marks can be drawn: personal self-sufficiency and the autarky of each village based on so called *barter economy*.

"There are a few peasants who amassed a fortune of about ten thousand

roubles, but one could hardly guess about their fortunes observing their circs and lifestyle. (...) Such men of substance neither changed their time-honoured traditional costume nor they rearranged their houses; they did not alter anything in their lives and even they did not buy more land" (*ibid.*). The account suggests another unique feature: the superiority of social traditions over individual lifestyles. In fact, tradition and social culture used to be sacred to a *Poleszuk*.

Finally, Jelenska listed eight types of small traditional farm buildings to be found on each farm. She also wrote: "There are no carpenters, as each peasant builds his own house (...) The only exception is a stove which cannot be built without help of *a mular,* i.e. a homespun stove fitter from the neighbourhood" (*ibid*., p.23). All building methods and built objects followed strong, old, local building traditions, sort of the ancestral canon of craft and building principles. The local *folk building culture* was fundamental as it preserved the oldest building technology unchanged. Actually, *the fixed building tradition* or *folk building culture* was the characteristic feature of the Polesie built environment.

To recapitulate, the following features seem the key factors that used to ensure the social and spatial stability and immutability of old Polesie villages: the utmost isolation, self-sufficiency and economic autarky, ancestral social tradition, well developed local folk culture and fixed traditions of self-made building.

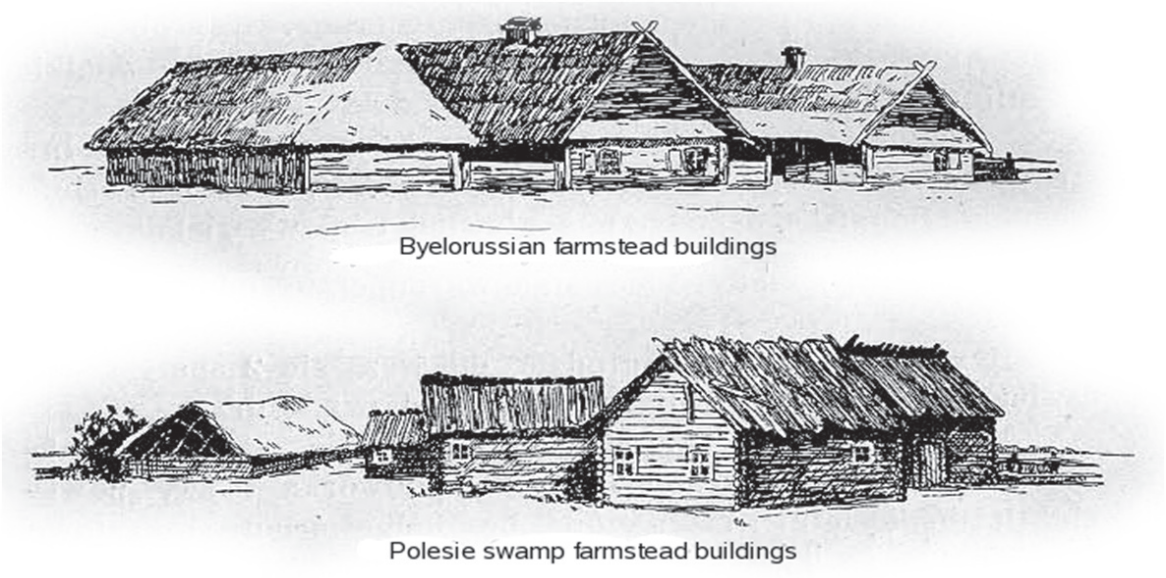



Figure 1. The specimens of farmstead building in Polesie, developed by two ethnic groups, according to Jerzy Niezbrzycki (sketched by
Halina Dybczynska-Niezbrzycka, in: Niezbrzycki, 1930, p.355).

## 6. A Case Study: A Row-shaped Village in Podlasie

The villages along the eastern peripheries of the Podlasie region used to

be perfect examples of sustainability and examples of spatial, temporal and cultural stability, as their spatial layouts, their building types and social culture remained unchanged since the sixteenth century until the 1960s.

Their layouts and spatial organisation, including the system of fields, date back to 1557, when the official royal decree called *Ustava na Volok* (Voloka Decree) initiated the reform of both agrarian and settlement systems in the crown estates in Grand Duchy of Lithuania, including Podlasie (nowadays in Poland). Firstly, cadastres and estate inventories were drawn up to record land and taxation. Secondly, pre-existing holdings of individual peasants in each village were merged and re-divided into three fields to grant each peasant parcels of standard size of about 5-6 hectares in each of the three fields. Thus, estetes were converted into compact, usually rectangular blocks of land, and eventually they were reorganized on a strictly regular three-field system (French, 1969; French, 1970). According to R. A. French, "the overseers aimed at achieving a completely standard layout. The three fields were to lie side by side, all of the same size, all with the same number of parallel strips; every strip was to be of identical length, breadth, and area. The village was to be resited in a single line of houses, one house at the end ofeach middle field strip. (...) The uniformity with which the three-field system was introduced into Lithuania was remarkable. (...) Indeed this uniformity has imprinted itself on the present-day landscape, in the regular 'street' village pattern. In some parts, which are now in Poland, the sixteenth-century field patterns survive almost unmodified" (French, 1970, pp.113-114, 117, 118). Regarding the original regular, linear 'street' village pattern, it consisted of compact rows of similarly lengthy building plots, often as elongated as 200 m in length and 25 m wide. During the centuries, building plots became much narrower. Finally, in the Podlasie region, their width reached 4-8 m in the 19th century.



Figure 2: The aerial image of a row-shaped village Wojszki (www.zumi.pl)



Figure 3: The examples of linear street villages, Sukowicze and Bialowieza. Copyrights: the Faculty of Architecture archive, TU Bialystok.

Each building plot included a slim line of farmstead buildings situated lengthwise (see Figures 2 and 3). The main building contained house chambers, pigpen and cattle sheds; it used to be 4 to 5 meters wide and 35 to 55 meters long (Czajkowski, 1961; Korolczuk & Szewczyk, 2008).

R. A. French underlines not only the uniformity, but also the long-term stability and immutability of settlement patterns and the agrarian system which were created by the Voloka Decree. Surprisingly, the most stable landscape patterns survived in the Podlasie region near Bialystok, where the mediaeval, obsolete three-field system used to be in existence until the 1960s, as stated by R. A. French: "The remarkable stability of the regime initiated in 1557 is demonstrated in a number of villages of present-day Bialystok province in Poland. In these villages not only has the field layout unaltered, but the fields are still cultivated in common on the same three-year rotation" (French, 1970, p.124).

The study of 'row-shaped', 'street' villages in the Podlasie region reveales the following determinants of the spatial stability of the built environment: firstly, the practical, economic and environmental excellence of both the settlement and the agrarian systems. Secondly, the strong mutual correspondence between the settlement system and the agrarian system. Thirdly, the extremely well-defined and legible morphological forms of villages and fields which shaped scenic values of human visual environment and framed aesthetical milieu. These factors became fixed in the memory of generations as archetypal patterns.

Additionally, the stabilizing influence of intangible culture fixed and pre-

served the culture and space of Podlasie, because the mutual dependencies between landscape and intangible culture were rather complex but not illusive (Korolczuk & Szewczyk, 2004; Korolczuk & Szewczyk, 2008).

## 7. A Case Study: A Settlement Landscape in Podlasie

The third example of *the sustainable human environment* was the agrarian and settlement landscape in the west part of the Podlasie region. The landscape used to be unique for its extraordinary spatial expressiveness such as the utmost patchwork quilt of extremely tiny and elongated fields, and the exceptionally well developed and rigorous agrarian three-field system.

The chequered patchwork of fields was extremely fine-grained on areas settled by poor gentry. This was the case of Western Podlasie which territory were characterized by the greatest dispersal and fragmentation of arable fields. In a great number of villages, poor noblemen possessed their arable lands divided into 400 to 600 narrow ribbon-shaped strips! This incredible *'pulverization' of fields* seems even more unbelievable when compared to the average in other European countries in the past, i.e. about 30 land strips per peasant in so called agrarian 'open field systems'. But in Podlasie, the granularity or 'pulverization' of arable lands was many times as much as in other territories. For example, in 1926 a man in the small hamlet Lapy-Kolpaki owned a few hectares of arable divided into 1221 tiny, narrow distinct patches! Moreover, he had his land strips scattered among other strips belonging to other poor noblemen from 11 neigbouring hamlets, all called Lapy: Lapy-Plusniaki, Lapy-Lesniki, Lapy-Lynki etc.; all the properties composed the fanciful mosaic of cultivable land (Zaborski, 1926, p.75). The arable strips were of fantastic shapes, too. The most elongated, extremely narrow, twisting or meandering ones were found near the village called Dabrowa Bialostocka, and each of them was 7 km long whilst only 2 m wide (Biegajlo, 1957, p.540).

The patchwork–like settlement system in Podlasie is important for studying sustainability issues because of the significance of 'a tangled patchwork quilt of fields', as it was called by Polish geographers (Biegajlo, 1957). The 'pulverization of fields' in the western peripheries of the Podlasie region, used to stabilize the setlement pattern as a whole. Firstly, these factors prevented excessive urbanization, because of the break-even point of agrarian profitability in overpopulated territory when based on cultivation of 'pulverized' and 'tangled' patchwork quilt of fields. Secondly, the granularity of arable plots and the three-field agrarian system guaranteed biodiversity and prevented overexploitation, because land cultivation was limited by the traditional, rigorous collecting farming methods;

numerous balks were excluded from normal land cultivation, too. Thirdly, folk way of life was also strongly determined and stabilized by the local uniqueness of the Podlasie landscape, because the whole sphere of local intangible culture in the Podlasie region was landscape-dependent (Korolczuk & Szewczyk, 2008). The large realm of folk superstitions, customs, beliefs, popular sayings and fairy-tales used to derive its semantics from the semantics of the surrounding landscape. Folk songs taxed also the resources of local landscape *toponymy*, i.e. place names. Moreover, despite the fact that the complicated land allocation generated many spatial misunderstandings and led to long-term litigations or contentions and even clashes and assaults, the great number and density of balks and arable strips forced the collective farming methods and thus indirectly stimulated the common social culture, including the abilities to maintain good neighbourhood relations. One of the most known effects was the local habit of neighbour's team aid and communal team work, even if not necessary economically.

A few remarks should be made upon the mutual dependencies between the landscape and the culture, if concerning sustainability and immutability issues. As it has been stated above, the intangible culture in Podlasie was landscape-dependent. The landscape toponymy played a key role as the carrier of these dependencies. Each piece of land, each strip of arable used to have its own name in the past. The more pulverized arable strips became, the more complex place names existed. Each place name, i.e. each *toponym* started and continued to enrich its semantics – associations, superstitions and legends; thus resulting in a growing sphere of intangible place-dependent culture. Consequently, the whole landscape proceeded to be overgrown with superstitions, connotations, legends, beliefs and reminiscences. Surprisingly, this process preserved the permanence and immutability of landscape, because peasants avoided any change to the *staus quo* of a spatial arrangement as these changes might endanger the intangible heritage which was regarded as respectable and worthy.

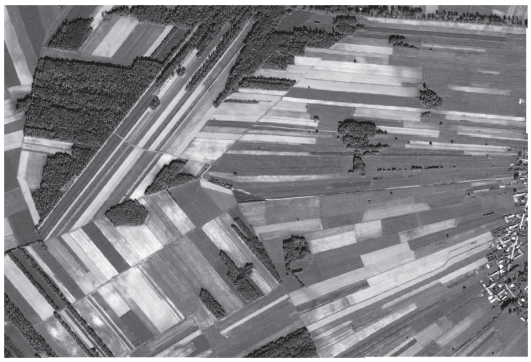


Figure 4: The contemporary remains of chequered field patchwork near Wizna (satellite photo: www.zumi.pl).



Figure 5: The remains of old buildings in Podlasie (Niewino Kamienskie and Mierzwin. Copyrights: the Faculty of Architecture archive, TU Bialystok).

In sum, the following features used to determine the social, environmental and spatial stability of old Podlasie hamlets, and influenced the long-term immutability of their settlement and agrarian systems based on the utmost chequered field patchwork:

- the extremely pulverized arable strips;
- landscape-dependent settlement patterns;
- fixed landscape-dependent social culture (including toponymy);
- collective farming methods including communal team work.

## 8. Discussion

On the basis of the described exemplary cases, the set of factors that determine the state of equilibrium in the traditional built environment, can be observed. The factors are displayed in the table 1.

Some draft generalisation can be drawn from this set of "climax factors". In the case of Polesie marsch villages, isolation can be regarded as the very characteristic feature, while on the opposite, the strong dependence on the local and wide landscape context plays a key role in the spatial and social stability of the system of Podlasie hamlets surrounded by the utmost chequered field patchwork. In both cases, the antithetical features seem to determine the immutability of the spatial, social and economic systems: *isolation* in the first case, and on the opposite, *context inclusion* in the second. But in some way each case should be classified as context-dependent, as each of the three "climax systems" depended on surrounding landscape, being subordinate to geographical factors that acted as the superior determinants in all cases.

Table 1: “The climax factors”, determining the immutability of built milieu.

| case | architectural | geographical | economic | social |
|---|---|---|---|---|
| 1 | the ancestral traditions of self-made building | the utmost isolation | autarky | isolation |
| | | | isolation (self-sufficiency) | strong ancestral traditions |
| 2 | the morfolo-gical legibility of villages | the legibility of the settlement system | the legibility of the agrarian system | folk culture based on archetypal patterns |
| | correspondence to the agrarian system | correspondence to the agrarian system | the efficiency of the agrarian system | folk culture as a stabilizer |
| 3 | correspondence to the settle-ment system | pulverisation of arable fields | collective far-ming methods | deep sense of heritage |
| | | landscape-based settlement patterns | landscape de-termined farming methods | landscape-de-pendent folk culture |

The legibility of settlement patterns and the related morfological legibility of villages seemed to be important but not necessary sustainability factors, as well as the legibility and efficiency of agrarian systems. These factors generated archetypal patterns related to the sphere of ancestral social culture which stabilized the settlement system. Besides, the agrarian and economic efficiency of agrarian systems stabilized the society and its space, preventing inventory attempts.

The economic self-sufficiency of peasants and autarky of their hamlets were very characteristic for Polesie marshland villages and they were also typical features in the two cases of Podlasie. But these factors should not be misinterpreted as the obligatory key determinants of sustainability, because of the countless peasants> attempts to overcome self-sufficient life style and neighbour-dependent barter economy, especially after the economic, political or social changes.

On the opposite, the Podlasie and Polesie folk culture and the strong ancestral social traditions seemed to be essential for the immutability of settlement, economic and social systems. Social culture stabilized and linked all spheres of private and communal life, preserving their integrity and merging architectural, settlement, geographical, economic and social realms in a coherent system, i.e. a human milieu. Just such a milieu that included tangible realms and intangible values was a tenacious and harmonious unit. Amongst the dependencies that united all spheres of life, *the subjection of culture to the landscape* (“landscape-dependent folk culture”) seemed the most important sustainability factor, as well as *the correspondence of the space, the economy, the culture and the agrarian system*. Finally, the relationships between economy and culture played an important stabilizing role, too.

The general conclusion can be drawn from the analyses that the most universal key constituting the sustainability of human built milieu was the hierarchical subjection of social culture to landscape, and strong interrelations between the social culture and other realms and spheres of life, with the superiority of the ancestral traditions and archetypal patterns to the whole rest of social culture. This hierarchy of dependencies is shown in a diagram (Fig.6).

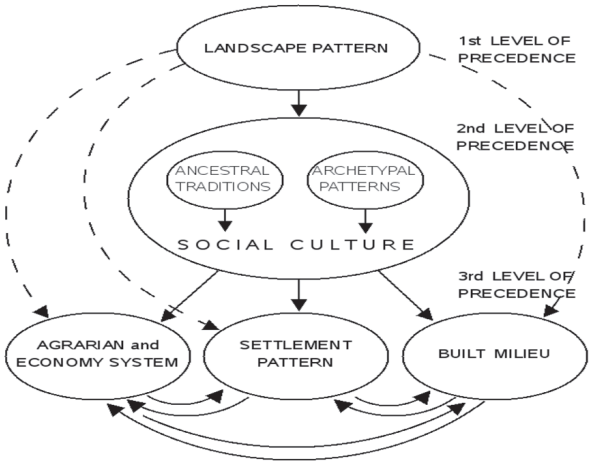



Figure 6: The hierarchy of "stability factors".

The next finding is that the common and indispensable feature of those human environments was the subordination of all aspects of space and life to the intangible social culture, i.e. to the system of habits and beliefs. The system was very stable and probably cemented the environment, maintaining its elements balanced, immutable and permanent. It opposed changes.

None of these human environments was spatially efficient in terms of present economy, contemporary agriculture or modern architecture, and none could meet the demands of contemporary spatial planning concepts. None could be accepted nowadays. But the strength and complexity of the corresponding spheres of their intangible culture were the reasons these environments lasted unchanged until the half of the 20th century.

## 9. Conclusions

The obvious general dependence is that the long-term technology and economic development usually acted against the immutability of the key stabilizers of local human milieu. The progress of civilisation modified folk social culture and agrarian system, and eventually it also resulted in the continuous changes of the open landscape and its vernacular built environment.

Of course, the technology impact on the stability and immutability of built milieu is much more complex, because the global progress of civilisation gradually changes the polite to vernacular architecture ratio, influences landscape

usage, stimulates the evolution of new patterns of social culture etc. For this reason, either the consolidating or destabilizing role of the technology should be studied in the future. It can be expected that technology-based, "climax" human environments could be developed as compared to vernacular environs in the past.

Based on the analyses of three exemplary cases, i.e. the types of villages which remained nearly unchanged for a few hundreds of years until as recently as the 1960s, the following five groups of features have been found important for safeguarding immutability and long-term stability of the built environment.

The first group referred to *isolation*. This group could be divided into *spatial isolation, social isolation* and, last but not least, *economic isolation*. The economic isolation resulted in *autarky* and *self-sufficiency* which also played an important role as sustainability factors. Of course, isolation resulted also in personal and social aloofness to the rest of the world.

The second group was the *legibility and efficiency of agrarian and economic systems*. The analysed agrarian three-field systems and barter economy are absolutely obsolete at present, but they were relatively legible and efficient as compared to other economic and agrarian systems in the past.

The third group was *the legibility of landscape and settlement patterns*. The related stability factor was the morfological discernability of villages.

Fourthly, *folk culture* played an important role as a stabilizer. This factor was related to all spheres of intangible culture and included strong ancestral social traditions based on archetypal patterns. The rich source of such patterns was the landscape with its semantics expressed in toponymy.

Fifthly, the whole large *sphere of mutual dependencies* and relations between the above-mentioned factors seemed to be even more important than the elementary atomic factors themselves. As it has been stated, the dependencies acted as stabilizers, because they merged all spheres of private and communal life into the optimum "climax system", preserving its integrity and joining architectural, settlement, geographical, economic and social realms in a coherent, tenacious and harmonious totality – a human milieu. The dependencies include the subjection of culture to the landscape (landscape-dependent folk culture); the correspondence of space, economy and culture to the common agrarian system (agrarian factors); the mutual relations between economy and culture (the social stabilizers of economy system).

Nowadays, we can draw the experience from the past cultures and societies to build stable and sustainable human environment, and then to maintain their main elements balanced, immutable and permanent. The contemporary techno-

logy development should be supplemented with the mechanisms which oppose the negative changes of human pressure on the environment and its resources. Our investigation has proved, that these mechanisms are more efficient if based on the system of habits, beliefs and feasts. They should tax the resources of intangible culture. But on the opposite, the contemporary technology development can result with new tools for management

Of course, not all the immutability factors are applicable nowadays, and perhaps none of them should be applied directly. For example, spatial or economic isolation, old agrarian economy or the three-field agrarian system are no more in use and cannot be restored. But in a sense, some aspects of social isolation protect the personal and social identity derived from one's family, social group, settlement distrint or nationality, although the past history revealed that these factors can also adversely result with discrimination and harmful social division.

The feature of spatial legibility in terms of architecture, urban space and open landscape can be applicable nowadays in order to create elementary, archetypal patterns for the perception and forming of built milieu. Such archetypal patterns can act as sort of "common denominator" for social communication and perception of values related to space.

The whole issue of mutual dependencies and connections between various spheres of life, or between architectural, settlement, geographical, economic and social realms, seems to be the essential problem to create modern settlement patterns that meet the needs of urban and environmental sustainability. This problem should be also studied in the future.

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# نقطة الذروة في البيئة البشرية المبنية

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**ملخص:**

في علم البيئة الطبيعية (Ecology) يرمز مصطلح مجتمع الذروة (Climax Community) إلى مجتمع حيوي من النباتات والحيوانات وصل إلى حالة استقرار والمجتمعات في مثل هذه الحالة من الاستقرار البيئي تسمى مجتمعات ناضجة أو كاملة النمو (mature or old growth community) وموضوع البحث هو إذا ما كانت فكرة نقطة الذروة أو الاستقرار البيئي يمكن أن تمثل أيضاً نموذج للبيئة البشرية التقليدية والتي تشمل على الأربعة عناصر التالية:

الناس ونظامهم الاجتماعي ومبانيهم والبيئة الحيوية من النباتات والحيوانات التي يرعونها ويتحكمون فيها.

والهدف هو الإجابة على الأسئلة التالية: هل يمكن وكيف يمكن للبيئة البشرية التقليدية المبنية أن تصل إلى حالة الاستقرار؟ والسؤال التالي المطلوب الإجابة عليه هو أياً من عناصر بيئة الذروة يمكن تطبيقها لاستحداث أنماط لمستقرات حديثة تحقق متطلبات الاستدامة في البيئة الحضرية.