FROM 'ALPINE VOIDS' TO REGENERATIVE DESIGN: THE SILENT FORTRESSES OF THE MOUNTAIN LANDSCAPE/

Anna Kerschbaumer - *Università degli Studi di Bari Aldo Moro - PasaP med, DIRIUM (Dipartimento di Ricerca e Innovazione Umanistica), Str. della Torretta, 70122 Bari, Italy.*
a.kerschbaumer@phd.uniba.it

Abstract. Located in the mountainous heart of the Eastern Alps, the Tyrolean region constitutes a historic borderland marked by an exceptional concentration of fortified architectures. Castles, towers, and defensive structures – predominantly medieval but often layered over earlier foundations – form a stratified system deeply intertwined with the area's complex orography. Their distribution reflects the region's long-standing geopolitical relevance as a strategic corridor between the Mediterranean and continental Europe, where topography historically enabled control of land and river routes. Within the framework of the call for papers Regenerative Design for the Built Environment and Urban Voids, this contribution proposes a rethinking of abandoned fortifications as a distinctive category of 'Alpine voids': mountain spaces stripped of function and progressively disconnected from the territorial and social systems that once sustained them. Once central to community life – structuring settlement patterns, agricultural organisation, and local identities – these sites have been marginalised by military decommissioning, infrastructural transformations, and the limitations imposed by their own topographical contexts. Preservation practices, often guided by rigid conservationist paradigms, have further struggled to re-establish meaningful contemporary relevance. Yet this condition of suspension conceals latent potential. Despite their apparent incompatibility with contemporary sustainability discourse, many fortified structures embody a forgotten form of environmental intelligence, grounded in careful adaptation to climate, topography, and resource constraints. Their spatial logic thus offers valuable insights for regenerative approaches in mountain territories. The following questions arise: Have these ruins truly reached the end of their life cycle? Can fortified heritage be reframed within regenerative design? By envisioning fortifications not as static relics but as adaptable components of a broader landscape system, the paper explores strategies for their reintegration as cultural, ecological, agricultural, or social nodes. Through context-sensitive design, Alpine voids can become catalysts of sustainable and inclusive territorial regeneration, reconnecting heritage, environment, and contemporary community needs.

Introduction. In the collective imagination, the term 'urban void' evokes images of absence. Derelict factories, disused rail yards, empty lots: abandoned fragments of the city where activity has ceased and meaning seems to have eroded. These spaces are the physical evidence of how urban and territorial systems evolve, forget, and renew themselves: each void records a pause in continuity, the trace of an exhausted function or a shifted paradigm. But what truly defines an urban void? Is it a condition bound to the city, or does it rather describe a broader phenomenon, a space marked less by geography than by disuse, disconnection, and loss of social relevance? Can voids exist outside the conventional urban domain, perhaps in territories whose apparent remoteness conceals similar dynamics of abandonment and potential?

This paper addresses these questions by extending the notion of 'the urban' beyond the city's borders. Through a focus on the Alpine context, it introduces the possibility of reading the territory itself as an expanded urban field: a continuum of settlements, infrastructures, and landscapes that interact with one another. Within this perspective, even non-metropolitan environments may reveal conditions analogous to those of the city's voids. For this fate of forgetfulness and disuse is not solely confined to factories or railyards: it may also affect other places that were once integral to the urban realm but have been progressively cut-off from it; sites once essential to human activity and collective identity, now emptied of use and isolated, having lost their role and centrality within contemporary life.

Many such spaces survive in the Alps in the form of disused fortifications: castles, towers, and military structures that once shaped the evolution of the mountain territory but now seem condemned to an inevitable condition of decline. These places will here be referred to as 'Alpine Voids': territorial voids embedded within the mountain landscape, defined by an evident interruption of relationships between form and use, memory and inhabitation, past and present. Despite their formal protection as heritage, such places often linger in a state of suspension: legally preserved yet substantially forgotten, visible yet disconnected from the cultural and environmental organism that once sustained them. Their neglect often stems from a convergence of factors: not only the obsolescence of their original purpose, but also shifting patterns of accessibility, territorial reorganization, or even, at times, the deliberate will to forget histories of conflict and control. Yet their marginality and exclusion need not be read solely as decay. They can also be understood as a state of latency: a pause that conceals potential and invites transformation. Seen through the lens of regenerative design, Alpine voids may be reinterpreted as fertile interstices where regeneration might take root. In addition to this, the accurate study of fortified structures may even uncover a deeper level of value: if observed closely, these voids may reveal a hidden, site-specific form of environmental intelligence from which contemporary designers can still learn. To reinterpret these spaces today means to unveil that latent value and reactivate their capacity to mediate between past and present, memory and reuse, heritage and ecology.

The Tyrolean Region as a Case Study: A Geography of Defence. Building upon the notion of Alpine Voids introduced above, the Trentino - South Tyrol region offers a tangible case in which this condition becomes visible. Located in the mountainous heart of the Eastern Alps, it presents itself as a territory where traces of the past endure in the form of fortified architectures. From prehistoric hilltop enclosures – such as the South Tyrolean Wallburgen, erected to protect early settlements and communication routes – to medieval castles commissioned by prince-bishops and noble dynasties, each epoch has inscribed its own architectural layer upon the landscape. Later centuries introduced aristocratic residences, particu-

larly numerous in South Tyrol, while in the nineteenth and early twentieth centuries, the Austro-Hungarian Empire consolidated the region through a vast network of forts. During this period, the Habsburg military authorities came to conceive of Tyrol as an Alpenfestung, which is to say a 'great Alpine fortress': a defensive system intended both to protect the Empire's southern frontier and to project its influence across the Italian plains and toward the German world beyond the Brenner Pass. The reasons behind this continuous interest in the area – and hence the remarkable richness of fortifications that characterise this geographical region – stem from a convergence of environmental and geopolitical factors: the favourable morphological conditions of the valleys and – above all – their strategic position along one of Europe's principal north-south axes. For instance, the valleys of Trentino and South Tyrol form a natural corridor linking Central Europe with the Mediterranean basin: a setting that – since antiquity – has invited both settlement and conflict.

The resulting landscape became a true borderland, a contested ground where topography itself demanded control: whoever dominated the passes and river crossings held power over communication, trade, and military movement. As a consequence, the proliferation of fortified settlements in Trentino - South Tyrol region must be understood as a complex and stratified process. Despite the existence of in-depth studies that attempt to analyse the fortification of the Italian Alpine region by classifying its architectural elements into a series of categories (i.e. the APSAT project, cfr. Possenti et. al., 2013), the diversity of typologies and contexts resists any single interpretative model. Yet it is possible to identify certain aspects that unite these structures and reveal a shared logic, starting from their intrinsic relationship with the mountainous terrain, the networked nature of their organization, or even their former role as centres of power. Each of these aspects deserves closer consideration.

Relationship with the mountainous topography: a "landscape of reciprocity". Indeed, one of the defining characteristics of Alpine fortifications lies in their intimate relationship with the complex mountain topography of the region. Nature and architecture here appear to merge, truly generating what has been described as a 'landscape of reciprocity': "It is the castle that creates a fortified landscape, deeply modifying the territory into which it is inserted; yet at the same time, the building itself is conditioned in its development by the morphology of that very place." (Azzolini, 2016, p. 64, author's transaltion).

This reciprocal attitude – of exploiting the terrain's defensive potential while respecting its constraints – has been interpreted by scholars as a pattern of vertical movement (Südtiroler Burgeninstitut, 1995). While in certain cases, fortifications were built atop of elevated spurs and ridges, securing visual and strategic dominance over the valleys below (Figure 1), in other cases it proved more advantageous to occupy the valley bottoms, in proximity to arable land and major communication routes. This movement – which follows the geomorphological rules dictated by the mountain territory – results in an extraordinary variety of architectural forms, each a unique response to local conditions rather than a replication of an established model. The presence of the landscape is hence to be understood not as a mere background, but as a co-protagonist. As eloquently described by Johann Wolfgang von Goethe during his Italienische Reise the transformation of the Alpine world into the Mediterranean one – which a traveller can observe while moving south along the Adige River corridor – is not only geographical but also sensorial and cultural. At the beginning of his journey, from the Brenner pass to Bozen, Goethe observes how cultivated slopes open southward, while Tyrolean peaks still guard the northern horizon; yet as he proceeds further south, the air becomes "mild and gentle" and a "touch of southern light" begins to permeate the valley. Near Trento, he rides "between high rocks along the rushing Adige, the sun shining, the wine ripening, and the air filled with cheerful warmth". He observes how "the river, the mountains, the cultivation – everything stands in beautiful balance". The very city of Trento appears to him as "pleasantly lying among vineyards, enclosed by walls of mountains". (Goethe 1912, pp. 25-31 author's translation). Yet in this idyllic landscape, Goethe soon comes to notice another important and impressive presence: imponent ruins from atop of cliffs come to dominate the territory, so magnificent to his eyes that he feels the urge to draw them. Those are the signs of a borderland, for long contented between the Venetians and the Austrians.

Signatures in the landscape: the symbolic dimension. Goethe's fascination with those ruins invites us to consider another essential trait of Alpine fortifications: they are first and foremost "architectures of power" (op.cit. Azzolini, 2016, p. 55). For instance, controlling the Adige corridor meant mastering not only the movement of armies and merchants but also the symbolic inscription of control over the land itself. Ecclesiastical, aristocratic, and imperial authorities each left their traces: castles and fortified residences functioned as landmarks of dominion; visible emblems of protection, prestige, and control. Around these strongholds, villages grew, at times even adopting their names, transforming those fortresses from isolated structures into the nucleuses of settlement. For travellers, towers and castles became reference points for orientation along the valleys (Figure 2), their silhouettes punctuating the routes that connected the Alpine passes to the plains.

This symbolic power continued to fascinate people in the centuries that followed – and still does today – long after the defensive function of these structures has waned. Among the most significant testimonies of this enduring appeal is the Codex Brandis: a collection of drawings and views commissioned in the early 17th century by Jakob Andrä Brandis to an unknown artist, which represents one of the earliest attempts to compile a systematic catalogue of the castles of Trentino and Tyrol. Once again, in the 19th century, another significant documentary work was undertaken by the artist Johanna von Isser Großrubatscher, who revisited these fortresses through a distinctly romantic lens, transforming them into poetic ruins. (Figure 3) These drawings – oscillating between documentation and imagination – contributed to fixing the image of the Alpine castle within a broader European iconography of memory and nostalgia. Finally, another important impulse was given in the 1950s and 1960s, thanks to the work of Aldo Gorfer, who produced a comprehensive guide to the castles of Trentino (Gorfer, 1958 and Gabrielli, 2017).

Lines of control: the networked nature. Another characteristic trait of the alpine fortified landscape is the networked nature of its components. For instance, castles and forts very rarely operated as isolated entities. Instead, they often functioned as parts of coordinated defensive networks: groups of fortifications – known as chiuse – formed synergetic checkpoints along river corridors and passes, controlling access to entire valleys. Each structure exploited the defensive potential of the surroundings, creating a situation of visual and communicative interdependence. As a result, fortified structures came to define continuous lines of control: along the Adige Valley, at least five such checkpoints can be identified (Figures 4, 5 and 6).

Alpine voids as fortified palimpsests. One last characteristic trait of the Trentino - South Tyrol fortified landscape that is worth mentioning, can be identified in the continuity of use and the persistent strategic importance of these sites. The result of this process is a 'fortified palimpsest': a landscape which is densely layered with centuries of adaptation and reuse, where each structure may rise above the remains of an earlier one, inheriting some of its parts and features while transforming many others. To this complex organism, the contemporary layer should add itself with knowledge and respect, but also with audacity

From system to fragments. Deprived of their original role, many alpine fortifications now linger in a condition of suspension. Scattered across mountain ridges, valley mouths, and river crossings, they remain powerfully present in the landscape yet largely detached from the rhythms of contemporary life. What were once strategic infrastructures – sites of control, surveillance, and exchange – have become isolated fragments: their walls still partially standing but their meaning deeply eroded. Those same orographic conditions that once guaranteed their absolute strength – steep gradients, limited accessibility, and visual dominance – now contribute to their marginality, rendering them difficult to reach, to use, and to maintain. Furthermore, infrastructural changes – such as the construction of the Brenner motorway in the 1960s and 1970s – have significantly intensified the landscape's fragmentation, further weakening the connection between the two sides of the river. This process of progressive disconnection has turned fortified structures into a peculiar category of void. They are no longer needed and understood by the communities that surround them, nor do they participate in the productive, cultural, or ecological systems of their territories. They have been forgotten.

Matters of perception: the ethical component. To this slow fragmentation, another interpretative layer may be added, concerning the ethical meaning of fortified remains. Once again, this issue can be effectively explained through Goethe's experience during his Italian travel. In particular, the poet narrates an anecdote about his stop at the village of Malcesine, on Garda Lake which goes as follows. As soon as he reaches the village, Goethe's attention is caught by the ruins of a castle illuminated by morning light. The poet remains deeply fascinated by it and decides to climb up and draw it. "In the courtyard of the castle" he writes, "I sat facing the old tower, built upon and within the rock; I had found a very comfortable place to draw, next to a closed door, raised three or four steps, in whose jamb there was a small stone seat, ornamented as one still finds in our ancient buildings" (op.cit. Goethe 1912, p. 34, author's translation). Those ruins appear to him so majestic that he wants to capture their grandeur. Nevertheless – to the local people – his behaviour is totally not understandable and they end up suspecting Goethe of espionage. The local people cannot fathom why anyone would wish to draw a crumbling fortress: to them, the ruin has no aesthetic or cultural value, it is a mere vestige of war which may even still be used – from time to time – to spy on the enemy. To Goethe, that same ruin is instead a vessel of imagination. He hence proceeds to explain to those people that not only the antiquities of Greece and Rome, but also those of the Middle Ages, deserve attention. He reminds them that countless travellers to Rome sketch ruins, for "Rome, the capital of the world, laid waste by the barbarians, is full of ruins that have been drawn hundreds and hundreds of times" (ibidem Goethe 1912, p. 35 author's translation). After a long discussion, the people began to believe to the goodness of Goethe's intentions. Nevertheless, their scepticism reveals another level of interpretation: beyond the pure architectural form, and their intrinsic link with the territory, fortified structures may represent something else. They embody a form of collective memory, encompassing both positive aspects – such as castles representing the proud heritage of a territory – and painful ones, like the lingering traces of war and oppression. Any contemporary intervention and regenerative design practice cannot avoid considering this aspect, which must be dealt with through great sensitivity and intelligence. Centuries after Goethe's narration, for instance, a situation of tension persists: many alpine fortifications oscillate between invisibility and fascination, ignored by daily life yet romanticized in tourist imagery. To perceive value in these ruins requires both education and empathy.

From Invisibility to Regenerative Meaning. The reflections traced up to this point naturally lead to the next necessary step. Rather than mourning the dissolution of a once-coherent defensive system, we might approach its remnants as opportunities for regenerative connection. Each ruin, however isolated, could serve as a node within a renewed network: ecological, cultural, social or even productive, if well integrated with the agricultural vocation of its surroundings. In this perspective, the fortifications cease to be mere vestiges of conflict: they become mediators between systems that modern infrastructures have long fragmented. What we need is a clear shift in perspective, which has been effectively defined as the "Mossa del cavallo", the 'Knight's move': an oblique, lateral move that defies linear trajectories.

> *"The inner areas constitute the Italy of voids, the fragile Italy; and it is precisely from these margins that the knight's move may begin: if we turn our gaze back to these marginal spaces, we will discover that they are the custodians of an extraordinarily rich stratification, capable of helping us understand the present and imagine the future".*

(*Cersosimo e Donzelli, 2020. pp.13-20, author's transaltion*).

Being able to capture the value of what appears residual or obsolete may trigger new opportunities.

Let us now apply this same reasoning to the identified case study. At first glance, the dialogue between ruined fortresses and contemporary

paradigms of sustainability may seem improbable. Yet through the knight's move, this apparent incompatibility conceals an overlooked potential. What if we were to study these structures not only as historical artefacts but also as repositories of environmental intelligence? What if the logic behind their siting and construction – so deeply intertwined with the morphology, climate, and resources of their surroundings – could inform and orient new ways of building today?

Seen through this lens, Alpine voids reveal themselves as silent bearers of forgotten ecological wisdom. Their architecture – often conceived with a deep awareness of topography, orientation, and microclimate – embodies an 'environmental intelligence' that precedes modern sustainability principles. A fortress perched on a ridge reflects knowledge of slope, sunlight, and access to water; another near the river mediates circulation, trade, and defence. The terraces surrounding them record patterns of settlement and the agricultural vocation of the area. To engage with these structures today is to uncover a historical reservoir of spatial and environmental knowledge; one that may guide future regenerative practices in mountain territories.

Conclusion. The challenge, therefore, is to bring Alpine voids back into visibility, proposing a regenerative approach that moves beyond a rigid conservation or musealization. Regeneration – in this sense – does not erase history: it reactivates it, weaving abandoned fortifications back into the territorial fabric through context-sensitive uses – i.e. cultural, ecological, agricultural or else – that resonate with their surroundings. Seen in this light, these structures cease to be isolated fragments and become potential nodes of connection within landscapes long fragmented by infrastructural and social change. Their environmental intelligence, shaped by centuries of adaptation to topography, climate, and resources, offers valuable insights for contemporary design in fragile mountain contexts. Reimagining Alpine voids thus becomes more than a simple act of preservation: it becomes a tool for resilience. In a time marked by climate pressures and demographic decline, Alpine voids have the potential to become efficient mediators between past and future, helping communities rediscover forms of belonging and use that rooted in the very landscapes that surrounds them.

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Figures.

FIGURE 1 – Picture of Schloss Haderburg, Salurn, South Tyrol, 2024. Picture taken by the author.
FIGURE 2 – Extract from the map "Le Valli di Annone e di Sole" copy by Luigi Dalla Laita from the original by Pietro Andrea Mattioli, 1889. © Biblioteca Comunale di Trento, TG 1 c 47.
FIGURE 3 – View of the northern Adige Valley by Johanna von Isser Grossrubatscher, 1896. © Tiroler Landesmuseum Ferdinandeum, Innsbruck
FIGURE 4 – Five checkpoints along the Adige river valley. Personal graphic re-elaborated version of the study made by Gian Pietro Brogiolo and Annamaria Azzolini (Cfr. Brogiolo and Azzolini, 2016, pp. 53-58)
FIGURE 5 – Satellite image of the fortified system known as 'Chiusa della Pietra', located near the present-day city of Rovereto.
FIGURE 6 – The castles of the 'Chiusa della Pietra' seen from the ruins of Castel Corno, 2025. Picture taken by the author.

1.



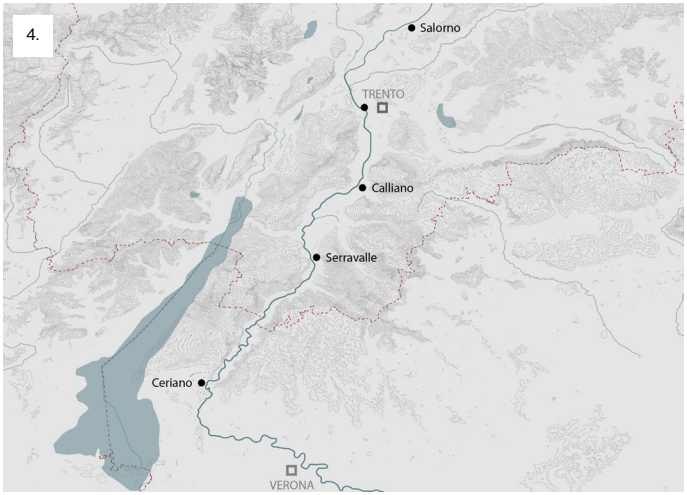
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Arco
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Vion
Molar
Vico
Belvedere
Ponte della Scherta

3.


BESENO

4.


Salorno
TRENTO
Calliano
Serravalle
Ceriano
VERONA

5.


Castel Barco
Castello di Nomi
Castel Pietra
Castel Beseno

6.


Castello di Nomi
Castel Beseno
Casteldi Barco
Castel Pietra

RECLAIMING INDUSTRIAL PALIMPSESTS: MUSEUMS WITHOUT WALLS FOR ADAPTIVE REUSE AND COLLECTIVE MEMORY OF POST-INDUSTRIAL SITES/

Parastou Mollahosseinali - *University of Aldo Moro, Bari*
p.mollahosseinali@phd.uniba.it

Seyedamirhossein Nourbakhsh - *Sapienza University of Rome*
seyedamirhossein.nourbakhsh@uniroma1.it

Abstract. Abandoned industrial sites in contemporary cities are treated as urban voids which represents both challenges and opportunities. The Bagnoli district in Naples, is among one of the most relevant districts in Naples in this sense. This area exemplifies a regenerative urban void, where decaying steelworks, rail infrastructure, and industrial remnants are present. There is an opportunity in this scenario for transforming the area into living civic landscapes. This study investigates how post-industrial sites can serve as ecological, social, and cultural infrastructures which serve the contemporary needs (Ahern, 2007). This structure tries to integrate memory, heritage, and community engagement into urban regeneration. The focus is to consider this area as a museum without walls and borders that creates a living testimony of rich history of steelworks in Naples through an accessible urban park (Hayden, 1995).

For better setting the scene, a similar project, the case study of Landschaftspark Duisburg-Nord in Germany, is chosen (Latz, 2001). This park is a critical example of urban regeneration of a post-industrial site, that can present similar necessities for rehabilitation (Reed, 2005).

The research proposes interventions for Bagnoli's Mediterranean setting, including urban regeneration of public green space and architectural adaptations for existing forms. The idea of "living memory" is crucial in this study where industrial fragments mediate between past and future (Nora, 1989). This will foster inclusivity, environmental recovery, and civic identity. By considering industrial sites as urban voids that are not pure remnants but active resources, the study tries to have a model for regenerative urban landscapes that combines historical continuity, ecological resilience, and social vitality (Rossi, 1982).

From wasteland to civic landscape; Bagnoli reclaimed. Bagnoli, the western district of Naples, lies in between the Bay of Pozzuoli and the slopes of Posillipo Hill. The landscape of Bagnoli is a palimpsest of industry in the 20th century – a steel factory developed starting in the 1910s and employed a multitude of workers and turned a rural seaside into an industrial zone. This location provides expansive views of Nisida, Ischia, and Procida. However, its coastline reveals a completely different reality. A landscape contaminated by the remains of abandoned factories. Italsider, one of the biggest steelworks in Italy, was once located here. It was a large industrial complex that dominated the neighborhood. The remnants of the plant have hung over the community since its closure in 1992. The plant left behind pollution for the population and lead to economic decline for this once-thriving area. The contamination is so extreme that swimming is prohibited in the bay. Previous attempts to redevelop the site—one as a sports park and another as science museums—were unsuccessful, eventually leading to the site's complete abandonment over time (Latz, 1999). Even with the physical decay, Bagnoli's industrial past lives on in collective memory. Local communities in Naples have connections to the steelwork's era, and the remnants from massive sheds to old rail lines are regarded not just as remnants but as relics of work and sacrifices made. Here, heritage value is intangible. Regeneration will have to account for this layer of memory: reconciling valuing Bagnoli's past and its trauma of environmental degradation with a new identity. In this regard, the Bagnoli site is a shared landscape of memory where the story of a community's labor and loss are literally rooted in the land and the steel.

As Figure 1 indicates, Bagnoli was a compact industrial zone of the city where majority of the land was taken in favour of the industrial steelwork site.

Landschaftspark Duisburg-Nord: A Model for Adaptive Reuse in Post-Industrial Regeneration. Instead of treating the industrial remnants as insignificant, in the contemporary regenerative design field, they are considered as valuable resources (Mostafavi & Leatherbarrow, 1993). The concept of adaptive reuse encourages one to find an alternate use for post-industrial sites, embedding artifacts of the past to help shape the inclusive public space. This is consistent with circular urbanism, which wants to prolong the service life of built environments and materials instead of demolishing and rebuilding (Storm, 2014). To consider this approach for the Bagnoli industrial site, a similar case studies which faced the challenges of ironworks site regeneration in Germany is worth mentioning.

The Landschaftspark Duisburg-Nord shown in figure 02, is among the several important cases of post-industrial site regeneration in Europe. It is in the Ruhr district of Germany, on a site which was originally established as an ironworks. It was founded in 1902 by August Thyssen to provide iron for his steel construction, with the first blast furnace lit in 1903. Over the next few decades, it grew into a complex of furnaces, coke works, sinter plants, power stations, and casting halls. By the middle of the twentieth century it was the time of decline in the steel industry in europe. In the 1960s and 1970s, furnaces were disassembled, and in 1985 the last blast furnace was shut down. This resulted in leaving a 200-hectare ruinous landscape of rusting machinery, contaminated soils, and abandoned rail lines. Rather than demolish the site, the city saw potential in this industrial site. In 1989, as part of the International Building Exhibition (IBA) Emscher Park an international design competition was launched. In this exhibition, landscape architect Peter Latz and his firm won in 1991 with a pioneering approach; instead of erasing the past, they proposed to highlight it. Latz's design emphasized "making time visible" by preserving blast furnaces, chimneys, bunkers, and pipelines as cultural monuments, while allowing nature to reclaim the site. At the time, this approach was among the first to consider regenerating post-industrial sites while preserving their character. In this approach, Polluted soils were stabilized or planted over instead