

Article

Don't Split Them Up! Landscape Design of Multifunctional Open Spaces Suitable for Coping with Flash Floods and River Floods

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Abstract: Pressures arising from agriculture, infrastructures and settlements have gradually reduced natural spaces of European watercourses limiting their self-regulation capacities, environmental and social potentials, resulting in widespread critical anthropic features. Dealing with flood phenomena adds artificiality, as several works for hydraulic protection are necessary. This was the case of Pistoia, a small city in the north of Tuscany, where the Ombrone stream, held in a straight-channeled course since the 18th century, sometimes breaks its embankments and floods the low plain from the southeast of Pistoia to downstream. Complying with the EU Floods Directive (2007/60/EC), the regional authority for flood risks planned some basins in the high plain upstream of Pistoia. A study we developed before this research assumed to shift the design approach from functional separation to full integration of hydraulic works in an area planned as an urban park for several years, but still in waiting. We now carried out a second study that adopts the concept of deep structure as the main design reference to “see” the park in the landscape features. This article concerns the research by the design process just developed to investigate a sustainable layout of the place new hydraulic asset as a basic landscape identity of the future park. Not to split spaces up with regard to their main functions was the general aim the process was focused on to combine an effective hydraulic protection with a full environmental and social enhancement of the urban park.

Keywords: landscape design; landscape integration; urban park; landscape deep structure; flood; hydraulic works



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1. Introduction. “Change”: Problem and Place Interpretative Paradigm

Change has been the essence of life on planet Earth since its early expressions. The evolution process led living beings to observe and understand the manifold properties of environments and their changes in space and time: “(...) this process of perception was vital in the evolution and survival of the human species (...)” [1]. Landscape is a perception-based entity influencing human behaviors and habitat adaptations [2,3]. From an ecological point of view, environment perceptions also allow other living beings to understand and select the habitat properties [4]: this matters with regard to the human awareness of landscape importance too.

Perception is a way to wonder about the dynamic relationship between nature and culture that merge in landscapes that are constantly evolving in space and time. There are no divided spheres in the world but just one with complex and systemic structures. The concept of humans as natural beings has emerged as self-evident: we do not need to be ecological, because we are ecological [5]. According to Timothy Morton, the real issue of ecological awareness and the related actions is not that they are awfully difficult but that they are too easy. This paradox is true in everyday life, when something simple and clear is subversive with regard to common sense, behaviors, and practices so far and

otherwise oriented. If the landscape perception skills of living beings are powerful means for their lives, landscapes are the essential media of relationships with environments and the different habitats they embrace.

In the nineteenth and in the twentieth century, ecology as well as landscape architecture have provided critical thinking and alternative solutions to many issues, often proceeding in different directions with regard to economic and political mainstreams. Today, the discourse on nature is intensifying, and the clear distinction from man appears to be a failed concept: humans' awareness to be part of nature is growing and spreading. Embracing an ecological approach means adopting a perspective that "requires profound changes in our perception of the role of human beings in the planetary ecosystem" in favor of less anthropocentrism [6]. It is not so far a landscape approach if it "(...) calls not for an inside-out, top-down, colonial design but outside-in, bottom-up, evolutionary, and democratic design. (...) Instead of a formal type, a landscape approach models after process and type using nature's generative and adaptive strategies. (...) This approach leads to a grown, cultivated, and open-ended form (...). It recognizes change and process rather than seeking permanence and monument" [7].

Natural factors and processes shape cultures, but several cultural forces also affect most of nature. Michael D. Murphy recalls how as early as 1968 the microbiologist René Dubos argued: "There is no 'natural' ecology. Man has changed everything in nature" [8]: there is no natural landscape; nothing is fully natural, but everything depends on natural factors and processes. Aware of this interdependence, it is necessary to act on the quality of the relationship to feed a balance.

Humans have developed the ability to shape habitats by changing landscapes, both enriching and impoverishing their ecologies and diversities. If agriculture and forestry are the most ancient and extensive human revolutions, industrial development combined with the exploitation of fossil fuels has deeply marked landscapes in a much more sudden way. The loss of biodiversity continues, in relation to more and more evident climate changes too [9,10]. Since the 1950s, "anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems" [11].

In this context, natural spaces of European watercourses have been reduced to such an extent that both the latter and the landscapes they flow through present widespread critical anthropic features. Rivers and streams have not enough space to develop their self-regulation capacities, environmental and social potentials. So, dealing with flood phenomena is adding artificiality, as several works are necessary for the hydraulic protection of the land and an EU directive [12] decreed plans must be drawn up by 2015. However, adding artificiality does not necessarily mean adding specialization by triggering further dynamics of territory fragmentation as well as of processes that animate it. Often specialized spaces designed through dominant sectoral approaches do not have multifunctional properties; their ecosystem services are restricted, including the enhancement of social identities through the place's inclusivity and expressivity. Because the landscape is often split into functionally specialized open spaces, many contexts show a self-evident lack of adaptive properties. This seems to be a paradox in design for flood risk management, and although the first aim of these kinds of projects and works should be adaptation, they often ignore several functions of open spaces. In such a context the project can play a pivotal role in the chain leading from decisions to actions. The functional splitting of places and their landscapes seems obsolete in the face of sustainability goals. Technocratic approaches often dominate design processes [13] with sterile outcomes of space specialization. A landscape approach rather aims to ensure hydraulic safety as an essential quality of sustainable places, without specializing but rather integrating functions.

A few years ago, we carried out a study process called the Pistoia Ongoing Masterplan [14–17] on the little Tuscan city. The hypothesis to shift the design approach from functional separation to full integration of hydraulic works in a project of a multifunctional public space emerged with regard to an area located in the very first urban outskirts that

was planned as an urban park for several years but is still in waiting. So, we are now investigating that vision through a specific study.

According to Anne Whiston Spirn, research adopts the concept of deep structure [18], intended as the “structure that existed prior to human settlement and that continues to exist after human settlement” [19] as the main reference to “see” the park in the landscape features. It is an enduring structure that depends on physiography, climate, and the interaction of natural processes that are then capable of evolving.

Working with it means “define a vocabulary of forms that expresses natural and cultural processes; then encourage a symphony of variations in response to the conditions of a particular locale and the needs of specific people. The result should be a dynamic, coherent whole that can continue to evolve to meet changing needs and desires and that also connects the present with the past” [20].

Beyond the deep structure, most landscapes are also marked and connoted by fewer or more recent factors and processes that we can ascribe to a landscape transition structure. In the first half of the twentieth century, the area we are dealing with was also an airfield for warplanes under repair at the nearby factory San Giorgio. More than two decades after the Second World War a silent colonization began: a nomad Khorakhanè community established itself in the area, near the Brusigliano ditch. In the same years, a center of applied research was set up in a wide eastern area of the Pistoia plain for the nursery production, and it is now a private company of research and education for sustainability. Then, a Sinti community arrived, establishing itself in the western part of the area while Khorakhanè where partially moved within the southern part of the area with hydraulic risks, and went on to produce an unauthorized waste metal dump. Nevertheless, the landscape transition also occurred in the second decade of this century with an important change. A new hospital was built despite the fact that the area has special relationships between water and earth and is fully enclosed by a watercourse and infrastructures. If the impacts should have been better assessed, nowadays we have to consider also the social centrality of such a facility and the related issues of safety, accessibility and livability of the whole area. This is about the material transition of the landscape, but an immaterial issue also matters with regard to perceptions, visions, and planned assignments. For over four decades, the whole area has both been perceived as a marginal enclave of spaces and planned as a park. This plan was never implemented; therefore, the case is really challenging beyond the category of the urban park too.

Since the 18th century, the Ombrone stream has been held in a straight channeled course in the plain of Pistoia and downstream. Sometimes it breaks its embankments and floods the low plain. To cope with this criticality, the Regional Civil Engineering Department of Central Valdarno (RCED), which is the hydraulic authority in charge, planned some flood basins in the plain upstream of Pistoia. Then, the previous plan for the Arno River Basin has been conformed to the EU floods directive for the period 2015–2021, and now the authority is carrying out the first updating 2021–2027 [21]. The Pistoia Ongoing Masterplan experience led to the option of changing an inappropriate location of some planned hydraulic works to carry them out in the above-quoted area of the urban park, where a new hospital has also recently been built (2013) with related protection requirement. Given this frame, discussions started in the socio-cultural, technical, and political contexts, and between 2017 and 2020 there has been a slow leaning towards the vision of an urban park as a landscape-based solution fully suitable for hydraulic protection too. This experimental opening constitutes one of the first and fundamental results of the applied research carried out in recent years on this topic at the local level. It also lays the foundations for experimenting and then consolidating both a landscape design approach to the hydraulic defense of the territory, which for too long was considered sectorial, as well as to the design of a contemporary urban park.

The article is focused on the design process just developed to set down a sustainable layout of the places’ new hydraulic asset as a basic landscape identity of the future park. So, the research questions were about the quoted keyword “landscape integration.” Is

it possible to provide hydraulic protection without wasting space? Can a contemporary urban park also be a floodable multifunctional complex of open spaces? Can such an approach integrate landscape ethics and aesthetics?

2. Approaches, Methods, and Materials: Learning from the Landscape

Landscape architecture has both shaped ecologies and shaped places through ecology since its early expressions, providing visions of humankind and life to deal with many issues of sustainability. This is more a call for the evolution of human knowledge as a whole, beyond old divisions between humanities and sciences, rather than just a complex issue involving some sciences and related technologies, and landscape architecture is widely involved in such a cross-cutting process.

Among the experiences and positions that ground the approach and method of this research, some milestones may be related to the concept of learning from the landscape and its manifold functional capacities: the park of Sausset (Aulnay-sous-Bois e Villepinte, France) [22] by Michel Corajoud, the book “The Granite Garden” [23] and the concept of deep structure [18,19,23,24] by Anne W. Spirn, the Prairie Waterway Stormwater Park (Farmington, MN, US) and the book “A Landscape Manifesto” [25] by Diana Balmori, the Greenwich Peninsula Park (London) by Michel Desvigne and the book “Natures intermédiaires: les paysages de Michel Desvigne” [26] by Gilles Tiberghien, the book “Le jardin planétaire” [27] by Gilles Clement, the park of Saint Jacques de la Lande (France), and the book “Le territoire comme patrimoine” [28] by Anne-Sylvie Bruel and Christophe Delmar.

The main item of the approach of this research is designing habitats changes with regard to the landscape deep structural features to provide an essential basis of sustainability. It also concerns landscape ethics and aesthetics and although Western modernity has lost its ancient cultural coherence and correspondence [29], a movement is likely emerging with regard to the ethics of sustainability and contemporary landscape aesthetics. Elizabeth K. Meyer provided a seminal contribution [30] at this open discourse in the landscape architecture field. It is culturally revealing that a call to search for a new union of ethics and aesthetics in sustainability has even come from a scholar of physical chemistry, Enzo Tiezzi, with the exhortation “to be good to be beautiful, as much as possible” [31]. A question which, for example, the research conducted by Anna Lambertini tried to answer with a meaningful critical survey of European approaches and experiences both about urban beauty and parks [32,33].

This quick literary excursus, clarifying the references to the contemporary design culture, also allows to better understand the research approach that starts with the experimental and provocative assumption that “the park is already there, in the landscape” and must be revealed by shaping its ecology. The issue is not to turn the landscape into a park but to imagine which features of a park the landscape can express. In fact, the “how” of designing a landscape change is not leading with regard to “why” and for “who,” “where,” and “what” to design. Therefore, we started by understanding the site-specific features of the landscape, with the aim of involving its factors and processes rather than drawing up spatial compositions.

This simple assumption affected the methods of researching that aim to discover the park in the landscape by imagining structures, functions, and processes before shapes.

However, these latter are also important for human perceptions, behaviors, and well-being. So, which shapes are we looking to create by shaping ecologies in landscapes?

Diana Balmori wondered about this, and her position matters here, for the research by design method too. Nowadays, we have to discover new ways of designing the landscape based on a renewed understanding of nature and our role in it. A landscape project does not have to create order in nature: instead, it must shape our relationship with it. Our aim should be to create or re-establish such a connection [34].

With regard to all the above-mentioned approaches, we propose a guide for the design process: join functions in spaces, do not split them up! So, three complementary goals were taken into account with the general aim of learning from the landscape how we can

meet our changing needs and create sustainability by multifunctional open spaces. First: basing the research on the deep structure of the landscape, according to Spirn [18,19,23,24]. Second: avoiding the technocratic shaping of landscapes, according to Corner [13]. Third: putting the city in nature, according to Balmori [25]. To address the three goals of the stated design approach, we employed methodologies that go under the macro categories of “Action research” [35] and “Projective design” [36] both used to investigate, from a landscape architecture perspective, some scientific issues briefly outlined in the previous paragraph, and integrated within a recursive process [35].

The immersive experience carried out by the research group (Figures 1 and 2), enriched the bibliographic, iconographic, and cartographic research and provided data for the precise recognition of the current state of the places and for the characterization of this portion of plain forgotten for years both by planning and people.

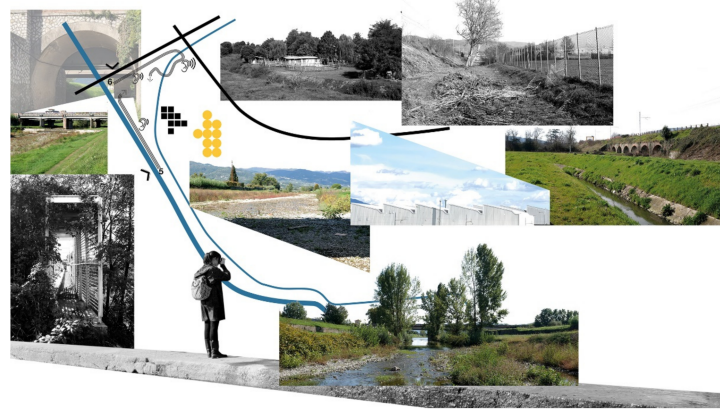


Figure 1. Sample of the photographic tale resulted from the immersive surveys carried out to look for the park in the landscape (2020, Landscape Design Lab, Department of Architecture, University of Florence). This practice of immersion in the landscape has contributed to multiple analytical phases (characterization of the landscape, recognition of Table 35 as stated in the introduction).



Figure 2. Samples of the photographic tale resulted from the immersive surveys carried out to look (2020, Landscape Design Lab, Department of Architecture, University of Florence).

Secondly, it made it possible to work on the imaginary of the park, first as a functional act to reveal its immanence in the landscape.

Still within the methodological framework of action research, we held several meetings with the RCED, technicians of the municipal authorities for urbanism and the public realm, and the management board of GEA s.r.l., a private company owning a park of over 20

hectares adjacent to the public areas of the urban park. These meetings were very important as they were phases of elaboration of design-orienting scenarios (DOS) or rather a “set of motivated and articulated visions aimed at catalyzing the energies of the various actors involved in a design process to generate a common vision between them and, hopefully, to make their actions converge in the same direction” [37]. Specifically, meetings have contributed to outline “focus DOS” [37] or rather to the convergence of the actors group towards a common vision.

Through these moments we aimed to foster the future formal process of landscape master planning and design, and in 2021 a formal meeting with local, regional, and ministerial public authorities allowed to discuss the hypothesis of a public park with functional properties suitable for an effective hydraulic protection.

According to the recursive process mentioned above, these, which we could define as convergent phases of the design process, have been interspersed and supported by as many divergent phases, which have seen the creation of “exploration DOS” [37] through a “research by design” [36,38,39] process.

Inscribed in the broader methodological framework of projective design, the research by design approach is defined “(...) as the development of knowledge by designing, studying the effects of this design, changing the design itself or its context, and studying the effects of the transformations” [39].

This process, benefiting from the direct involvement of the RCED hydraulic engineers and geologists, was carried out in a synchronous way [36], with the elaboration of alternatives and comparative analysis of the effects, and produced what we have defined as Exploration DOS (F Starting from the understanding and identification of the deep structure of this landscape, also achieved through experiences of action research, the research by design process made it possible to prefigure, discuss, and test sustainable transformations to fulfill the research questions.

The scheme in Figure 3 intends to provide a systematization of the process followed as well as of methodologies used in this research, which should not be considered closed or exhaustive. Precisely because of the philosophy that inspired both the action research and projective design, it is in fact an open and implementable model.

Given the general approach described so far and the two methodological frames used, we are already able to anticipate something about the future phases of the research, as they seem to be relevant here to complete the framework of specific research methodologies necessary to substantiate above all the third of the complementary approaches declared. Everywhere as in this park, two main fields are really close connected: soil–water relationships and vegetal changes. Soil is the ecological interface through which the park growth is imagined in space and time. Therefore, it would be relevant to carry out three main surveys, about pedological features, landform, and vegetal species. On the basis of such a dataset, relevant advancements of research could be carried out through both a detailed parametric design of the landform and a time-related model of vegetal management. A dynamic identity of the park would emerge, making change perceptible as the essence of life also in the urban landscape.

Finally, it may be useful to clarify the type of data and sources we found and used so far in this research. Scientific literature on the natural and cultural local history were used to understand the landscape and to imagine sustainable future changes by looking at its past. The historical landscape iconography is also meaningful for both understanding and imagining landscape changes (Figure 4). Contemporary information sources grounded the process with regard to both general and sectoral territorial plans and data on the landscape state and dynamics with specific focuses on the site and the adjacent areas. An original revised detailed representation was carried out by merging and processing available data (Figures 5 and 6) and drawing up a plan on a 1:2.000 scale (Figure 7). Furthermore, we developed a systematic photographic survey that updated in 2020–2021 our 2014–2016 archive [14–17].

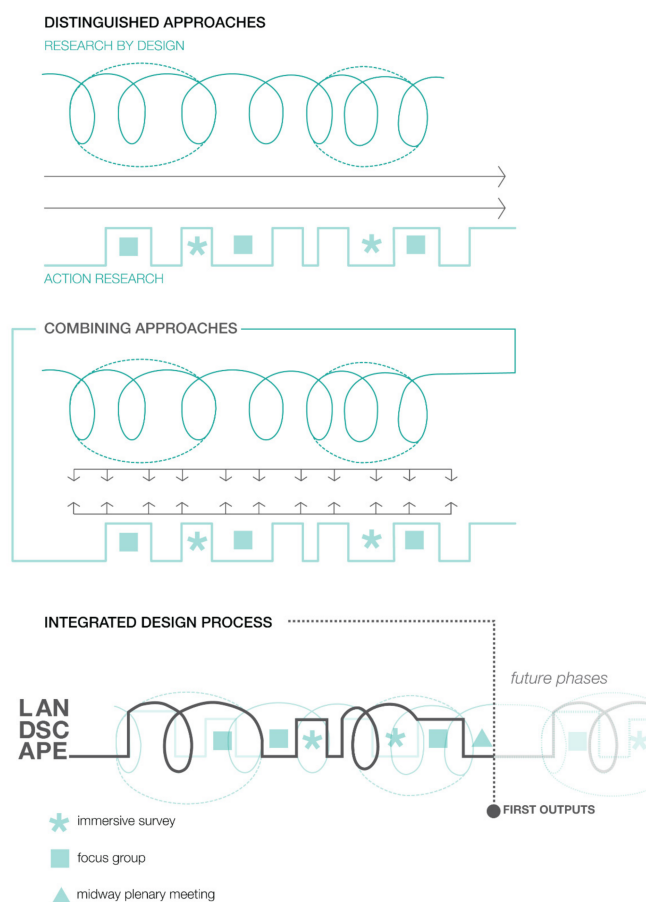


Figure 3. Methodological outline of the implemented process of research. The selection of two or more complementary approaches (top scheme) and their combining (middle scheme) allows to carry out an integrated design process (down scheme) getting specific outputs (2021, Landscape Design Lab, Department of Architecture, University of Florence).

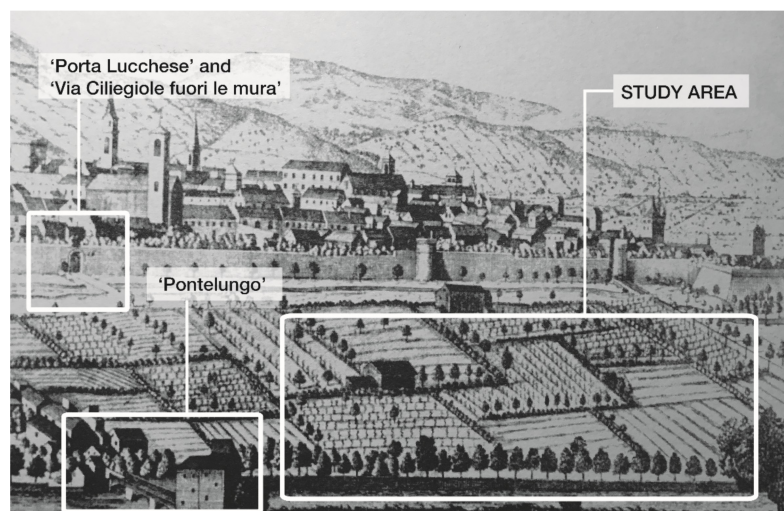


Figure 4. The landscape of the case study in the eighteenth century (source: F. B. Werner, about 1745. In: Lucarelli M., 1995, Iconografia di Pistoia nelle stampe dal XV al XIX secolo. Comune di Pistoia, Pistoia). The iconographic research and study of the perceived image evolution of this territory portion over time is among the techniques used to understand and define the profound structure of this landscape.

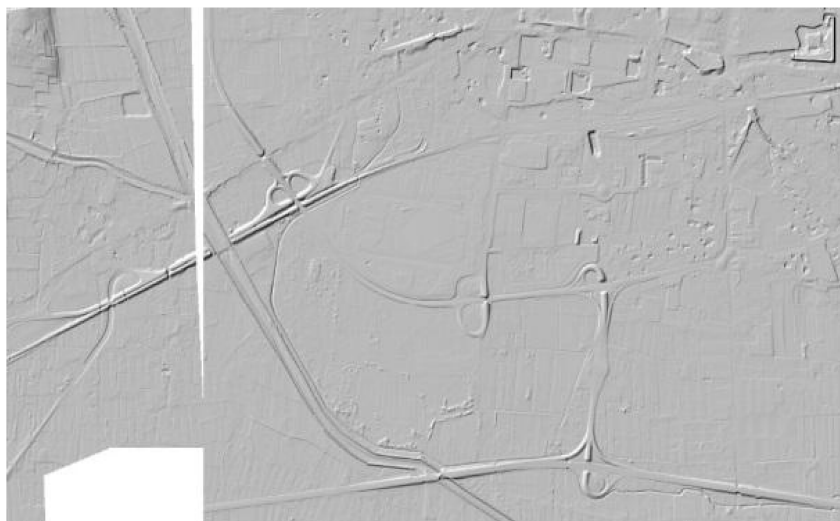


Figure 5. Studies of the landform (2020, Landscape Design Lab, Department of Architecture, University of Florence).



Figure 6. Studies of the landform (2020, Landscape Design Lab, Department of Architecture, University of Florence).

3. Assumption and Results: Design-Orienting Scenarios for San Jacopo Park

Among the first results emerging from the integrated design process, we produced an updated cartography of the places (Figure 7). A sensitive map whose composition made extensive use of the data resulting from the immersive experience of action-research. This because the available institutional knowledge base was completely insufficient to know the precise evolution of the forms with which the anthropic and plant communities inhabit the places. We mentioned the fact that this area has been for a long time forgotten and marginalized both by the population and planning at different scales. Among the results of this abandonment process there is the inheritance of blurred images, partial data, incomplete maps, superficial descriptions, and approximate definitions with which we have been confronted. The various activities carried out by the research group both in the action-research and in research by design phases, made it possible to refocus this area, producing updated data and a new knowledge base. Intervening on the fragmentary cartography, with updates, checks, and revisions, to compose a single map was a fundamental step in recomposing, even on an immaterial level, the entirety of this place and highlighting the unity of this landscape. Read in the operational context of converting the design approach

from functional separation to integration, this operation also reveals its importance in terms of communication. This area must be conceived as a large continuous public space, a multifunctional park, and not as a disjointed mosaic of spaces with specialized functions.

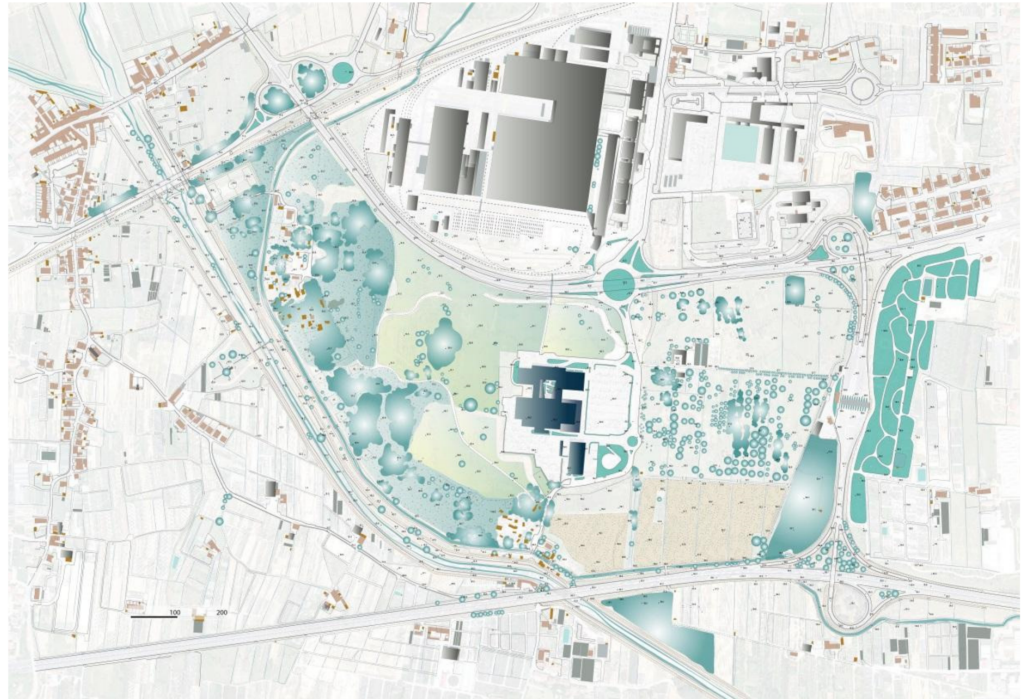


Figure 7. Planimetric representation of the landscape in the site of research (2020, Landscape Design Lab, Department of Architecture, University of Florence—original scale 1:2.000). Updating the cartography and the knowledge base was among the first important results of getting closer to places.

Sharing the quoted James Corner’s critical view of the common technocratic domain of design and conscious that an effective dissemination may be crucial not just with regard to the scientific literature, we started the above-mentioned research by a design process with hydraulic and civil engineers and geologists of the RCED to cross-cultural vision and technical approach barriers. The process had begun from the sharing and discussion of the deep structure of this landscape whose characteristics and functioning are strongly characterized by the presence of waterways and by the geomorphology of the places. Taking advantage of what emerged from the landscape analysis (landscape characterization, study of historical perception, and the results of immersive investigations) and from the hydro-geomorphological ones (flood risk dataset and hydraulic modeling of the area), we identified natural or anthropic factors and processes that make up the deep structure. On this base, some simple schemes about possible changes of the landscape (Figure 8) were developed and compared by crosscutting technical discussions aimed to select the best options to test through hydraulic parametric modelling. These schemes resume the “Exploration DOS” [37], and they must be conceived as hypertexts: they are the extreme synthesis, sought precisely for dialogical and procedural purposes, of a study that is always transcalar and transdisciplinary. In fact, during the research, each proposed and investigated structure was accompanied by studies by both parties involved (LDLab and hydraulic authority) including technical drawings, modeling, sketches, renderings, and photo simulations. The analysis of natural features of the landscape’s deep structure highlighted a main constraint: protecting the water-bearing stratum means not digging. This is a landscape issue because it affects the environmental, social, and economic aspects of resource management and can address human actions.

Therefore, the protection of underground water became a landscape quality objective for strong forward-looking actions according to the European Landscape Convention, an

issue that concerns social perceptions. The more people understand the reasons behind a landscape project the more they understand the places involved, which can be perceived as identity and cared for as heritage. The position we propose is more a scientifically based starting point rather than a deterministic outcome.

Other aspects could be considered even with regard to sustainability. For instance, not digging has at least two implications: the hydraulic works will require earth from other sites and produce embankments some meters high on the soil surface. While embankments provide opportunities in terms of visual connotations and enjoyment of the future park rather than constitute a problem, it is clear how the sustainability balance can be affected by environmental and economic impacts due to the need for over 250,000 cubic meters of earth. The issue has at least three focal points. A hospital and other settlements in need of protection have been built in a floodable area. A high water-bearing stratum needs to be protected against the risk of pollution due to surface human activities. As the balancing lake must store water above the soil, the demand for earth cannot be met on-site. Therefore, the comparison of the park articulation options, between the floodable and the protected fraction, led to the definition of the hypothesis represented in Figure 8. Several issues influenced the design, first of all the need to have a floodable area of about 20 hectares for a maximum reservoir volume of about 700 thousand cubic meters, corresponding to that of the hydraulic work previously envisaged upstream this area. This aspect immediately assumed importance due to the conditioning presence of the hospital complex and the nomad settlements that the municipality needs to preserve in the area.

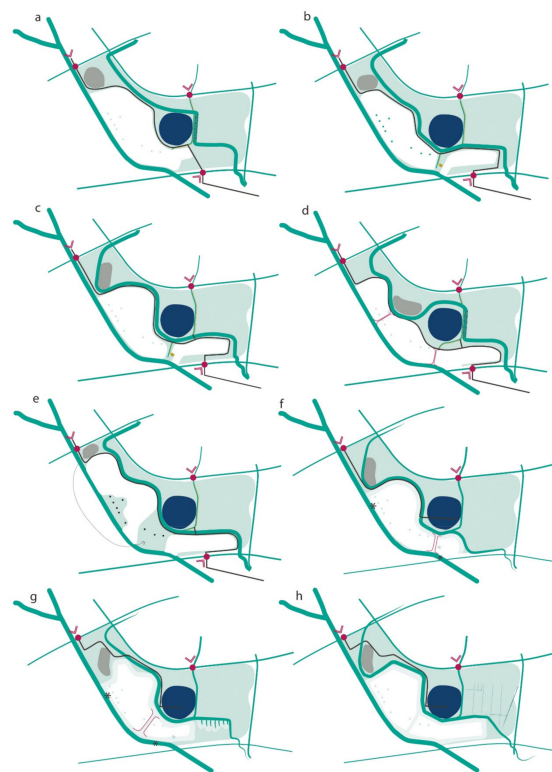


Figure 8. Mosaic of the Exploration DOS synthesis schemes, showing the park's structure in the prefiguration of its integrated hydraulic performances. In blue, the area occupied by the hospital; in turquoise with greater thickness, the watercourses; in turquoise with less thickness, the road network that delimits the park; in black, the hospital emergency road network; in magenta, the park's main entrances; in white, the river basins; in gray, the settlement of the nomadic Korakhané community (May 2021; Landscape Design Lab, Department of Architecture, University of Florence; Regional Civil Engineering Department).

Furthermore, the extension of the floodable portion of the park influences that with protected and mostly drained spaces. Finally, the aforementioned incidence of land needs for the construction of embankments must also be considered among the main elements. The volume relating to the hypothesized configuration would increase significantly with a greater extension of the hydraulic expansion areas, weighing in environmental and economic terms on the sustainability balance of the works.

The outcome of this integrated design process resulted in the sharing of a park layout hypothesis (Figures 9 and 10) capable of best contemplating the multiple needs and requests of a hydrogeological, environmental, social, aesthetic, ethical, and economic nature. The result is a structure that knows how to welcome change, biodiversity, and the variety of possible interpretations and uses of the living beings that inhabit it, a democratic space. The work carried out on the deep structure made it possible to understand the intimate nature of the places and the dynamics of the systems' behavior, bringing out some evidence that then influenced and guided choices and design studies.

These and other research results become an important asset for the design process and precise definition of the strategies and steps necessary to carry out the transformation, made available to all the interlocutors with whom the group has interacted: the hydraulic authority, the Municipality of Pistoia and the present stakeholders.

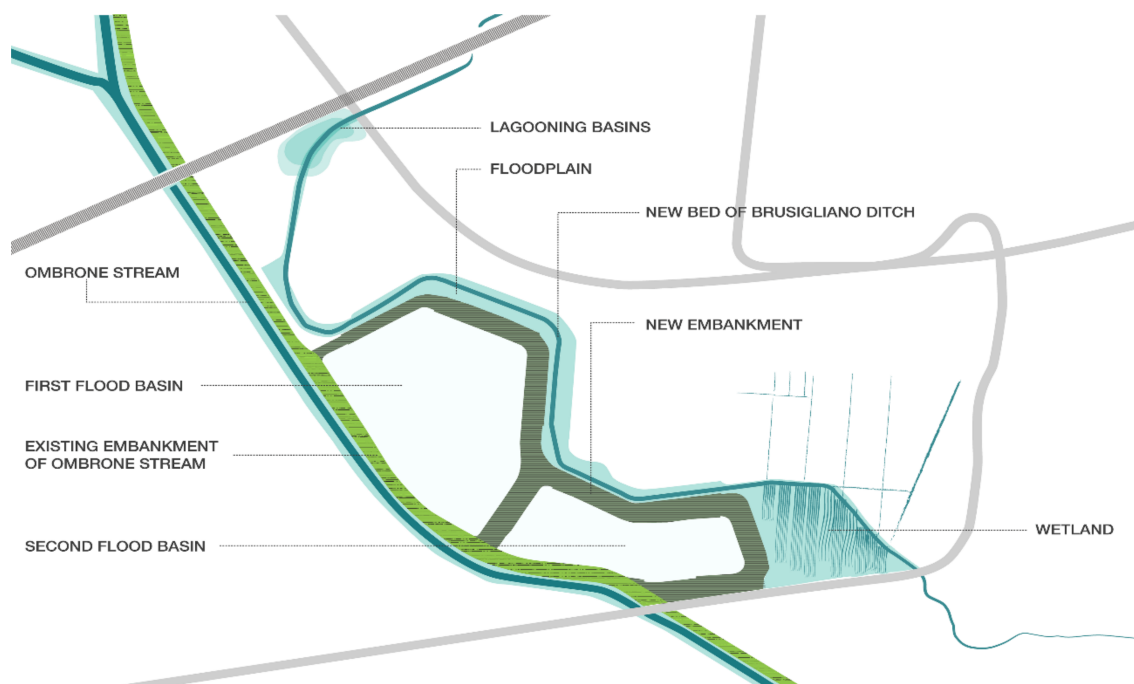


Figure 9. A scheme of the hydraulic hypothesis of change. This is the outcome of the research by design process conducted with the hydraulic authority starting from the investigations carried out on the landscape deep structure of this site (ongoing; updated at 2021, May; Landscape Design Lab, Department of Architecture, University of Florence; Regional Office of Civil Engineering).

Using design as a crosscutting tool of dialogue with geologists and hydraulic and civil engineers about the first and the second main topic of research stated in the previous paragraph, the cooperation led to a hydraulic hypothesis with two flood storages for high water related to the Ombrone stream. The separation into two basins is because the soil surface slopes about 6 m in height. From the outset of the process, the research stressed the hydraulic requirements and the hydrogeological constraints, in addition to the aforementioned design concept of discovering “the park -in-” the landscape instead of putting “a park inside” it. In fact, the goal is to not split up the space, as in such a hypothesis the park would be smaller to grant functional specialization to the flood management area

just for a few days of the year at most. Learning from the flexibility of the landscape, we can shift the vision towards a partially floodable public park.

With regard to the “low waters” network, a new course of the Brusigliano ditch has been planned outside the flood basins of the Ombrone stream. In the southeastern part of the area, a small wetland has been imagined in spaces subject to stagnation to provide ecosystem services: purifying water together with the new watercourse upstream, offsetting the risks of flash floods due both to the ditch and hospital facilities (Figures 8 and 9).

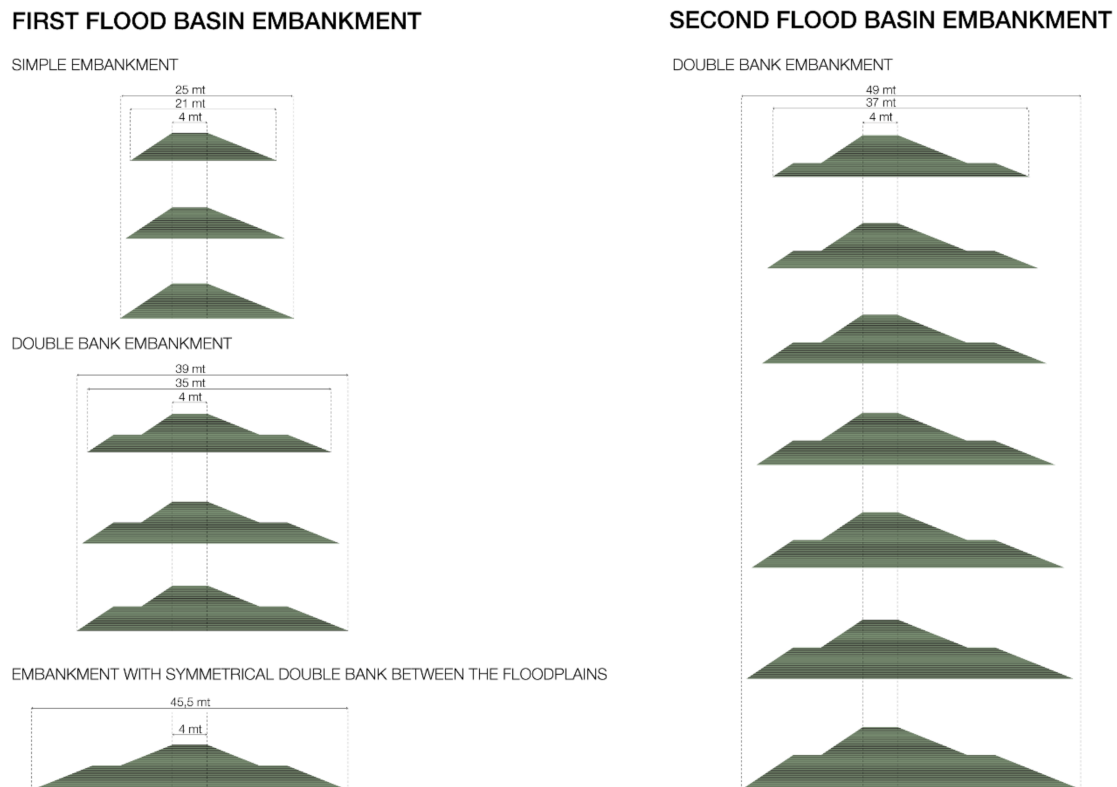


Figure 10. Typological study of the minimum resistant sections of the embankments including park routes according to the configuration hypothesis shown in Figure 9. (2021, Landscape Design Lab, Department of Architecture, University of Florence).

4. Discussion: Shaping Ecology

In the Pistoia plain, the landscape has been built and shaped for a long time by a Plio-Pleistocene basin that has been filled by stream and lake deposits. The Ombrone stream and its tributaries then operated a natural process of erosion and accretion of detritus, which again changed the landscape of the alluvial plain. However, the main natural factors and processes of the deep structure changed the landscape and at the same time preserved it. The human sedentarization processes have changed natural landscape by draining and reclaiming wetlands, to provide agriculture fields, roads, and settlements: the last drainage works were carried out just a few centuries ago (Figure 4). Because of such a deeply layered structure, nowadays, life on the plain again depends on both natural and cultural interacting factors and processes. The watercourses of two networks named “low waters” and “high waters” flow on the plain: the first one is made up of the Ombrone stream and its tributaries, while the second one includes all the ditches and field drainage systems. These networks have anthropogenic hydraulic separations in the part of the plain we studied because the riverbeds of the first watercourses are often higher than most of the surrounding fields, buildings, and roads. The waters of both these networks have natural underground relationships in wide and rich water-bearing strata. The tops of these water tables are close to the soil surface, so the waters are vulnerable to pollution, and thin earth

strata provide their environmental protection. With such functions, the landscape features are indicators for sustainable changes. If designing the park means shaping the ecology of the place, by reading the landscape, we also see how its ecology can shape the park: it is the other side of the same issue. Therefore, the creative loop triggered through the integrated design process drives to shape the ecology of the place and to shape the place through ecology, neither with linearity nor with a direction, but rather through an iterative and investigative imagination.

The landscape design position plays an essential role in shaping the ecology of the places involved, not just about the properties of the new watercourse but more widely for most of the park. Our aim was to foster the process of design with regard to the exhortation of Diana Balmori: “we must put the Twenty-First Century City in Nature rather than put nature in the city” [25]. Looking at natural systems, we can make our habitats more and more ecologically efficient so they are less subject to environmental, social, and economic weaknesses. As shaping ecological changes by learning from the landscape first means taking into account its deep structure, the park’s new ecology could not be natural but nature-based because of the layered cultural constraints. In fact, this landscape has been subtracted from the water domain in order to host human habitats. Therefore, the issue is incorporating the human features of the landscape in nature and not returning it to nature. A meaningful planned landscape change would act as the barrier between the high and low water flows. This work represents an opportunity to shape the ecology of the park: it allows developing two wide areas with humid soil suitable to become wet sometimes or also flooded. In terms of both the accessibility and visual enjoyment of the park, the hydraulic embankments become a high-line with pedestrian, cycle paths, and panoramic resting points (Figures 11 and 12). Furthermore, these earth works can enrich the spatial diversity and morphology of the park, both in the semi-wet places inside the flood basins and in the drained ones beyond the embankments, in the low water landscape.



Figure 11. A view of the small wetland planned in the south-eastern area (2021, Landscape Design Lab, Department of Architecture, University of Florence).

Therefore, understanding and enhancing the landscape ecology of a site through the project, as we experimented working with the deep structure of the park, means not just preserving its biodiversity or its degree of naturalness, because even a strongly anthropized landscape has its own and authentic ecology. It means understanding the spontaneous

dynamics of change and reaction of ecosystems (whatever their degree of artificiality) and envisioning interventions capable of relating to these systems, modifying them while continuing to guarantee their ability to evolve spontaneously. This means giving them sustainability and thus producing a new ecology, adapted to new needs. The ecological approach is not necessarily naturalistic, as ecological and natural do not mean the same things. Shaping ecology is a dynamic work, and it must be understood as a process that goes beyond the sectoral notions of the design, implementation, and management phases and conceives them all as immanent, connected, and cyclical.

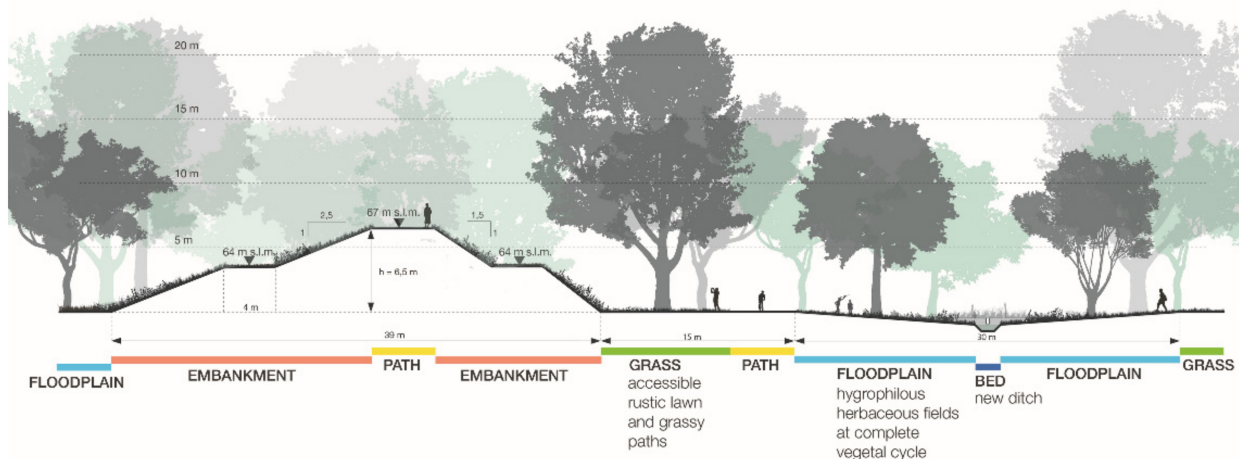


Figure 12. A sample of the main embankment studies of hydraulic protection and its relationships with a safety path for the hospital close the new course of the ditch Brusigliano (2021, Landscape Design Lab, Department of Architecture, University of Florence—original scale 1:200).

5. Conclusions: A Landscape-Based Framework

The results of the integrated design process show that through a landscape approach it is possible to provide hydraulic protection without wasting space. Indeed, this is capable of generating a double benefit: on the one hand, it provides for the full integration of the hydraulic work in the context without the need for additional mitigation or compensation works since the work itself possesses all the structural compatibility requirements; on the other hand, the functional integration multiplies the public open space, making it usable for most of the year and giving it a degree of morphological variety with interesting aesthetic implications. While sectoral splitting approaches are dissipative, a landscape-based joining vision can address the design process to create multifunctional changes that meet environmental and social needs, with safety requirements also taken into account.

The research provides a landscape-based outline of the park close to sustainability that expresses a critical position on the design problem with an approach focused on the functional integration of open spaces.

A nature-based thinking rather than a set of nature-based solutions allows to ground the design process of public open spaces, in this case a new urban park, on the natural deep structure of the landscape they belong and on the ecological dynamics that it expresses. Such a vision is neither environmentalist nor naturalistic but rather an inspiring approach to shape ecologies by designing. A further positive effect of functional integration is found in the management and care of the places. Lived as an open, public, and multifunctional but unitary space, this area returns to being entirely accessible and experienced both by people and by living beings in general. In addition to being a new fulcrum of biodiversity, it is more easily offered for care and maintenance.

Based on these results, the case of Pistoia demonstrates how designing public parks in the city of the 21st century can be an opportunity to respond effectively to the hydraulic and hydrogeological protection of the territory and more generally to the challenges imposed by global warming, with positive systemic implications.

In our vision, achieving sustainability establishes new relationships between ethics and aesthetics by looking at and working through ecosystems.

As everything and everybody is connected through the landscape, we strive to join instead of split up places and their environmental and social properties. As Jordi Bellmunt wrote, this kind of design is effervescence, strain-controlled by the rigor of investigations and the ethics of wishes, it is necessary and increasingly attractive [40]. Each landscape is an open and changing source of knowledge and inspiration, but at the same time, it is a particular set of places of imagination and action. Looking at site-specific relationships between natural and cultural factors and processes inspires and can drive landscape design towards sustainable visions of change. This seems like a path towards a new union of ethics and aesthetics, but just striving to design good and beautiful places as far as possible matters for the present and the future. Among the results that this research is gradually producing, there is therefore also a new cultural vision of the urban park in the city of the 21st century. We speak of political vision as it testifies to the opportunity to build spaces that possess and transmit a new union of ethics and aesthetics and that not only claim their active part as subjects in building reality but that even promote the transition towards an ecological development model. The urban park acquires the important role of actor of change, space, and opportunity to inaugurate a new relationship with nature, propelling place for a new model of sustainable, circular, ecological, and democratic development.

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