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landscape research

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AIM

The aim of the Journal of Design Studio is bringing different design studio researchers together on a multidisciplinary design studio research platform. This design studio research platform gives the researchers who made experimental studies in their design studio education to share their works with the other researchers in the same area or similar research fields. The scope of the Journal of Design Studios include all research and experimental works realized in all type of design studios.

SCOPE

Design studio pedagogy,
Design theories and methods for studio works,
Architectural design studio education,
Design principles for studio work,
Product design studios,
Interior design studios,
Urban design studios,
Landscape design studio,
Communication design studio,
Graphic design studio,
Media design studio,
Fashion design studio,
New trends in design studios,
Virtual design studios,
Design thinking,
Studio culture,
Studio teaching,
Innovative and creative works in design studios
Quality assessment in studio work,
Collaborative design studies in design studios,
Integrated design studio,
Design studio practice,
Design practice,
Design research,

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SPECIAL ISSUE “LANDSCAPE RESEARCH”

Contents:

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Editorial
"Landscape Research" special issue

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Dear Colleagues,

We would like to welcome you to "Landscape Research" special issue of the Journal of Design Studio. Journal of Design studio is a juvenile journal which constituted under the leadership of Prof. Dr. Orhan Hacıhasanoğlu and Dr. İlgi Toprak and well substantially succeeded. I consider it a great honor to be the invited special issue editor of this special issue and would like to thank and express my gratitude to Chief editor, Prof. Dr. Orhan Hacıhasanoğlu and associate guest editors; Dr. Kaan Özgün and Dr. Dinemis Aman for providing the support and feedback necessary to find, develop, and publish material of such consistent high quality.

As the world reaches the limits of natural resources, humankind must become more responsible than ever before. Landscape research special issue is focusing on the subjects related with hazardous results of climate change, management of the risks and taking actions on those subjects. Besides the educational panel of the landscape research is another important subject that should be tackled since including the basic root of the education methodology and creating sensitivity for the way of thinking of humanity. There is a great need for an interdisciplinary mechanism by which research and expert knowledge can contribute to effective solutions clearly, this is why we have decided to embark in the special issue of this journal through an ecological planning perspective.

The scope and the brief content of the valuable papers that are published at this special issue are explained briefly below. The study with the title "Recording Landscape Education: Research-Based Design Studio Approach" is trying to answer two questions that are 1- How can landscape memory be used in design education; 2- How can a research-based design studio pedagogy be conducted on this approach? This paper uses a research-based design approach in landscape architecture education to decode and recode the memory of the landscapes in the design process. Covering these two approaches, the research-based design studio expresses the discovery of the knowledge through a strong research process. The results are come out as implementing a research-based process ensured a place-based and innovative perspective to shape a design concept. Using the pre-specified landscape memory model empowered the research phase and helped students to analyze and discern the place with their own perceptions.

In the other valuable contribution with the title "Disaster Awareness and Education-center Park: Design Investigation of Outdoor space on Graduation Project of Architecture Students"; has an original evaluation and classification methodology. Project designs are evaluated on the

subjects of both spatial and functional criteria and their sub criteria from the aspect of disaster areas.

The study titled "Around Water: A Research-Based Landscape Design Studio" is including water-based case studies produced around the world from cisterns to sinking cities, from basins to water footprints, from the value of holy water to its technological aspect with game design; enriching the outputs and creating cumulative studio knowledge.

The study titled "Design practices for flood resilience in Istanbul: Case of Kadıköy waterfront" focuses on physical measurements to adapt Istanbul to the effects of coastal flooding. In this regard, the paper aims to develop site-specific spatial design proposals as possible measurements to increase Istanbul's waterfronts capacity for a practical flood resilience approach. This paper also handling the flood management in case of storm events and tsunamis that are intensified through climate change.

The last paper titled "New approaches on urban agriculture: a case study in Ataköy" discusses the urban agriculture practices in the context of sustainability through examples from Ataköy in a comparable style. Idle industrial areas or vacant lots and urban agriculture potentials are examined based on the R-URBAN strategy through methodologies of literature review and feasibility and field studies that carried out in Ataköy. A scenario produced and an implementation model has been developed for Ataköy in the context of urban agriculture at the basis of R-URBAN strategy.

We are proud to present our special issue on the theme of Landscape Research. I would like to thank all of the authors and reviewers and valuable academicians who have devoted much energy to a sustainable future.

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Recoding Landscape Education: Research-Based Studio Approach

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Abstract: The landscapes and the memory of the landscapes are evolving with natural and human-centered activities. In some places, landscapes continue to reveal their memory ecologically, socially, and culturally. On the other hand, in some places, landscapes lose their ecologic and socio-cultural archive as a result of globalization. This issue causes to emerge fragile landscapes according to lack of water resources, global warming, a decrease in biodiversity. Preserving the memory of landscapes and using it in the practice of landscape is a deeply crucial issue. The paper tries to answer two questions: How can landscape memory be used in design education? How can a research-based design studio pedagogy be conducted on this approach? This paper focuses on the research-based design approach in landscape architecture education to decode and recode the memory of the landscapes in the design process. ITU Landscape Architecture Department 2019-2020 Fall Semester Landscape Design Studio I-II, which is the case study of the research, worked in Savur, Mardin. The study area provides unexpected landscape carpet including browns and greens together in the valleys of the region that have a rich social and ecological structure. The methodological process of the studio was based on the three approaches which are integrated into each other: The Landscape Memory Model, Action-based Design Studio, and Research-based Design Studio. The model provides a guide for reading the memory of the landscape with various memory codes hidden under the visible and invisible values of it. This core process is used by the students for understanding the cultural and ecological values of the study area and implementing them into the design process. The action-based studio approach allows the tutors to find the problematic points in the design process of each student and resolve them in a positive way. Covering these two approaches, the research-based design studio expresses the discovery of the knowledge through a strong research process. The results are as followed: Implementing a research-based process ensured a place-based and innovative perspective to shape a design concept. Using the pre-specified landscape memory model empowered the research phase and helped students to analyze and discern the place with their own perceptions. Action-based flow allowed the instructors to leave the conventional studio performing and helped to use in-situ (special to the studio) instructing techniques within the semester. This paper may be influential for especially landscape design studios and relocate conventional studio approaches with more flexible and progressive techniques to understand the place and beyond.

Keywords: Landscape design studio, landscape design education, design pedagogy, research-based design, landscape memory.

1.Introduction

The landscapes are evolving with natural and human-centered activities such as erosion, wildfires, drought, floods, urbanization, intense cultivation and over irrigating, policy interventions and local actions (Stahlschmidt,

Swaffield, Primdahl, & Nellemann, 2017). Global crises enable us to come up with new solutions in the way of designing and understanding the landscape. In addition to the evolution of the landscape itself, the memory of the landscape is also constantly changing, since the landscape includes natural and human-based activities. However, these activities continue to be carried embedded in the landscape, providing no written evidence (Hoskins, 1955), and continuing to build the palimpsest on an ongoing basis. The unique character of the landscape comes from the tangible and intangible morphology of this multi-layered memory. As this morphology begins to break away from its buried memory layers, it turns into a fragile structure; besides creating a landscape crisis that is affecting people in a way of feeling displeasure (Antrop, 2013). Therefore, the proposed design approaches should include holistic readings of landscape memory. This reading will enable the creation of resilient landscapes, ensure sustainable water management and store fragile habitats. On the other hand, they will also ensure that human-based memory codes are carried into the future. Thus, place identity, sense of place, and local designs will be created. The design education needs to evolve with the landscape itself from the perspective of students and instructors. The education in landscape architecture should combine different issues (ecologic, aesthetic, ethical perspectives) and approaches (pedagogic and practical perspectives) and make them theoretical and practical attendees of the studio (Freire, 2013). The research on the landscape architecture education focuses on the historic process of the landscape discipline and implementing this knowledge to the design education (Jørgensen, Stiles, Mertens, & Karadeniz, 2020; Treib, 2006), representation techniques and their advantages in landscape education (Montarou, 2006; Schön, 1988; Swaffield & Deming, 2011), and pedagogical approaches (Keswani, 2019; Milovanovic & Gero, 2020; Salama, 2007, 2016, 2021). These studies also try to combine different approaches in other disciplines and creates different possibilities for the future studies. At this point, the main research question of the study is how to implement multi-layered landscape memory into design studios as a design problem. The aim of this study is to seek an answer to the question of how the tangible and intangible layers of the landscape memory can be used in design education, to form a research-based landscape design studio pedagogy and share its outputs.

The ITU Landscape Design Studio I-II included 24 undergraduate level students. The "Memo-Structural Landscapes" studio was formulated as a case-study to conduct to answer these questions; How multi-layered landscape memory can be integrated to design studios as a design problem? How can a research-based design studio pedagogy be conducted on this approach? The title of the studio was selected as "Memo-Structural Landscapes" (Figure 1) and focused on a small town in southeast part of Turkey, Savur-Mardin. The cultural landscapes of Mardin is in the tentative list of UNESCO and Savur is announced as an urban protected area (Tunçer, 2013).The project area hosted various civilizations in the historical process. The daily life in the town was shaped by the buildings compatible with the natural topography of the place, living spaces arising from the intersections of the buildings, and traditional production methods coming from the cultural and social past, spatial organization shaped by climatic conditions. Topography, climate, accessibility of the natural resources, religion, community life, privacy, aesthetic and building elements have been the main basis of the settlement fabric (Halifeoğlu & Dalkılıç, 2006; Karagülle & Demir, 2010). Thus, Savur offers unexpected potentials to understand the place and landscape, reading the memory of landscape and experiencing the contextual space-making practices. With research-based design approach it is aimed to unbury these potentials and understand all of the interrelations between different potentials. This approach was needed to preserve, heal and sustain the structure of the town enriched by natural and human-based activities. The title of the studio, thus, comes from the buried memorial strata under the visible and invisible, tangible and intangible aspects of Savur.

Including rich landscapes in the meaning of ecologic, economic and social structures, the project area matched the concept of the studio marvelously.


the
SAVUR GAZETTE

Memo-Structural LANDSCAPES

2019-2020 Fall Semester
Landscape Studio I-II
Assoc.Prof.Ebru Erbaş Gürler
Landscape Architect Cemil Aktaş
Res.Assist. Arzu Güler

Savur, Mardin is selected as a project area for the 2019-2020 Landscape Design Studio I-II.

Savur hosted various civilizations in the historical process. The daily life in the town is shaped by the building forms are compatible with the natural topography of the place; living spaces arising from the intersections of the buildings; traditional production methods coming from the social life. For this reason, Savur offers an important potential for understanding the relationship between place and landscape, reading the memory of landscape and experiencing the contextual space-making practices.

Edward Ted Relph, Place and Placelessness

"The transformation of a piece of land by human hand into a place and gaining a physical and visual form shows itself in the landscape."

Between Nature and Space

Landscape memory refers to the memory records of a landscape. In this sense, for example, natural memory codes (geomorphology, climatic history, flora traces formed after a flood etc.) and anthropogenic memory codes (architectural structures, natural walkways, place names, oral history, art products etc.) refer to memory codes of a landscape.

The natural and cultural memory structures help us to read a landscape together. Because landscape reflects the entire cultural activites between nature and space. These records are also important inputs for our design practices. Because the existence and continuity of these memory records increases the place attachment and sense of the place.

Important Dates

Site Visit
23-28 September

Juries and Submissions

İstanbul
Mardin

1st Submission: 15 October 2019
1st Jury: 1 November 2019
Sketch Exam: 26 November 2019
2nd Submission: 3 December 2019
Final Jury: To be announced

Workshop
23 September
Experiment with Watercolor

Figure 1: *"Memo-Structural Landscapes" Studio Poster*

2. Research-Based Design Studio Approach

The design studio structure has three-components: the landscape memory model at the core, the action-based design studio that covers it, and the research-based design studio that builds the shell (Figure 2). The *Landscape Memory Model* is a guide for reading the memory of the landscape with various memory codes hidden under the visible and invisible values of it. The model was proposed by Güler and Eşbah Tunçay in 2019. While it enables revealing the unique character of the landscape through natural and human-based memory codes, it provides design practices to be more place-based, full of place-identity, and resilient for the natural crisis by using the memory codes (Güler, 2019; Güler & Eşbah Tunçay, 2021). The action-based design studio approach expresses the expectations, outputs and new actions through them during the studio. The actions taken at the points where students have difficulty aim to build an uninterrupted design process. The research-based design approach, on the other hand, forms the main structure of the studio through the landscape memory model and the action-based design approach.

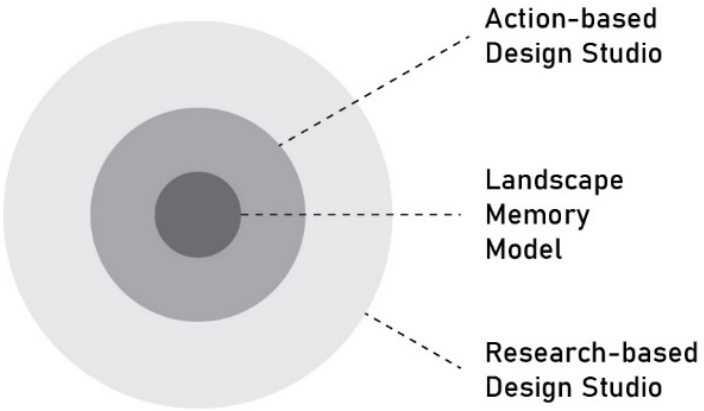

Figure 2: *Diagram of the Research-Based Design Studio Approach*

For landscape memory model, reading the memory strata and researching the codes of landscape forced the students to look for not only the existing situations but also for the past and then think about the future. Students used the model as a guideline for reading the memory and as a basis of the design idea. They studied the origin of the place-names, cultural background and outputs, land-use practices and place identity, climate, hydrology, geomorphology and biodiversity in Savur. The essence of the model is to encourage users to combine different research titles and make assumptions on them. Thus the model encouraged students to think about the design styles and enabled the students to come up with instinctive analysis and unique design concepts.

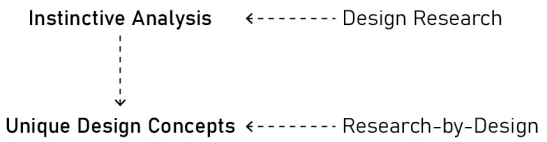

Figure 3: *Methodology of the Landscape Memory Model*

The action-based studio approach basically consists of identifying the points where the student has difficulty in building concept and implementing it into the design with scale transitions and improving the problematic points through instant activities. Three main forms of action spanned the period: Pop-up Events, Self-Media Approach and Pop-up Exercises & Competitions. In order to follow this action-based flow, tutors kept a studio diary throughout the term. This diary includes the mainframe of the studio day, expectations, what the students brought to the studio (income), the action decisions and outcome of them (Figure 4).

The design studio has two main actors: Tutor and Student (TS). From TS perspective, the nature of the studio was built on the intention of searching for knowledge rather than receiving it directly from the tutors (Figure 5). The output of this perspective was the "discovery of knowledge", which is used for enlarging the possibilities of reaching and gaining the knowledge for the student's needs (Aydınlı & Akpınar, 2003). Discovering the knowledge uses the methodology of systematic knowledge, which is constructed by the research by the steps of description,

Week	Date	Expected Materials	Income	Outcome
Week 3	30th September	Landscape Memory Model - Sketches	Processing of the Model through the existing situation Making sketches with water color material	Students completed their sketches and hung them on the wall. There was a productive discussion on the current situation of Savur, based on the model studies that came. Almost all students participated in the discussion with their own observations. It was seen that they internalized the field in every aspect.
Week 6	21th October	Upper-scale Landscape Program of the Site	The students couldn't program the site.	Pop-up program trials were made on the landscape plans with sticky notes. After that, the programs were discussed and made suggestions. This action gave successful results regarding rapid production.
Week 10	21th November	1/500 scale Basemaps of the Selected Areas	1/500 scale Basemaps of the Selected Areas	It was determined that the students could not focus on the 1/500 design scale in the previous studio. Thus, a competition was held to solve their design problems between 14.15-15.15 hours. The voting phase was carried out in two stages (by students and by the tutors). Pop-up competition exercise and limited-time challenge accelerated students on the scale of design. Spending a long time on the starting to design was thus avoided.

Figure 4: *A Section from the Diary of the Tutors for the Action Process*

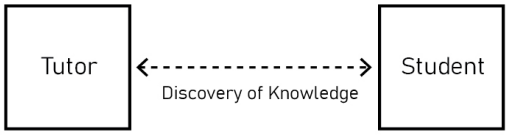

Figure 5: *The Diagrammatic Relationship Between the Two Main Actors: Tutor and Student (created by writers)*

classification, action research, modelling, interpretation, design, experimentation, evaluation and logical systems (Stahlschmidt et al., 2017). The students get the knowledge of how to make the "practice of the practicum" under the studio tutor who acts as a "coach" rather than a "teacher" (Schön, 1988). With this approach it is aimed that the students access and own the information by themselves, and therefore provide the completion of the semester more efficiently.

3. Case-study: Research based design studio "Memo-Structural Landscapes"

3.1. Landscape Memory Model

In the design studio, the *Landscape Memory Model* is used as a core tool for the research-based design approach. The model provides a holistic perspective to read the natural and human-based events shaping the landscape itself (Güler, 2019; Güler & Eşbah Tunçay, 2021). It includes natural memory codes (fauna, flora, hydrology, geomorphology, and climate) and anthropogenic memory codes (land-use-land cover, identity, traditions, social life, cultural outputs, and place names). These different memory codes are processed separately on a timeline from the past to the present time for each title on the model. If there are future provisions for the area, these are also processed above the present line. In the next stage, relationships are started to be established between the memory codes listed under each main theme. Thus, the cause-effect relationships of the events are revealed, the problems experienced in the landscape today are diagnosed, and used as an input in the design solution. At the same time, since the model reveals the value and richness of the

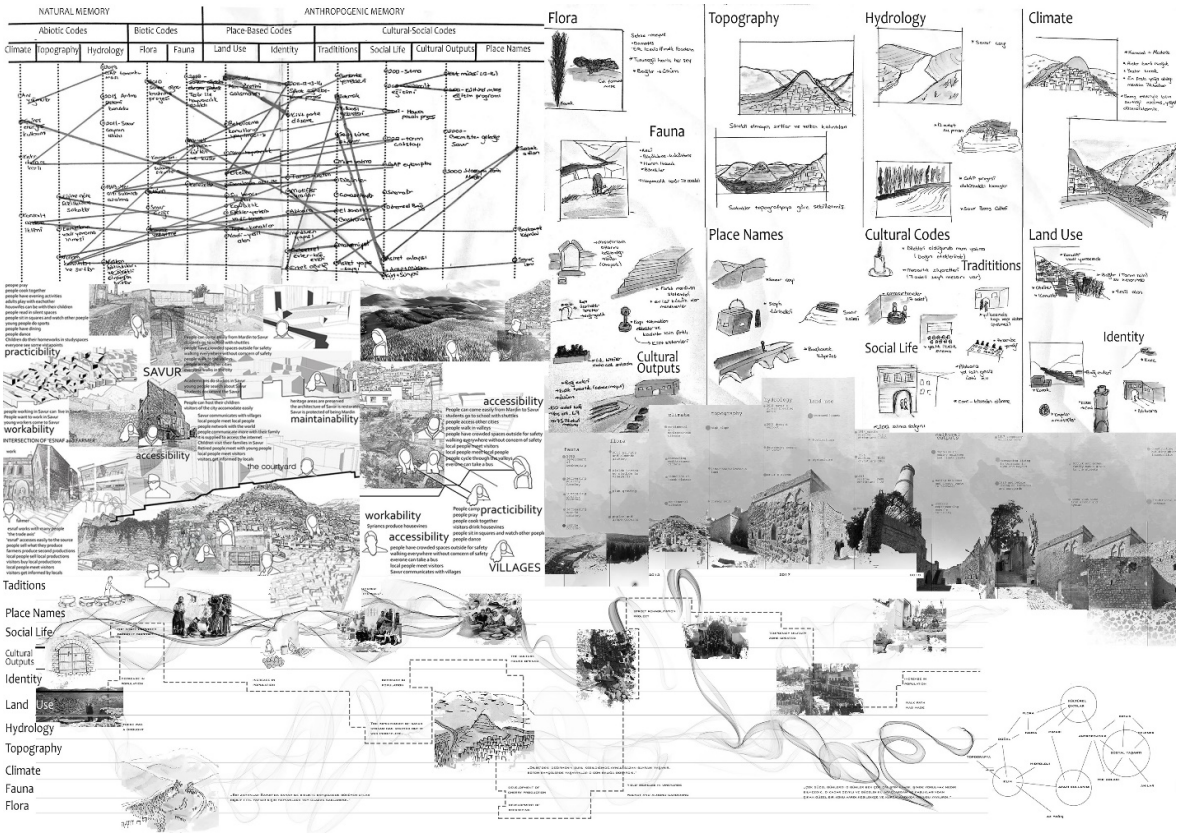

Figure 6: *Research Conducted on Landscape Memory Model*

place, these memory codes are used as an input in the design to make the design related to the place. At the end, it is aimed that the landscape gains both natural and sociocultural resilience.
For the first step, the explanation of the model was given to the students. During and after the site visit, they started to use and fill the model. While processing the model, they started to think about the relationship of every piece of the memory code. Moreover, this relationship-building state was not only singularized under natural and human-based activities but also tried to establish relationships between natural and human-centered ones. They started to ask the questions: How did the topography affect the land-use practices in Savur? How did climate affect public use of roofs which is an essential part of daily life in this region? How did the color of the soil give the identity of building fabric? This way of thinking differs from the traditional analysis techniques such as slope analysis, urban fabric analysis, water resources, etc. The works on the model continued in various approaches such as text-based, collage-based, mixed-used, sketch-based (Figure 6). In the representation of the research on the model, a more flexible way was preferred. Students were invited to explore their strengths in the representation of the research process. Some students used textual expressions and connecting them with strings; some students preferred the collage method with digital representation techniques. While some students used sketches they produced in the site visit as a model base, some students tried to match the model with abstract expressions.

3.2 Action-Based Process: Pop-up Studio Events

The Action-based studio is based upon identifying the student's difficulties and improving them through pop-up activities. Three main forms of action spanned the period: Pop-up Events, Self-Media Approach and Pop-up Exercises & Competitions.

Action I - Pop-up Events: The first of the actions taken in the studio was to organize pop-up events and workshops: Watercolor Sketching Workshop, Digital Representation Workshop and Sectoral Firm Trip. Organized in the courtyard of the campus at the second week of the semester, the watercolor exercise increased the sense of dynamism in the studio. The aim of the workshop was to encourage the students for using sketch books more effectively and prepare them for the self-media

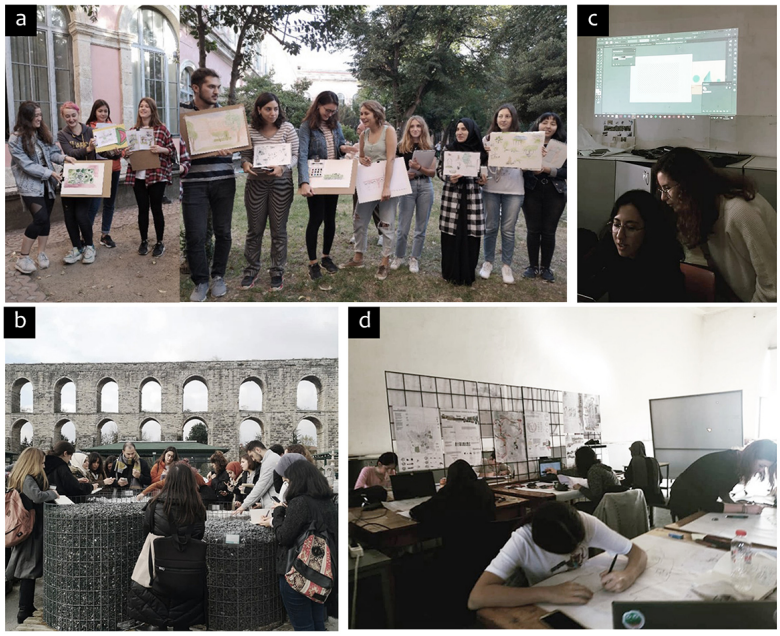

Figure 7: *Images from the Pop-up Events (a-Watercolor Sketching Workshop, b-Sectoral Firm Trip, c-Digital Representation Workshop), Exercises and Competitions (d-in Studio Competition)*

approach in Savur trip (Figure 7). In the week of thirteen, the second pop-up event was organized for visiting the sectoral firms. The aim of the action was to increase the material knowledge of the students especially for the detailed plans. Touching the materials physically helped them to understand the textures, scales, and character of the various landscape design materials. Another pop-up event was about the representation techniques and was conducted on a digital illustration program. The event, helped students to understand the value of the representation to give the main idea of a drawing or diagram. They learned new software and used it on the final submission of the semester.

Action II - Self-Media Approach: According to this approach, the self-media action was adopted by the students during the site visit instead of using conventional media tools. The aim of the self-media approach is to enlarge perception to read the place and feel the spirit of the place. This process can be defined as "intrinsic research" fed by personal or designer experiences in place (Milburn & Brown, 2003). Thus, the approach was targeting in situ sketching instead of taking photos, cognitive mapping instead of using navigation apps, collecting materials instead of Google research (Figure 8-9). With limiting media tools, site visits and in-situ analysis/observation provided opportunities for students to build a perspective for decode-recode-processing steps of the place. Additionally, implementing hand drawing techniques provided a continuous circulation for hand-paper-creation process besides the in-situ observations. In the sketching processes, the relationship between drawing and body enhances the way of seeing through the body (Montarou, 2006). As Montarou explained, with hand-drawing and recording, a monologue and dialogue start between the body and inside, outside, past and future. This circularity opens the way not only for recording things but also for creative production. In the common era of digital tools, the monolog tools of the architect have started to be forgotten as observed in the design studios. For this reason, the "self-media approach" was made a part of the studio.

Action III: Pop-up Exercises and Competitions: In the semester, two pop-up exercises and one competition were held. The exercises were organized on upper-scale approaches while the competition was focused on lower-scale design. The first design exercise was held at the sixth week of the semester with the aim of help students to program the area in an upper-scale. Students were asked to write the names of their programs on sticky notes

Figure 8: *Experiences from the Self Media Approach – Site Visit Works*

Figure 9: *Experiences from the Self Media Approach – Site Visit Works*

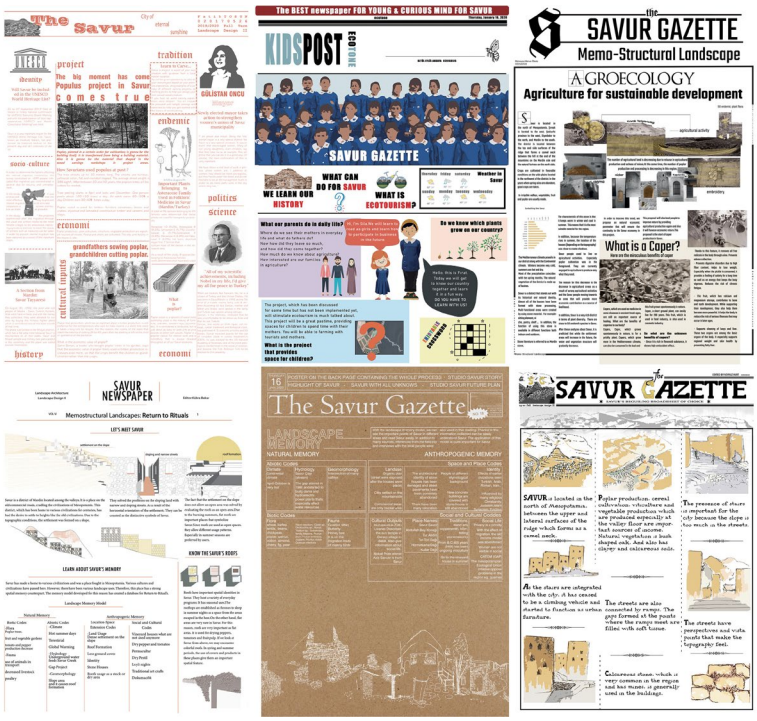

Figure 10: *Cover Design Samples from the Final Submission*

and place them over their places in the plan (Figure 8-d). The modularity of the note papers motivated the students. The second exercise was held the next day. It was observed that the students could not comprehend the transition between the scales, while they were expected to process the program decisions on their plans. For this reason, they were asked to implement their program decisions on their plans in a limited time. The exercise provided a productive environment and synergy between the students. The last exercise was organized as a studio competition in the tenth week of the semester. On the studio day, students were

expected to select areas from their 1/1000 scale plans and start to design them on the 1/500 scale. However, it was observed that they could not make this transition between scales. For this reason, a 1/500 design competition was held in a limited time in the classroom. The competitive and focused working environment strengthened the students' perception of the design studio.

4.Discussion and Conclusion

Considering the final submissions and studio process, Savur's morphological, ecological and socio-culturally challenges could be overcome by only intertwined approaches in the studio. The model helped to discover the knowledge and connection between the tangible and intangible values of a place. On the other hand, the action-based studio approach, where immediate interventions are expressed, increased the dynamism of studio environment and improved the motivation for design process. These two flexible approaches in the studio were implemented to the final submissions of the projects as well. It was decided by the tutors that the submission could be made in newspaper format instead of conventional poster format in order to reveal the creativity of the students. Newspaper format submissions have been extremely helpful in highlighting the originality of representation and reflecting the research-based design process (Figure 10).

Leaving the traditional layout format provided the emergence of new ways of representation techniques and composition styles. Coupons and advertisements in traditional newspapers were reinterpreted as coupons for each student's activities in their projects, and advertisements for proposed programs and activities (Figure 11). At this point, there was no intervention by the tutors, and the students discovered the new styles on their own. Informal representation techniques gave confidence to the students in terms of creating and presenting their designs. With the help of the studio process, the unique designs and representation languages became different from a conventional landscape project since the strong relationship between the place and designer.

Landscapes and the memory of it continue to change with the natural and human effects. In some places, landscapes continue to reveal their memory in the meaning of ecologic, social, and cultural ways. On the other hand, in some places, landscapes lose their ecologic and socio-cultural archive as a result of globalization. This issue causes to emerge fragile landscapes according to lack of water resources, global warming, a decrease in biodiversity. Preserving the memory of landscapes and using it in the design of landscape is a deeply crucial issue. At that point, this paper tries to find the answers for two questions: How can the landscape memory

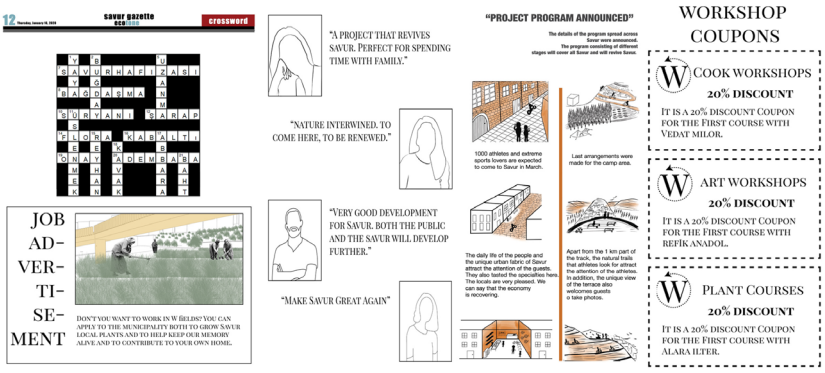

Figure 11: *Details from the Inner Pages of the Final Submissions*

be used in design education? How can a research-based design studio pedagogy be conducted on this approach? In a globalized world with information spreading everywhere, design and design issues are also turned into stereotypes. As a result, mass production design projects that can be applied anywhere, emerge. Placelessness not only causes loss of place attachment and belonging (Auge, 1995; Relph, 1976), but also belonging to the environment and nature. In this sense, landscape memory, which helps to read the natural and cultural strata of a landscape, provides designs to be more place-based actions with the natural and cultural identity of it. Concerning the first research questions mentioned previously, the use of the model in the educational practice strengthens the cause-effect nature of the student's design process. In the Savur's project, using the landscape memory model in the studio supported the intention of the research environment. Reading the memory strata and researching the codes of landscape forced them to look for not only the existing situations but also for the past and then think about the future. This way of research led them to build individual and unique concepts in the design process. For the second question, the model goes beyond only being a guideline but forms the core of the research-based studio. Cross-reading between memory codes and self-discovery of

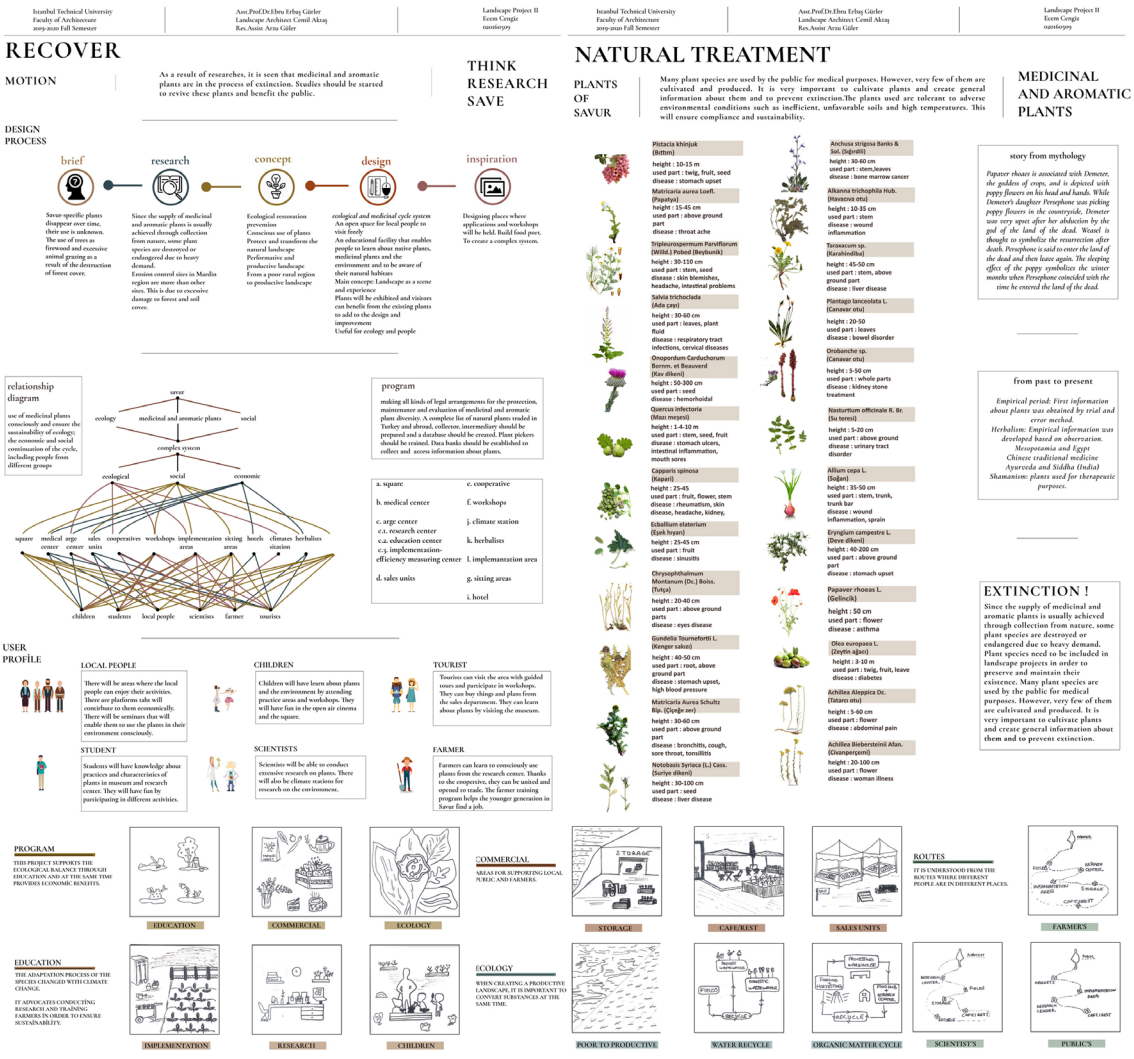

Figure 12. *Samples from the Analysis of Landscape through Local Environment Characteristics*

knowledge pushed the student to do more research. The research-based design approach based on landscape memory model encouraged students for discovering and using the natural layers of the landscape in their designs. Without any intervention, some of the students looked for the endemic and natural plant species which can be used as design elements in detail. They used the plants for raising public awareness of the local environment and creating sustainable and resistant landscapes for the future (Figure 12).

The instinctive analysis coming from the results of the model enables the students to create unique concepts in the studio (Figure 13). In this sense, the students included their individual memory codes in the design processes. Among the outputs, it was observed that the natural bird species in the area turned into bird watching routes, the diverse range of religious culture of the region was turned into the memorial surfaces, the poplar trees transported over the streams of Savur were reinterpreted as a landscape element. In this context, students' free design processes have led to the emergence of different concepts for each of them, since their approaches to the landscapes are different in the meaning of understanding and interpreting it.

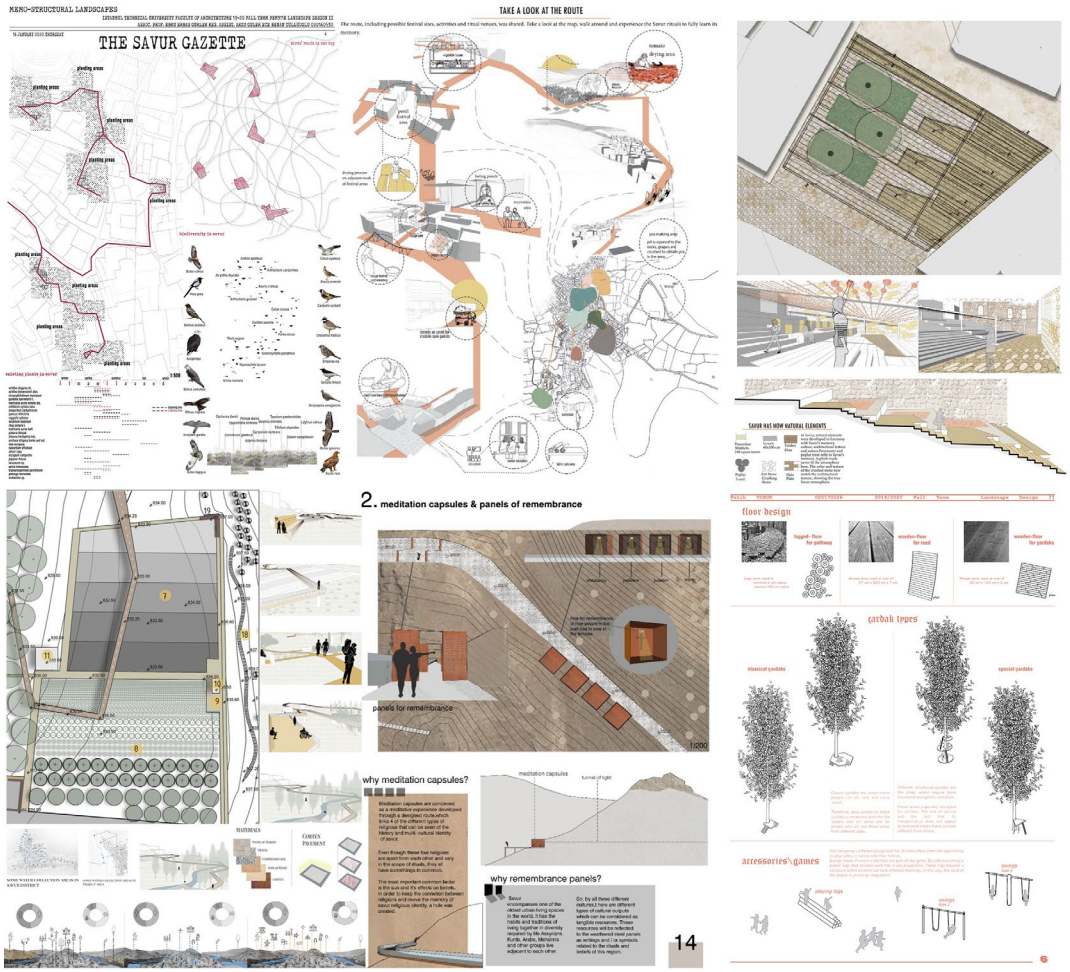

Figure 13. *Samples from the Designs (Upper-scale to Details for Various Students)*

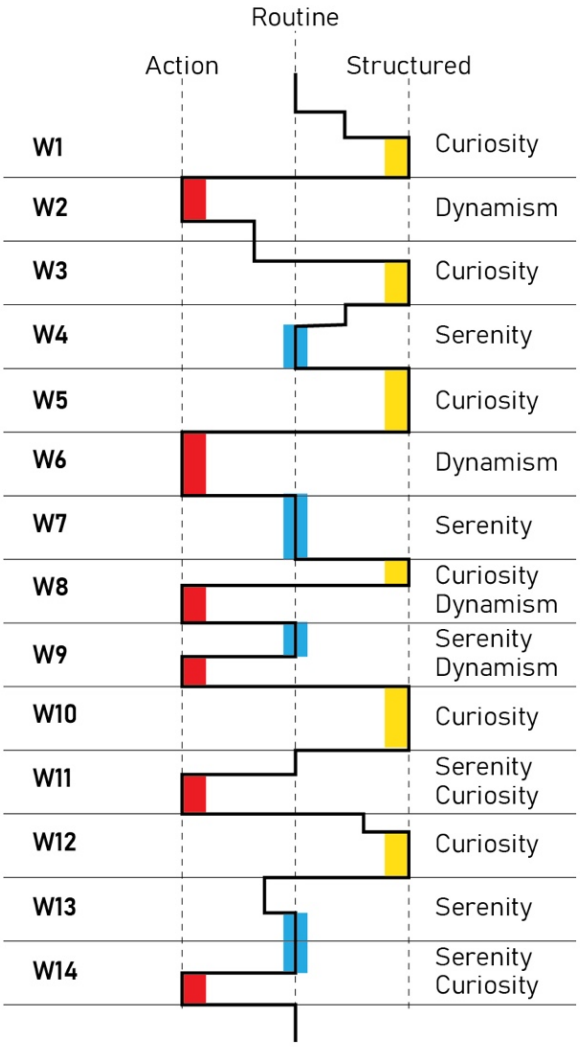

Figure 14: *The Timeline of the Action Flow and The Changing of Atmosphere of the Studio*

Provided to heal the problematic points faced by students throughout the term, the action-based design studio was held. Tutors kept a studio diary to track this action-based flow and understand the results of actions on students and studio environment. The diary revealed the wider perspective of the period. It provided an output of the changing atmosphere in the studio after the actions taken (Figure 14). It has been observed that new actions generally increase the dynamism in the studio. In such activities, students seemed more active and energetic. On the other hand, it was observed that the sense of curiosity increased in structured activities contrary to the traditional studio process. Activities such as the landscape memory model explanation, seminars, examination and discussion of sample projects from the previous studios increased the students' sense of curiosity. The routine studio days conducted on desk critics or collective discussions created a calmer atmosphere. As a result, design studios are like a constantly working machine.

While implementing a research-based design approach to the studio pedagogy, the first challenge encountered was the introduction of the landscape memory model while the undergraduate student was learning landscape design for the first time. In order to make it easier for students to feel an attachment to the

project, it was thought that the site selection should be appropriate with the concept. Therefore, Savur, Mardin, where the socio-ecological landscape layers are perceived as a whole, provided a strong medium for the project. Another point was to understand the model with their own interpretations rather than using the model as it is and to explain that it is something that can be developed with their own ideas. As in this way, the student was able to make sense of the model, implement it and interpret it. Another challenge was that the students were more accustomed to the traditional studio process. The traditional studio processes are conducted on strictly structured pre-defined analysis (occupancy gap analysis, green areas, land-use, transportation, etc.) and from upper-scale to lower-scale design. The schedule of the process continues with this structured approach. This difficulty was overcome with the action-based studio approach. The action-based design studio, the decision of how and which the analysis will be done is left to the students, and back and forth design transitions are encouraged.

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Disaster Awareness and Education Center-Park Design: Investigation of Outdoor Spaces on Graduation Project of Architecture Students

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Abstract: Introduction: Turkey has a history of various natural disasters. In architecture education, students need to be informed about natural disasters, produce information, and use the knowledge in their designs to play an essential role in shaping the built environment. The disaster awareness-education center and park aim to raise awareness and educate all segments of society about natural disasters and create practical solutions when necessary. **Objectives:** The research aims to systematically examine urban landscape design solutions to raise awareness of the architectural students about disasters through an exemplary disaster awareness park in Istanbul. The proposed landscapes are classified concerning disaster awareness level, education and training capacity and the potential to serve as a post-disaster meeting point and temporary management center. **Methods:** This research presents an architectural design process. The research uses landscape planning and design principles to evaluate student projects concerning the relationship between indoor spaces and disaster awareness and education parks in open areas. **Results:** Architecture graduate students have been successful in building outdoor-indoor connections, multi-purpose use of outdoor spaces, designing open space services, and solving services and meeting areas through their projects. However, their designs did not address planting, ecological and sustainable green space, and emergency water use.

Keywords: Disaster awareness, Education parks, Outdoor spaces, Graduation project.

1. Introduction

Challenging environmental problems and increasing frequency of disasters cause the need for proactive and creative solutions. Therefore, cities should consider the concept of disaster-sensitive spatial open space and landscape design solutions related to the physical environment for each phase of the disaster life cycle (mitigation, preparedness, response, and recovery) to support pre-disaster and post-disaster resilience. Although spatial design is an essential component of disaster management in architectural-structural design, urban design, and landscape design, the

relationships between spatial design and disaster management are rarely discussed in the literature (Murao, 2008). In addition, the role of architects is as vital as landscape architects in landscape design solutions for disaster management since open urban public spaces and architectural structuring require creative solutions to address the multidimensional nature of disaster awareness and management.

Local disasters such as climate change, global warming, global epidemics, earthquakes, environmental pollution, soil erosion, fire, and flood occur in social life and concern the world. Effective management is needed to reduce disasters' impact in advance and save and normalize life if disasters occur. Successful leadership is possible by recognizing the disasters and raising awareness by knowing their causes, processes, precautions, and prevention training.

The research aims to reveal solutions for an exemplary disaster awareness park for Cekmekoy Istanbul. The proposed landscapes are classified concerning disaster awareness and used in the organizational plans as an emergency meeting point, and temporary disaster management center during and post disasters for disaster awareness and education in the urban environment. The research then systematically examines landscape design solutions arranging buildings and parks to increase the awareness of architecture students about disasters and reduce the impact of disasters on society and social organizations. The "Disaster Awareness-Education Center and Park will be used for local disaster management centers during and after disaster events to educate the public about urban disaster awareness and education. It will provide training on disaster prevention and the management of disaster measures to raise awareness of individuals, primarily to educate using interactive environments about global and local disasters that the society may encounter.

The following research questions formulate landscape design for architecture students' graduation projects developing architectural designs on disaster awareness-education center and park: 1) Do the students use basic landscape design principles in their projects appropriately? 2) What are the fundamental building settlement decisions regarding the use of open space and landscape needs for disaster awareness and education parks? 3) Do indoor and outdoor organization and landscape planning and design support local neighborhood disaster management for emergencies? The research hypothesizes that as part of architectural education, a proposed disaster awareness and education center and park program designed mainly in the final architectural design phase for functionality, indoor-outdoor connections enhanced with approaches based on landscape makes the design and architectural program successful and contributes to the education of the society and disaster awareness.

It is appropriate to evaluate the environment with effective evaluation criteria, choose the suitable planting approaches, and properly make the outdoor open spaces' spatial and planting designs. This hypothesis further includes measures and the role of spatial design in disaster management. Urban public landscape designs and disaster prevention management processes are essential topics interacting with disaster awareness and suggesting disaster management in architectural design. The research methodology connected the site and the roles of architects and landscape architects in the process. The research was carried out while developing the method, especially constructing the subject's background.

In an architectural design project, the architectural program and requirement of the subject should lead the layout and open space arrangement decisions at the level of landscaping along with the general requirements for disaster awareness and education center and park. In this research, student projects are evaluated by arranging disaster awareness and education indoor spaces and classifying the essential landscape planning and design criteria that established the relationship between the outdoor education and practice park.

During these evaluations, the precautions are taken to use the central structure, besides the students' disaster awareness and education opportunities defined in the architectural program, disaster impact reduction management, and basic landscape approaches discussed in the seminars. The surrounding disaster awareness park as a local disaster management coordination center, especially open spaces, may be used by the public during a disaster.

2. Background

2.1. The role of Spatial design

Urban open spaces play an active role in decision-making regarding urban health and protecting cities against external factors within urban planning and design disciplines. León and March (2014) and Hossain (2014) highlight that the planning and design of urban open spaces can play a vital role in influencing disaster risk reduction and making cities resilient. The United Nations Office for Disaster Risk Reduction (UNISDR) (2012) recommends increasing the capacity to absorb and recover from disasters through strategic planning and the design of urban open spaces. The main task of planning and design disciplines is to facilitate people's living as individuals and communities in well-being, in healthy and comfortable indoor and outdoor spaces, and in the natural, physical, and social environments formed by the buildings and buildings and open spaces where these spaces are located. A biophilic design is defined as "integration" or sometimes "manipulation" of natural elements or systems to create a sense of "life" in the built environment. Bringing biophilic design patterns into a vision for healthy homes, workplaces, and cities helps shed light on the importance of human connections with nature in our built environment and encourages people to challenge convention (Sat Gungor, 2020). In the context of this fundamental purpose of ecological approaches, disasters should be considered the main factors in the planning, programming, design, construction, and use stages of places, buildings, and spaces. It is thought to contribute to urban public spaces, especially in disaster awareness, education, and disaster reduction management.

Jayakody et al. (2016) classified "public open spaces" as follows: 1) Green spaces, including parks and gardens; 2) Natural and semi-natural green spaces, including urban woodlands, greenways, outdoor sports facilities; 3) Facility green space for children and youth playgrounds; 4) Allotments, community gardens, and urban farms; 5) Cemeteries, churchyards, and other holly open spaces. In addition, green public open spaces offer environmental benefits such as water and air purification, noise and wind filtration, and microclimatic comfort. Fuentes and Tastes (2015) highlight the importance of the link between public open spaces in cities as an integral way to plan and design cities flexibly. Urban open spaces, especially parks, meet the open and green space needs of cities and produce solutions such as reducing or eliminating the effects of flooding. Drake and Kim (2011) introduce the concept of Urban Sponge Park, which combines the concepts of stormwater engineering, urban design, and urban habitat. French et al. (2019) conducted a literature search. They found the following classification for urban open spaces used for disaster reduction purposes: multi-functionality, networks (redundancy, accessibility, scale, distribution, and grouping), site location, and suitability (risk identification). Scenario planning, site conditions), size and function, site elements (water, sanitation, food, power and lighting, wayfinding and communication), social resilience (programming, community engagement, education). This study evaluates the student projects related to disaster awareness and education park as a public open space, green open space for local users, and a local government center to reduce the impact of disaster during and after a disaster.

2.2. The relationship between the educational facility of disasters and landscape planning and design

Masuda (2014) stresses the importance of educating society with activities and exercises informing the community about the disaster functions of earthquake parks and raising awareness about disasters. French et al. (2019) highlight the significance of urban open space functionality and ensuring that its inhabitants can use its features independently, both in

daily life and in an emergency. Mazereeuw and Yarina (2017) give examples of landscape elements in park and green space design that can warn users about the instability of the land during an earthquake. Villagra-Islas and Dobbie (2014) suggest that beyond the structural features, educating local communities will foster the resilience of their environment, such as raising educational awareness on flood mitigation strategies, a better understanding of problems, preventive measures, and achievable solutions. It is suggested that the effects of earthquakes can be reduced and durability of living environment can be increased by choosing the most suitable building materials and technologies in construction, and determining the number of floors of buildings correctly, making earthquake parks ready for use (Yıldırım et al., 2021). It is essential to create infrastructure and wide-open spaces in settlements (Çelik and Erduran, 2011). Çelik and Ender (2016) suggest that indoor and outdoor areas should be made available for training programs such as "Basic Disaster Awareness Trainings" throughout the year in earthquake parks.

2.3. The role of landscape in disaster management (mitigation, preparedness, response, and recovery) cycle

Open green spaces are vital to disaster recovery situations. Generally, the importance of open space planning and design for earthquake disasters is emphasized. However, attention is drawn to the fact that topography profiles in open areas are designed for floods, droughts, landslides, extreme temperatures, fires, and biodiversity loss (URL-1). Although floods, landslides, and fire can follow earthquakes, there are no standard approaches for natural earthquakes, building collapse, or other secondary hazards such as tsunamis and liquefaction. Research on responses to earthquakes shows that the large and adaptive amount of open space surrounding buildings is invaluable both during and after an earthquake (Godschalk, 2003). Allan and Bryant (2010) explore the critical role of open space in recovery during earthquakes and analyze the successful integration of recovery planning and urban design with a consideration to the ratio of a city's total open green space, overlapping with theories of urban design, remediation planning, and urban resilience. The diversity of the city's open space structure creates a range of options that allow people in the pre-crisis community to come together, support each other and re-establish the order of their daily lives during the emergency period immediately after the earthquake (Middleton, 2007). The location of the planned open areas used after the disaster, the available data, the adoption of different methods in ensuring the accessibility of the site, the distance measure, the cumulative opportunity measure, and the benefit-based measure inform the disaster agenda (Makri and Folkesson, 1999). For various disasters, how the landscape, especially the location of the disaster awareness and education park, is defined in the disaster management cycle and how the disaster management cycle operates are discussed next.

2.4. Disaster Management Cycle

The disaster management cycle is generally divided into four interrelated phases: mitigation, preparedness (disaster-incident), response, and recovery.

1. Mitigation describes the measures taken to reduce the severity of a hazard and includes a wide range of expertise, from planning to policy, education to engineering (UNISDR, 2017; World Bank and United Nations, 2010).
2. The preparedness phase includes planning and activities that ensure effective response and recovery after a disaster (UNISDR, 2017). Studies to raise awareness, such as public education, are essential.
3. Disaster-Event The first 72 hours after a disaster is called the "power gap" before official rescue and relief teams are mobilized or reach affected communities (Halford and Nolan, 2002; Lowe and Fothergill, 2003). In most cases, neighbors are the first to arrive on the scene. Social networks play an essential role in supporting those in need, mainly on their own.

4. Response phase also deals with the provision of emergency shelter (typically overnight) and temporary accommodation (several days) (Quarantelli, 1995). When urgent response needs are addressed, priorities such as rebuilding supply chains and laying the groundwork for long-term recovery come into focus (EMBC and B.C. Department of Justice, 2015). Recovery includes activities that restore, rebuild and reduce the risk of future disasters (UNISDR, 2017).
5. While the recovery period can be seen as an opportunity for change or a chance to 'rebuild' for better solutions (World Bank and United Nations, 2010), problems created by time constraints and pressure to rebuild and return to normal can be avoided.

Figure 1: *Disaster management cycle (French, 2017).*

The different phases of the disaster management cycle and the activities in these phases are given in Table 1. While the first phase, prevention/mitigation, is related to public education, the second phase,

Table 1: *Activities of different phases of the disaster management cycle included in the disaster awareness-education center and park.*

Phases*	**Activities***	**Including disaster awareness and education center and park**
1. *Prevention/Mitigation*: Reduction or elimination of the likelihood or consequences of hazards to make them less severe and cost-effective.	● Construction of engineering structures ● Arrangement/development of building codes ● Disaster insurance systems ● Land use planning ● **Public education** ● Safety codes ● Tax, incentives, and disincentives	Public education with indoor spaces and open spaces, indoor and outdoor rehearsal places
2. *Preparedness*: Reduction of the extent or impact of disaster through planning, development of warning systems and other measures.	● **Emergency operation plans** ● **Emergency public information** ● **Resource management plans** ● **Training cadre** ● **Rehearsal of emergency response plans** ● **Stockpiling of supplies**	Local emergency disaster management operation center including stores for supplies / indoor and outdoor training areas
3. *Response*: Taking action in a few hours or days to cope with a disaster.	● Medical care ● **Distribution of essential supplies (water, food, clothing, etc.)** ● Accommodation/housing ● Infrastructure services	Stores for basic supplies
4. *Recovery*: Dealing with the aftermath and returning to 'normal' through the restoration/establishment of vital life-support systems.	● Debris clearance ● Contamination control ● Temporary housing and service restoration ● Reconstruction of permanent houses and infrastructure	

**Sources: Acar and Yalçınkaya Çalışkan (2016) Taken from Thurairajah et al. (2011). Additions are from March and Leon, (2013) and Malalgoda et al. (2010).*

preparedness, include; emergency operation plans, general emergency information, resource management plans, training cadre, rehearsal of emergency response plans, stockpiling of supplies. The third phase, response, is about distributing essential supplies (water, food, clothing, etc.). The fourth phase is related to recovery and has debris clearance, contamination control, temporary housing and service restoration, reconstruction of permanent houses and infrastructure.

2.5. The role of architects and landscape architects on prevention– mitigation- preparedness- response and recovery of disasters and its relationship with their undergraduate education programs

Architects and landscape architects are among environmental creators in the planning and designing of public spaces and urban public spaces. They are taking an essential role in the disaster management cycle in such areas and places to reduce the risks of possible disasters, in case of reducing the chances of prevention– mitigation- preparedness- response and recovery of disasters. They take a role in their education and professional life about what they can do in their phases.

What kind of roles architects and landscape architects should have, and therefore what skills, throughout the disaster management cycle is noted by Glass (2008) as architects' role as designers is exciting because of their potential to influence the properties and configuration of materials. Lloyd-Jones (2009) explains the subject in detail and comprehensively summarizes the architects' possible roles with other professionals. However, apart from such a limited number of comments, it is seen that there is a knowledge gap about the educational dimension of the disaster phenomenon and the current weaknesses of the academy in integrating the relevant strategies into design education (Acar and Yalçınkaya Çalışkan 2016). According to Cage et al. (2009), there are very few countries where architecture students have acquired the skills to design for disasters. As a result, "architects may have to 'learn' their usual approaches and relearn new ways of working to be effective," where collective problem-solving skill becomes particularly critical (Cage et al., 2009).

3. Methodology

The study's methodology is based on the classification of how students approach the disaster awareness and education park in the context of a Graduation Project, and the students use the determination of which architectural and spatial solutions. The assessment model includes two categories as functional and spatial. Within the scope of spatiality, basic spatial approaches in open areas are classified. In this classification, there are a) relationships between indoor and outdoor spaces, b) courtyard usage, c) outdoor landscape design d) relationships between outdoor spaces and surrounding areas. The scope of functionality has three sub-criteria: a) use of open space in the post-disaster environment b) multifunctional spaces c) landscape design. The spatiality parameters derived from basic biophilic design parameters (Browning et al., 2014), (Zhong et al., 2022). Criteria related to these basic parameters are defined in the booklet of the graduation project of the case study of this research paper and also the criteria used by the students which were based on the refereed literature. The functionality parameters derived from Designing Public Spaces (2018), Basova and Stefancova (2016), the criteria with the basic parameters taken from the booklet of case study graduation project and the criteria suggested by students and instructors of the according to refereed sources.

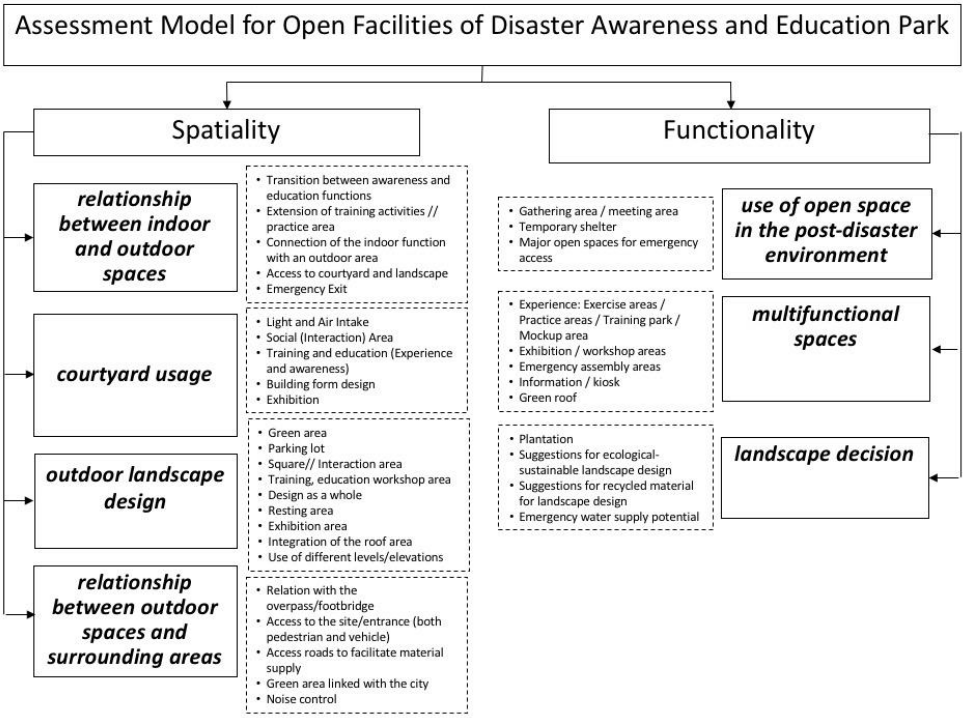

Figure 2: *Assessment model, criteria, sub-criteria and parameters.*

Within the scope of spatiality evaluations, parameters are used in four subtitles. These are the parameters that are addressed in spatial analysis in student projects, especially in open spaces, the relationship between indoor and outdoor spaces:

Relationship between indoor and outdoor spaces parameter has sub-criteria such as a) transition between awareness and education functions, b) extension of training activities/practice area, c) connection of the indoor function with an outdoor area, d) access to courtyard and landscape, e) exit organization.

- **The transition between awareness and education functions** (1) Evaluation of the transition between the program's awareness-raising and education functions.
- **Extension of training activities // practice area** (2) Providing a transition between indoor training activities and outdoor practice areas,
- **Connection of the indoor function with an outdoor area** (3) Relationships of indoor and outdoor connections of other functions
- **Access to the courtyard and landscape** (4) Access to the courtyard and use of the courtyard, the relationship with the landscape.
- **Emergency Exit** (5) Features at the exits of the spaces to open spaces to connect with the open space.

Courtyard usage the second essential parameter is the use of the courtyard. Courtyard use evaluates a) light and air intake, b) use as a social interaction interface, c) training and education (experience and awareness), d) building form design, e) outdoor exhibition.

- **Light and Air Intake** (6) Evaluation of utilizing the courtyard in terms of air and light "Utilizing the courtyard to provide sunlight and fresh air for indoor spaces."
- **Social (Interaction) Area** (7) Evaluation of the use of the courtyard as a social interaction area.
- **Training and education (Experience and awareness)** (8) Utilizing the courtyard as an open space for training,

for experience and awareness-raising activities
- **Building form design** (9) The relationship between the building form and the courtyard form, Evaluation of the design concept comprehensiveness regarding the relationship between building form and the courtyard form,
- **Exhibition** (10) Evaluation of the use of the courtyard for exhibition purposes.

Outdoor landscape design Criteria progressed for basic landscape design principles of outdoor spaces of building immediate environment.
- **Green area** (11) Organization and proportions of green areas.
- **Parking lot** (12) Evaluation of open car park spaces.
- **Square //interaction area** (13) Evaluation of square/small square interaction area in an open environment.
- **Training, education, workshop area** (14) Outdoor usage of training, education and workshop activities.
- **Design as a whole** (15) Evaluation of the joint creation of the building and outdoor spaces.
- **Resting area** (16) Evaluation of open spaces as resting areas,
- **Exhibition area** (17) Evaluation of the use of open spaces for exhibition purposes,
- **Integration of the roof area** (18) Integrating the use of open space roof garden,
- **Use of different levels/elevations** (19) Evaluation of the use of different levels in the open field.

Relationship between outdoor spaces and surrounding areas
- **Relation with the overpass/footbridge** (20) Evaluation of the communication of open areas with the surrounding area,
- **Access to the site/entrance (both pedestrian and vehicle)** (21) Pedestrian and vehicle approach/entry assessment from the environment to the land,
- **Access roads to facilitate material supply** (22) Evaluate the possibility of material distribution from warehouses,
- **Green area linked with the city** (23) Evaluation of open spaces that can establish a relationship with the city,
- **Noise control** (24) Evaluation of noise reduction measures taken in outdoor space design

Functionality

Use of Open Space in the Post-Disaster Environment Evaluation of the use of open spaces in the post-disaster period
- **Gathering area/meeting area** (25) Evaluation of meeting and aid areas with the neighborhood residents after the disaster,
- **Temporary shelter** (26) Provide an opportunity/potential to host post-disaster temporary shelters in open spaces
- **Major open spaces for emergency access** (27) Evaluation of the arrangement of open spaces for emergency access.

Multifunctional spaces Evaluation parameters of multi-purpose open spaces
- **Experience in: Exercise areas / Practice areas / Training park / Mockup area** (28) Evaluation of the multi-purpose use of experience / practice areas / training areas / mockup areas,
- **Exhibition/workshop areas** (29) Evaluation of the multi-purpose use of exhibition and workshop works,
- **Emergency assembly areas** (30) Outdoor assembly areas in case of emergency.
- **Information / kiosk** (31) Evaluation of desk / kiosk usage,
- **Green roof** (32) Evaluation of the multi-purpose use of the green roof,

Landscape decisions Evaluation parameters related to landscape design decisions
- **Plantation** (33) Evaluation of plant material suggestions,
- **Suggestions for ecological-sustainable landscape design** (34) Evaluation of ecological and sustainable landscape proposals in landscape design,
- **Suggestions for recycled material for landscape design** (35) The use of recyclable materials and technologies in landscape design and development.
- **Emergency water supply potential** (36) Water reservoirs for emergency uses.

4. The case study

Graduation Projects are private studios where students at the graduation stage in architecture

and design are evaluated to what extent they have achieved what they need for their professional life. The projects examined in this research were given in the spring term of the 2020-21 academic year, within the scope of the graduation project, which is the last of the design studios in the Department of Architecture every semester. On graduation projects, Tafahomi (2021a) wrote that this latest architectural project estimates the graduate candidate's general knowledge, skills, research, and problem-solving skills in architecture and related fields. Studies have found that students have four characteristics: knowledge, practice, presentation, and communication to develop the theoretical framework in their graduation projects (Tafahomi, 2021b). In the spring semester of the 2020-2021 academic year, the fieldwork graduation project was conducted online using technological devices under pandemic conditions. The situation, which is widespread all over the world within the scope of the COVID-19 pandemic, on the one hand, paved the way for the testing of "new" tools, methods, and experiences in teaching and learning; on the other hand, it enabled us to understand better the potentials and well-functioning aspects of "existing" pedagogical models (Yorgancioglu, 2020). Özorhon and Lekesiz (2021) identified the benefits of the remote studio with the feedback they obtained from their students as follows: 1) saving time, 2) understanding the feedback more accurately. In the same Evaluation, 1) lack of motivation, 2) difficulty in effective communication, 3) technology addiction (technological problems) were the challenging aspects of distance education. The Graduation Project, included in the case study of this article, is a disaster awareness and education center and park in Istanbul, described later in this section.

The Disaster Awareness-Education Center and Park aims to inform and raise awareness of various segments of the society with interactive exhibitions, simulations, and experience galleries about climate change and meteorological disasters, earthquakes, epidemics, soil erosion, forest fires, and environmental pollution. Disaster awareness will be located in the park by the interrelation route open and closed spaces. Visitors' interest suggests experiencing the galleries and the relevant parts of the park in an appropriate order or visiting one by one. Educational training activities such as conferences, seminars, certificates, workshops, group projects, exhibitions, and forums occur at the second part of the center. The architectural program needs of the facilities were created accordingly. The education department should engage with the different disaster awareness galleries and connected open spaces in the park. The training applications can be carried out in the open area of the park or the interactive exhibition areas. The center will have a management section, common social areas, technical areas, parking lots, and a disaster awareness-education park. The Disaster Awareness-Education Park should be planned to cover the exhibition sections and applied training areas for education and awareness in open spaces. These regions can be practice-based, especially for disaster prevention and post-disaster management training. Since the issue is related to disasters, it is essential to minimize the environmental effects, implement sustainability decisions, and highlight park features.

Disaster Awareness-Education Center and Park located on the Ümraniye-Şile highway in Taşdelen, on the new metro line that still serves as an amusement park at the southern end of the land (Figure 3) in the Cekmekoy district of Istanbul. The total size of the land is 19000 m2 (Figure 4). It was explained to the students that the relationship between the future metro station exit and the central park was expected to be handled together with all other environmental data and to be applied as hmax (maximum building height): 15.50 for the land. To make good use of the land, a limited number of above-ground cars and a maximum of two-bus parking spaces should be considered, and other parking lots should be solved underground.

Figure 3: *Map of Istanbul and location of project site.*

Figure 4: *Project site: Taşdelen – Çekmeköy - İstanbul.*

4.1. Analysis and Findings of the Case

This study assessed the spatial and functional landscape solutions for the open spaces proposed in the undergraduate architecture students' final architectural design projects. From a total of thirty-six evaluation criteria, twenty-four evaluation criteria were identified under four subtitles of the spatiality title, and twelve evaluation criteria were classified under three subtitles of the functionality title.

Students' written and graphical explanations informed these criteria. Two methods were used in the study in which a total of 16 students' projects were evaluated. The first evaluation method comprises the findings related to the criteria emphasized by the students in written and graphical expressions used in the project. The second evaluation method involves the results that were not stressed by the students in writing or graphically but were found to be met by the authors in the planning and design solutions. These are shown with separate notation in the relevant Table 3.

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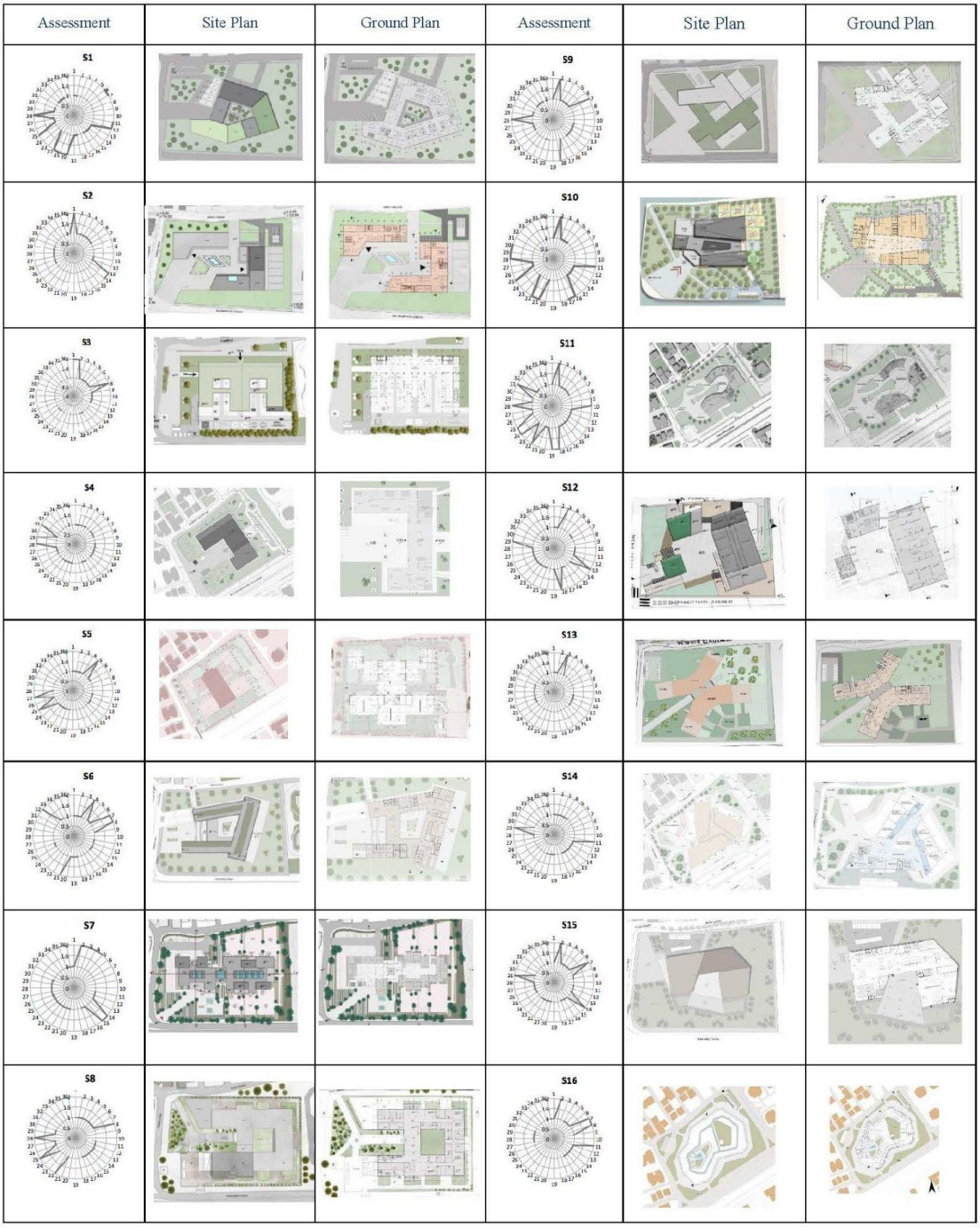
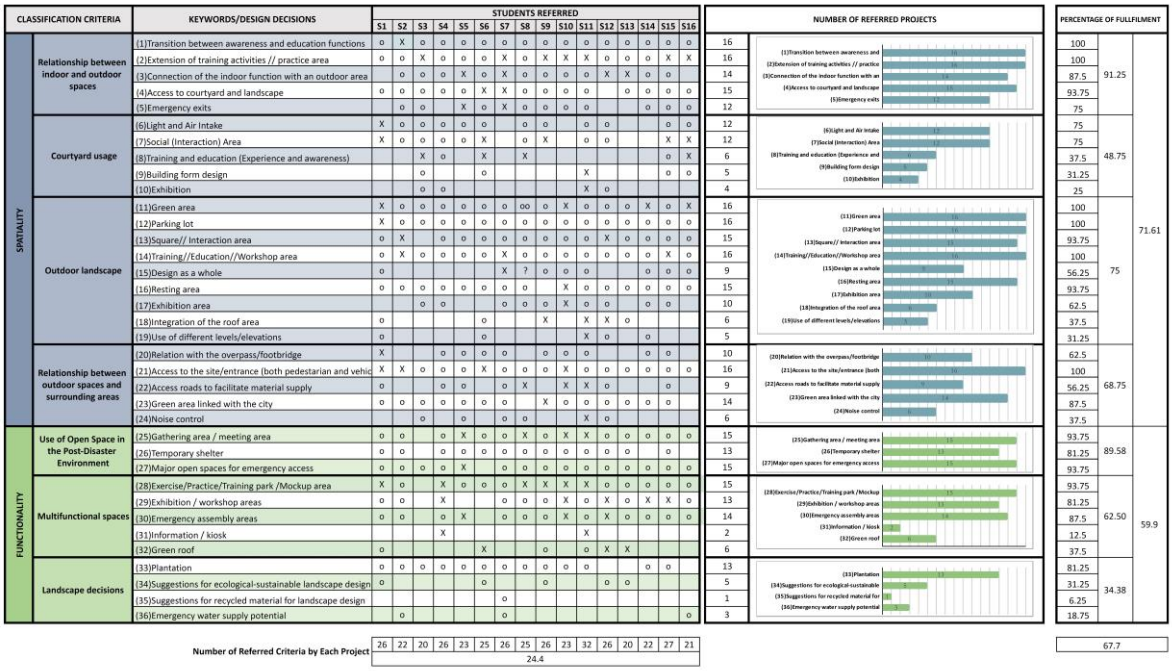
Table 2: *Student projects*



Legend of Table 2: Relationship between indoor and outdoor spaces parameter (1) The transition between awareness and education functions (2) Extension of training activities // practice area (3) Connection of the indoor function with an outdoor area (4) Access to the courtyard and landscape (5) Emergency Exit. **Courtyard usage:** (6) Light and Air (7) Intake Social (Interaction) Area (8)Training and education (Experience and awareness) (9)Building form design (10) Exhibition **Outdoor landscape design** (11) Green area (12) Parking lot (13) Square //interaction area (14) Training, education, workshop area (15) Design as a whole (16) Resting area (17) Exhibition area (18) Integration of the roof area (19) Use of different levels/elevations **Relationship between outdoor spaces and surrounding areas** (20) Relation with the overpass/footbridge (21) Access to the site/entrance (both pedestrian and vehicle) (22) Access roads to facilitate material supply (23) Green area linked with the city (24) Noise control Functionality **Use of Open Space in the Post-Disaster Environment** (25) Gathering area/meeting area (26) Temporary shelter (27) Major open spaces for emergency access , **Multifunctional spaces** (28) Experience in: Exercise areas / Practice areas / Training park / Mockup area (29) Exhibition/workshop areas (30) Emergency assembly areas, (31)Information / kiosk (32) Green roof . **Landscape decisions** (33) Plantation (34) Suggestions for ecological-sustainable landscape design (35) Suggestions for recycled material for landscape design The (36) Emergency water supply potential.

Table 3: *The assessment model.*



In Table 3, the sign "x" refers to the criteria that are both met by the design and also mentioned by the student in the project documents while the sign "o" refers to the criteria which are not indicated by the student but are evaluated by the authors as being met by the project. The assessment model has two main dimensions under classification criteria, one concerned with spatiality and the second with functionality. The evolution of the authors are given in the table with outcome graphics and success percentages.

5. Discussion

Landscape assessment of architecture student works on Disaster Awareness-Education Center and Park defined the scope of Outdoor Spaces Design Investigation on Graduation Project of Architecture Students. The methodology had two critical evaluation criteria, specified as a) spatiality b) functionality. Under these two criteria, the method suggested seven sub-criteria and thirty-six parameters. In the case study findings, all students got satisfactory results in the sub-criteria of "relationship between indoor and outdoor spaces parameter". As seen in Table 3, the "Courtyard usage" assessment on the project also gave positive results since 78.5 % of the students use courtyards. Outdoor landscape design sub-criteria resulted in 75% satisfactory with applying six parameters; the last sub-criteria under spatiality criteria was the relationship between outdoor spaces and surrounding areas. The projects were evaluated 68,75% successful under this sub-criteria.

The second criterion for assessment was functionality. The functionality criteria had three sub-criteria which were defined as "The Use of Open Spaces in the Post-Disaster Environment", "Multifunctional Spaces" and "Landscape Decisions". According to the first sub criterion, student projects were evaluated as 89,6% satisfactory. Multifunctional spaces sub-criteria resulted in 62,5% satisfactory with applying five parameters. The results of landscape decisions based on four different parameters ended with 34,4% after the assessment method had been used.

The average of the covered sub-criteria reveals that student projects met 71,6% of the spatiality criteria. At the same time, they meet 59,9% of the functionality criteria. The subcategories' overall average ratio is 67,7. When the students are assessed individually, the number of sub-criteria that each student has met varies between 20 and 32. The average number of sub-criteria met per student is 24,4 out of 36 sub-criteria. This result shows that

student projects could meet 70% of the assessment criteria on average.

6. Conclusion

Increasingly over time, it is shared that the disasters will become more critical and effective in the future due to climatic, ecological, political, and economic crises. Although education is seen as a proactive and long-term strategy for building resilience at all levels, many professionals demonstrate the importance of disaster management, and designing an environment to overcome disasters that are not recognized as an integral part of the disaster management cycle. In general, designers can take a more active role in the process of raising awareness of society about disasters and increasing their capacity to respond to disasters through sustainable and socially/culturally sensitive design solutions. This study aims to identify a few issues that should be emphasized in educational processes to achieve this goal. When the research results are evaluated with the methodology applied, it is seen that successful results have been obtained in the connection of indoor spaces with open spaces, their multi-purpose use, and the integration of indoor-outdoor spaces. However, it has been determined that they are not equally successful in making sustainable ecological landscape decisions and using renewable resources in open areas. To make life easier in the future, the need for more studies on disasters in design studios emerges, together with an intellectual familiarity with society's problems about disasters.

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Around Water: A Research-Based Landscape Design Studio

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Abstract: Water is the source of life for our planet, guided the ancient civilizations, and formed its current footprint on the earth. Water has always been a crucial element of our biological survival; consequently, humankind has permanently settled around it while carrying the responsibility of protecting it. To understand the water pattern in various cities throughout history and analyze how the emerging problems were overcome, Istanbul Technical University Landscape Architecture Department Graduate Level Design Studio was held under the theme of "Around Water". Despite the adverse effects of the Covid-19 pandemic on education, international researchers contribute to the studio in a beneficial and diversified manner with the effective use of online tools. As a result of the literature review and the online, multidisciplinary education, and research-based design requirements, a new studio method was developed. Water-based case studies worldwide produced enriched outputs. While creating new discussion environments, the diversified outcomes of the studio "Around Water" contributed to the creation of cumulative studio knowledge.

Keywords: COVID-19 pandemic, Landscape architecture, Research-based design studio, Water-based design, Water-based planning, Water history.

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1.Introduction

Water is vital for our planet, especially for living beings. Since the beginning of time, human beings have constantly searched for water resources. They built their civilization near water sources. From small settlements to large societies established near water, they improved themselves by supporting large populations. On the other hand, cities hosted by civilizations have been the centers of many significant exchanges in history. In cities, people shared their natural resources as a community and their ideas as individuals. Since water forms the basis of cities, its presence or absence has significantly affected the morphology of the cities. Water problems resulting in crises have always had a growing effect on the development of civilizations. Today's urban challenge is water scarcity caused by climate change, inadequate urban planning, and unplanned population growth.

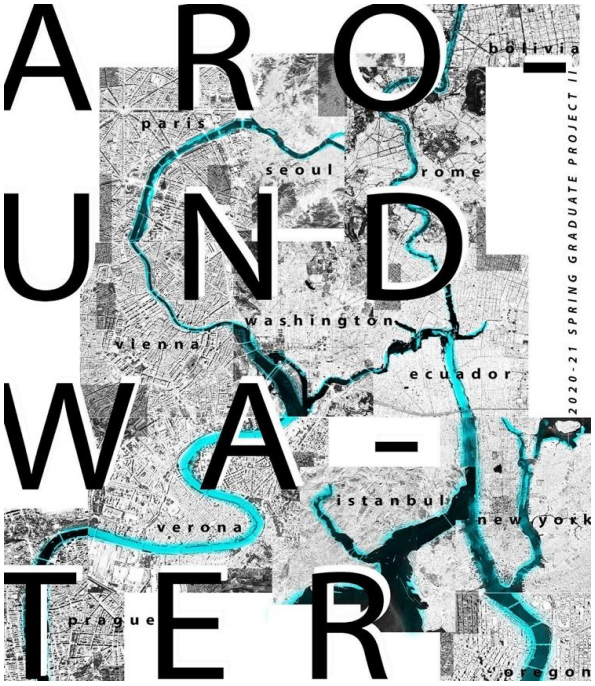

***Figure 1**: Project Poster*

Through historical case studies, water patterns were studied in the Graduate Level Landscape Studio "Around Water" in the 2020-2021 Spring Semester Term at Istanbul Technical University Landscape Architecture Department. In the studio, the students sought to understand how the cities overcame the water-related challenges to be resilient and sustainable and how they occupied a place in water history. Conducted online due to the pandemic conditions, the studio aimed to find new and creative solutions for 21st-century cities. The studio projects explored water-related issues, seeing water as the twenty-first century's most significant design and planning challenge. Also, water is one of the most significant factors in tackling the climate crisis, with the Conference of Parties (COP) contract signed for the 26th time.

While water is an element of nature around which life is shaped and civilizations are established, today, it is in a position where cities are under the threat of flooding due to water surplus or suffering from its absence. Within the scope of this studio, the discussions investigated water in every aspect and every scale, from today's design parameters to the importance and meaning of water in different religions in the spiritual dimension. Since the study was handled as part of a graduate studio project, it was not carried out around a single focus. As a method, students were asked to design a research project. Research topics were diverse, and they ranged from cisterns to sinking cities, from basin to water footprint, from spiritual status to games and technological innovations.

2. Methodology

Due to Covid-19 pandemic conditions, the 2020-2021 Spring Fall Semester Graduate Level Project Studio was conducted online. Within the circumstances of online education, new education techniques were applied to the studio. Simultaneously, to follow a research-based design studio process, a new studio method was required to face the needs of the online education system. This research aims to discuss the newly applied studio method results and contribute to the literature with the outcomes. To conduct the study, the research article was structured as follows. Firstly, a literature review was done to examine research-based design studio, online, and multidisciplinary education systems worldwide under the title of "landscape architecture graduate-level studio education". Secondly, a new studio method was developed under the *"Around Water"* theme. Finally, the outcomes of the studio were presented with the selected various case studies and discussed. Projects as studio outcomes are categorized as "Water History", "Water-Based Planning", and "Water-Based Design".

3. Landscape architecture graduate-level studio education

3.1 Research-Based Design Studio

Developing an idea in a research project often stems from the experience of practical problems (Trochim and Donnelly, 2001). As a method in this graduate-level studio project, students were asked to carry out a research project. They started their projects by studying the literature in their fields. Conducting a literature review is essential to general knowledge of the relevant research topic.

Each process has been planned subjectively in this project since the theme, scope, and desired result of each research is different. In a study, variables direct the research, and each variable can be considered an entity that can take different values (Trochim and Donnelly, 2001). Within the scope of this studio work, the variables of each study differ from each other depending on the concentrated theme. In the systematic design method, the design process is mainly in the form of *"Analysis, Synthesis, and Evaluation"*. In both design and research, the perspectives of the literature reveal different views according to the field of use. In evaluating the various contextual objectives of the research project, the researcher's questions inevitably arise. *"What is the motivation for this research?"*, *"Who is the target audience of the study?"* and *"What is the potential or intended impact of this research when completed?"* questions can be taken as examples (Groat and Wang, 2013). In this framework, it should be noted that the reason for choosing "water" as the scope of this study is to increase the recognition and importance of water in every stage and scale of our lives and to include it in the education system. As a multidisciplinary architecture faculty team that values its environment and natural resources, it is imperative to understand the unique needs of the societies of our age and that we do not offer the right solutions. Therefore, as a designer, knowing that our life is highly dependent on water and giving importance to water-related works has been our priority within the scope of this research project.

The education method applied in design studios has a deep-rooted tradition in architectural disciplines. Studios, which provide a platform where students interact with the instructors, are exemplary in other disciplines (Boyer and Mitgang, 1996; Kvan and Jia, 2005). Similarly, in this research-based design studio, the projects for which the graduate students created their research questions under the main title of *"Around Water"* were discussed with the lecturer and other students in each lesson. The process progressed, and the projects were discussed.

3.2 Online and Multidisciplinary Education

With the appearance of the Covid-19 epidemic in the recent past, many studies focused on examining its impacts, consequences, and confinement periods. This phenomenon affected education deeply through the schools' closure. Several studies examine the negative impact of unusual routine and online learning on various levels of education. According to the existing literature, e-learning brought about psychological issues such as anxiety, tension, and concerns about future education and careers, to both teachers and students. Poor internet connectivity, particularly in digitally underdeveloped countries, inadequate study areas at home, lack of face-to-face contact with classmates and tutors, and consequently low morale and enjoyment lead to a loss of real-time transmission of ideas. (Adnan, 2020; Hasan & Bao, 2020; Toquero, 2020; Vaez Afshar et al., 2021).

While the issues are comparable to the previously stated distance learning ones, Adnan (2020) claims a greater concern for tactile learners, who are the subject of this research as art and design students. Despite their proficiency in using online educational technology due to the related knowledge they acquire, thanks to their major, art and design students confront a variety of problems in their applied classes (Dilmaç, 2020). According to the interviews conducted in Dilmaç's (2020) study, the participants mentioned that these types of practice courses require face-to-face practical training with enjoyment and some apparatus in the sessions that they do not have at home. Additionally, the Covid-19 period's anxiety impacted their intention and inventiveness in creating artworks.

Almost all academic institutions now use video call sessions on platforms like Zoom, which are tedious for students to attend. However, considering classes being held online as a mandatory consequence of Covid-19 and the mentioned subsequent issues, the instructors and students noticed the inevitability of the situation. Hence, they tried to focus on the bright sides of widespread e-learning. We let

students manage the time to avoid the downsides of a poor internet connection in the studio. When the students were available and felt comfortable, the presentations and the critics were made. In order to just discuss the students' projects due to lack of face-to-face meetings, we tried to have various conversations related to news around the world. Students were allowed to discuss and interact to provide a chance for every student to receive required critiques. Students were asked to consider their interests each week to keep studio morale high. The studio allows students to enjoy their interest topics, which gives extra motivation to the studio. Despite turning negative impacts into positive ones, the online studio was beneficial to invite international colleagues to the studio. Juries from La Sapienza University and Columbia University listened to the students' presentations and gave valuable critiques to them. Additionally, watching related videos during the class was one of the notable activities leading to interactive conversations and brainstorming by students on online whiteboard platforms such as Miro (URL-1).

Most of the time, carrying out a project takes place with the collaboration of people from different disciplines on the scale from implementation to design. When scholars of various disciplines cooperate to use each other's tools or knowledge, multidisciplinarity occurs (Youngblood, 2007). Considering the students' approaches to dealing with the water issue, the class had a multidisciplinary theme. The orientations and productions of this group, which included students from different nationalities and disciplines such as architecture, interior architecture, and landscape architecture, were also different from each other. They had technological, historical, cultural, and educational points of view for tackling the water issue of the planet.

4. New studio method: "around water"

It is unthinkable for humans to survive without being around water. They need fresh water to survive biologically and to maintain their physical health. Without water, humans can only survive for a few days. Also, water affects societies, including setting up their settlements around the water besides the physical health dimension. Cities are born, developed, and collapse around water. Water is one of the essential elements; it has been the source of life and civilization throughout history and has been culturally and geographically influential on architectural, construction, and management styles. Systems have been established, and facilities have been built to deliver water, which is an important need for living things to survive, from past to present. Sometimes artificial, sometimes naturally occurring waterways told the story of water and the surrounding lives. Water carried to the cities by canals and aqueducts came to cisterns to be stored and reached fountains and pools through pipes.

On the other hand, a changing water story has been shaped differently in every society. Every life that has developed around water has been specialized in terms of water use. Each civilization has developed its own ancestral water culture collection and uses techniques considering its nature, land, and climate variables. Today, because of climate change and the water shortage crisis, it is first needed to understand the water ancestral culture. So, in this studio, we first become testimonies of water cultures throughout history, from Qanat systems to aqueducts, stepwells, and cisterns.

Within the scope of this research-based design studio, the main title of *"Around Water"* was adopted, and graduate students traced the story of water in various parts of the world. The field of study to be chosen in these projects was left to the students, and the final output was not subject to a specific format. While some students decided on the project area based on their observations about the water they live in their hometowns, some focused on areas at risk of submersion or countries with water access problems. As the theme selection, while some projects focused on architectural structures culturally shaped by water management, such as stepwells, cisterns, and ports, a more futuristic perspective was dominant in some projects. Game design and futuristic architectural solutions were produced. In

addition, the scale of the research projects has varied from the biophilic approach at the human scale to the mapping of the city and representation with illustrations.

Furthermore, World Water Day, organized by the UN with a different theme every year since 1993, has been among the subjects discussed in the studio, having similar aims. Closely related to "Around Water", 21 March 2021, World Water Day was celebrated by sharing a video work consisting of the visuals describing the relationship between the selected case studies and water on the social media account of the landscape architecture department (Fig. 2).

Students participated in three jury sessions and received required critiques. They submitted a booklet section at the end of the semester. The studio calendar was divided into three sections with three jury days: General research about water and the case study areas, physical and non-physical analysis of the areas, and proposed research design discussions. Each section contained its own data visualization techniques. In the end, it has been evaluated how the case studies can be read through analysis and how successfully these readings can be transferred to a planning or design scale proposal.

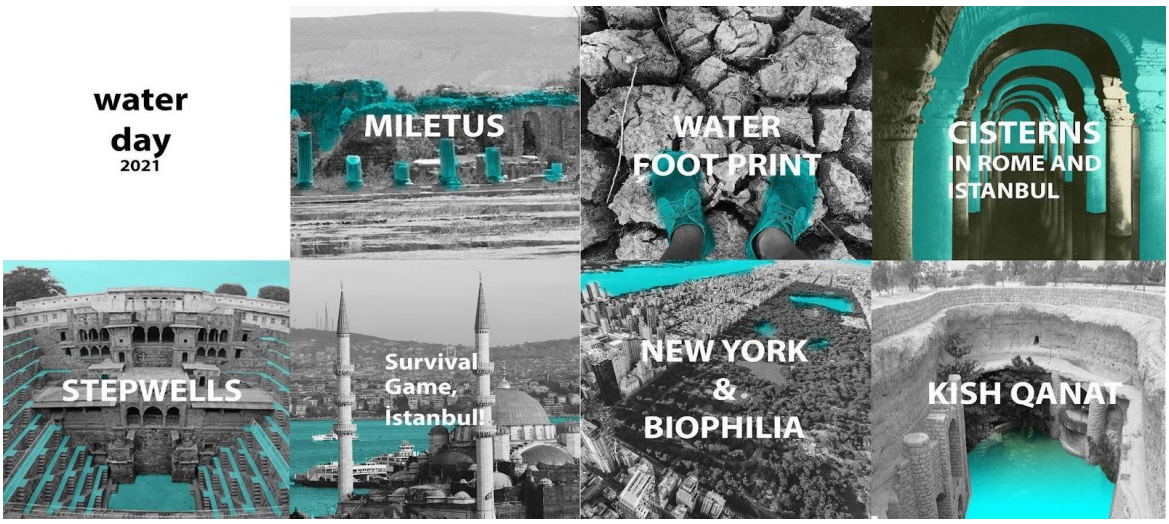

Figure 2: *World Water Day 2021 Works of The Studio*

4.1 Studio Method

The Graduate Project I studio follows a 15-week, 3-hour-a-day program. During the 15 weeks, students selected a topic under the title of *"Around Water"* and chose their case study area depending on their interests within the framework of the subject. Students analyzed the selected case studies in-depth and proposed a research-based design or planning approach. Students presented the information they had gathered every week as part of this process. All the studio participants were responsible for stating their critiques to all presentations.

4.1.1 General Research About Water and the Selected Case Studies

The first four weeks were devoted to the general research approach. After introducing the subject in the first week, the "Around Water" theme was discussed. As a result of the discussion, one week period was given to the students to choose a case study in which they will work on water depending on their interests.. The information through the water they gathered was presented to the studio audience by visualizing with the mapping techniques which provided significant contributions to the research-based design thinking. At the end of the first phase, the

"Around Water" information was transferred to the first guest jury through visualization techniques such as mappings, illustrations, or diagrams.

4.1.2 Physical and Non-physical Analysis of the Selected Case Studies

After visualizing the decided subject through a literature review, Figure 3 focused on the case studies selected from various parts of the world. Performing the analysis of areas with different geographies worldwide through water and sharing it with the studio members diversified the analysis and enriched the field reading ability. First of all, searching physical factors such as climate and landscape formations and then adding social and cultural factors such as human relations or education as layers were essential steps in specifying the relation of the case study with water.

4.1.3 Proposal Research Design Discussions

Depending on the analysis, each project developed its own specific proposals. Case study diversity and students' multidisciplinary approach informed projects as varied as a conservation plan and an educational digital game. Such diversity enabled projects outputs discussed by everyone in the studio. In the last jury, an international guest joined the studio and gave the students critiques on their proposals.

At the end of the three stages, determined at the beginning of the semester, students submitted their projects in a booklet format by converting them into a publishable form, as a result, developing proposals depending on a detailed analysis created research projects around a specific subject and case study that dealt with the subject of *"Around Water"* .

5. Results and discussion

Landscape Architecture graduate-level studio, which took place in the spring term of 2020-21, was conducted as a research-based project in line with the education level of the students, and each of the diversified projects under the *"Around Water"* theme offered new discussion environments. In the studio with multidisciplinary participation, water, which is the most significant design and planning challenge of the 21st century and one of the most important natural factors to be addressed against the climate crisis in the 26th COP agreement, was discussed. The fact that a specific project area was not given for the projects carried out within the studio's scope and that research and project making in any part of the world was left to the students resulted in a rich and diverse output.

Figure 3: *Case Studies Around the World*

By discussing a multidisciplinary team about the water topic, multiple layers around the water were discovered, leading us to the cumulative knowledge of the studio. Afterward, the variation of the ideas exchanged in the class enabled us to become aware of diverse water issues. While the topic, around water, limited the scope of the research, it was enlarged by letting the students select their approach towards tackling it. Hence, the students gained research-based design ability in their graduate-level education. Moreover, each case study as the studio's output can turn into academic research.

5.1 Studio Outcomes: Case Studies

5.1.1 Water History

5.1.1.1 Ancient City Miletus in Büyük Menderes Basin

The story of water begins long before history. Water shaped the structure of today's cities thousands of years ago, which is carried to the present through cultures throughout history. Reading the water story over Miletus, an ancient Ionian port city in the Büyük Menderes Basin (Fig. 4), adds an entirely different aspect to the landscape. Due to its cultural heritage value with a substantial historical background, it is a first-degree archeological site in the basin. Once a port city in the Aegean Sea, Miletus has become separated from the sea more than ever to the point of being inland, influenced by the meander. Bruckner et al. define Miletus as "from the archipelago to flood plain" (2006), which shows its direct relation to water. The meander is the key to the morphology of Miletus City, which dates back to prehistoric times. The meander shaped and changed the city during its history. The conservation methods for an ancient city in a meander basin are investigated within the scope of landscape change.

Through literature, landscape change is examined through five concepts concerning water: time, coastal change, cultures, architecture, and water technologies. The five concepts are mapped onto a timeline and modeled in three-dimensional ways. In the created timeline, it is seen that before 1500 BC, there was seawater instead of a meandering riverbed in the Büyük Menderes Basin. The shoreline was located further in the eastern part than it appears today. Lake Bafa was a part of the Aegean Sea. Miletus was an archipelago. With the formation of a delta in the Aegean Sea by the alluvium brought by

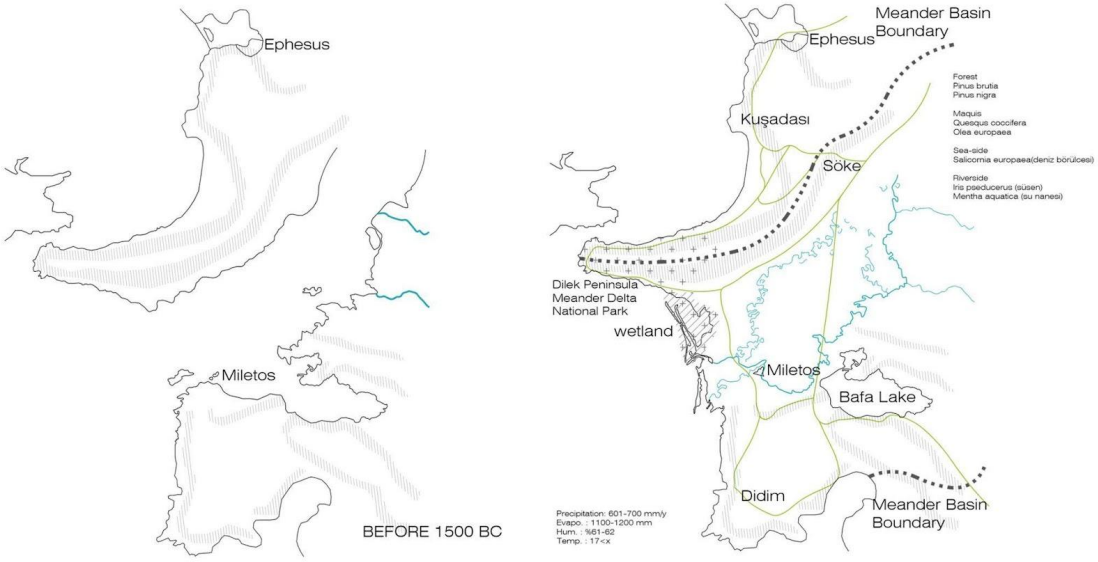

Figure 4: *Büyük Menderes Basin*

meander, the coastline has moved westward over time. Miletus became a peninsula. In the Modern Age, Miletus becomes a land not adjacent to the sea and is surrounded by the meander. Today, it is under flood risk of the Menderes River (based on visualizations in the timeline). Second, the research was about the existing protection status of the area through archeological sites, urban sites, natural sites, significant natural areas, or heritage sites. By combining landscape change in Miletus City and Büyük Menderes Basin and existing protection maps, a conservation master plan including a protection zone and a buffer zone is developed for the meander landscape character atlas.

5.1.1.2 The Management of Water in Istanbul from the Past to the Present (Cisterns of Istanbul)

Istanbul is a water city with its Bosphorus, shores to two seas, streams, fountains, and spring waters. Within the scope of the class project, water has been used in many different ways, both above and underground in Istanbul City. Plenty of structures have been built for the use of water in history. Because Istanbul city hosted many empires, tackling water management with various methods and history, this study was first examined water management from the past to the present. For instance, cisterns with transmission lines were designed to store and carry water throughout the city. Also, with the advancing age and the historical process, other water structures such as dams were built around the cisterns to enable water portability instead of using cisterns just as storage. In this study, the definition of cisterns, their distribution according to periods, typology, and their current status, are extensively investigated by predominantly examining the cisterns.

The result section of the research examined the Byzantine and Roman period cisterns in the Historical Peninsula in detail. A water source excursion route was proposed and presented in the Historical Peninsula in line with the connections between water resources. This route, which is created to narrate the link between water resources and their historical background, aims to understand and reinvent the relationship between superstructure and infrastructure in the city. The route is planned (Fig. 5) to guide both citizens and tourists in the context of public, history, architecture, and tourism. In addition, the study intends to bring

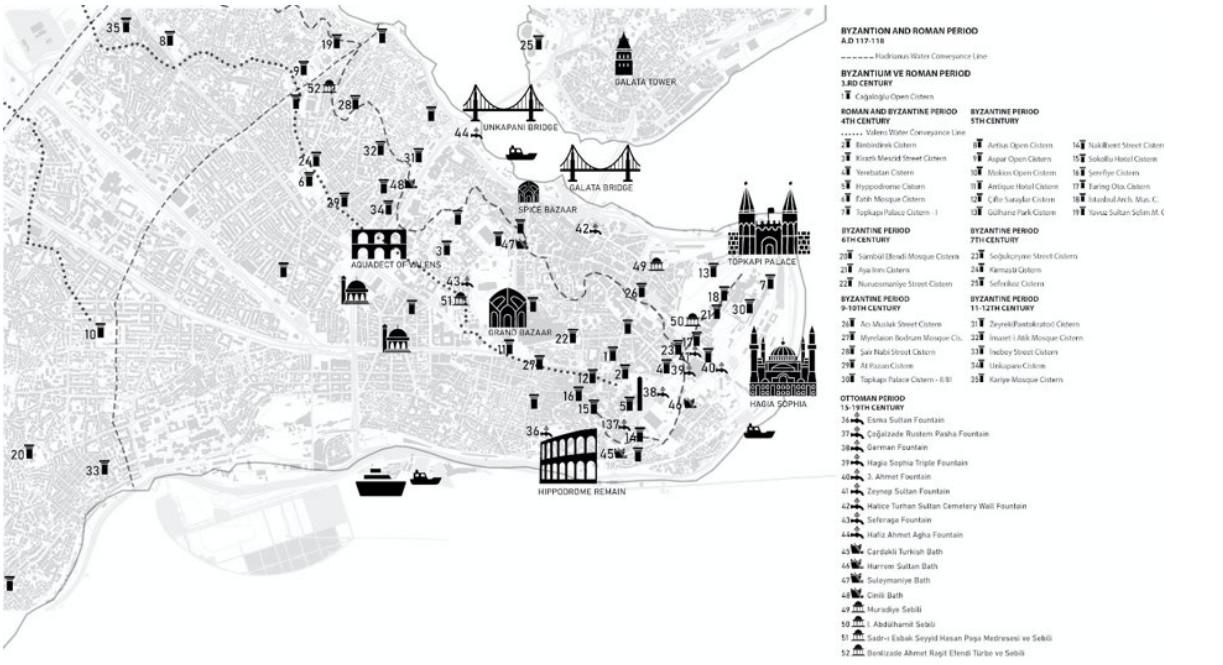

Figure 5: *Proposed Map for Cisterns of Istanbul*

new functions to underground structures by considering their historical identities and establishing new links between the past and the future.

5.1.1.3 Water and Its Importance During History in the Case Study of Iran's Qanat System and Gardens

According to the undeniable place of water in human civilization from past to present and in the future, the project tries to examine the importance of water in Iranian cities based on descriptive-analytical methods using historical library documents. It focuses primarily on its arid and semi-arid regions, examining the strong relationship between the shaping of Persian gardens and water. Finally, it explores different types of water usage and its function in gardens named the Qanat system, known as Iran's cultural heritage nowadays.

Iran is a mountainous, arid, and semi-arid country. People have tried to find a solution for the water management issue for a long time. Consequently, the Qanat system that played a fundamental role in water management and shaping Persian gardens in Iran's harsh environmental conditions is one of the most important systems invented by Iranians (Fig. 6). Indeed, Qanat is not only a general and efficient structure for water transfer, but also it is a water resource for other systems like cooling systems, water reservoirs, and land irrigation. When it comes to gardens, water circulation defines the geometry of the gardens and their location. Hence, it can be stated that water has been used for two purposes; While the first one is functional, the second one is decorative with various running structures, such as basins, streams, water creeks, and fountains. Also, gardens use water with its multiple aspects such as liveliness, brightness, cleanliness, light, inertia, and motion, bringing numerous feelings in the human soul and enhancing mental comfort (Fekete and Haidari, 2015).

The study shows that nowadays, according to fast urbanization in Iranian cities, the function of the Qanat system is decreased, and some of them are destroyed. As a result, the gardens and green spaces irrigated by Qanat are at risk of deterioration, and cities face different problems in water management. All these problems are ringing alerts for understanding the importance of water in daily life and finding ways to manage it before it becomes much more critical.

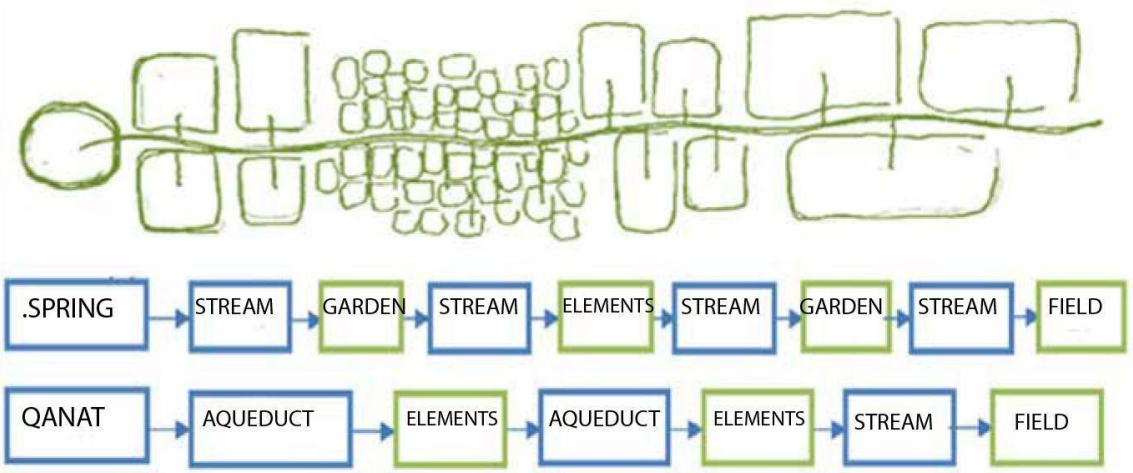

Figure 6: *Qanat System*

5.1.2 Water-Based Planning

5.1.2.1 Water, Biophilia, and New York City

In metropolitan areas where human density is high and intense construction, designs should be made harmonious with nature to ensure human health and welfare and sustainable urban infrastructure. The goal of creating cities with high human density reveals a perspective that questions the existence of a relationship with nature in the urban environment. In this framework, the question arises, "Can a sustainable and biophilic city that maintains its connection with nature be created by designers?" The human need for nature is inevitable. Connecting with nature in the city is necessary for societies where human health and welfare can be achieved.

In this context, New York's city has been considered one of the cities with the highest urbanization and dense human population. Manhattan Island has been determined as the study area for investigating water management systems and the city's green infrastructure. This study aims to relate and explore the connection between New York, Manhattan Island, and "water", both as part of nature and as a system to manage, under the concept of biophilic design. First, the term biophilia was introduced to establish the link between them, and water was emphasized as a design element in terms of biophilic design. Secondly, current usage percentages were given to understand the movement of water. Thirdly, the history of urbanization of Manhattan Island was introduced in connection with schemes and critical historical events. Then, the waterways and water systems built to bring water to the city are examined by comparing with green infrastructure systems and assessing its biophilic dimension. Another aim of this research is to trace the link between being in harmony with water and being a biophilic city. Water and green infrastructure systems in Manhattan Island, one of the most extreme examples of urbanization, are examined under the title of biophilia to reveal the water management of this settlement and examine the efforts to bring people together with nature. The city's relationship with water at the user and city-scale could be monitored and presented by mapping (Fig 7).

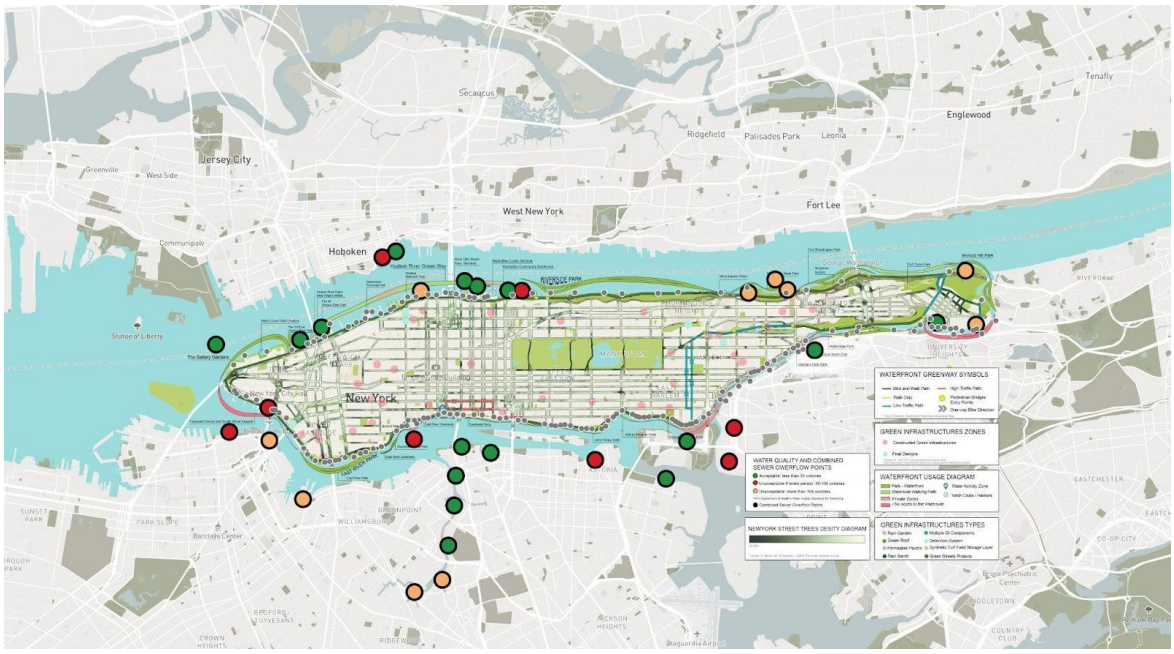

Figure 7: *Manhattan Island Water-Related Parameters Map*

5.1.2.2 Water Footprint: Burundi, Kirundo

Water, an essential source of life on Earth, is running out day by day due to human and natural factors. Although water is a matter of rights, it cannot be fully applicable worldwide. Many African countries are dealing with very long drought seasons, and their infrastructure systems are not developed due to the lack of adequate financial support. Even some countries in Africa do not have an infrastructure system. That is why people living in these dry regions have serious difficulties accessing water and have lost their fundamental rights. Since life in African countries is entirely based on water, many people do not have the right to food, shelter, washing, and education if there is no water. As a result, the landscape of one of the African countries is investigated depending on the lack of water, which is so significant and not on the agenda much around the world. Burundi, which has the world's unhappiest African countries and the second largest freshwater resource globally (Assessment, 2007), is focused on throughout the study. After investigating water footprints worldwide, Burundi is analyzed depending on the spatial access to water. For the Kirundo Region, where it is found that the access to water is the most sensitive in the country, spatial water access scenarios are created. Besides the scenarios with low cost and low maintenance requirements, accessible installation structures that supply water to the city are proposed to adapt local people to spatial water access. Kirundo city is the pilot study area for Burundi (Fig. 8). Decisions made for Kirundo are transformed into planning strategies applicable within the entire country of Burundi.

5.1.3 Water-Based Design

5.1.3.1 Su: A Serious Game for Water Management - Based on Istanbul

Due to the crucial role of clean and fresh water for the planet and the inhabitants, its lack impacts their physical, social, and economic well-being. However, the steadily increasing urban population growth and their water demand generate a fateful threat considering the decay of available water resources (Van Leeuwen & Sjerps, 2016). As a consequence of this phenomenon, society may face water insecurity and fail fulfilling its water need for a long time. Besides, the aridity of a region aggravates human condition by endangering the food resources, natural ecosystem, and health. Hence, for the sake of the next

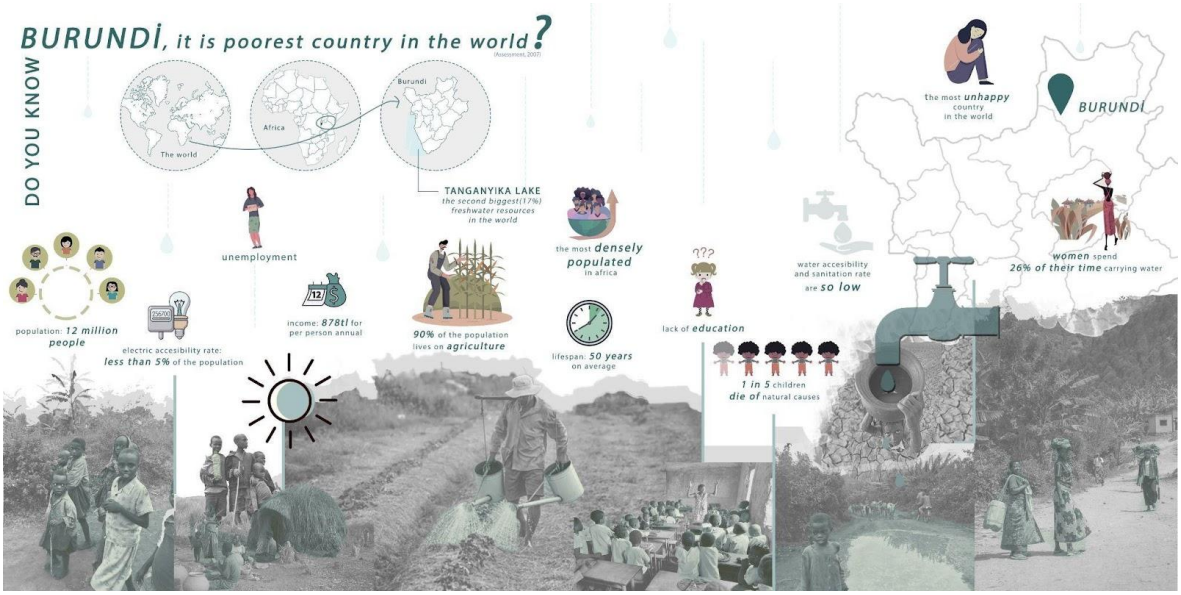

Figure 8: *Water Footprint, Burundi*

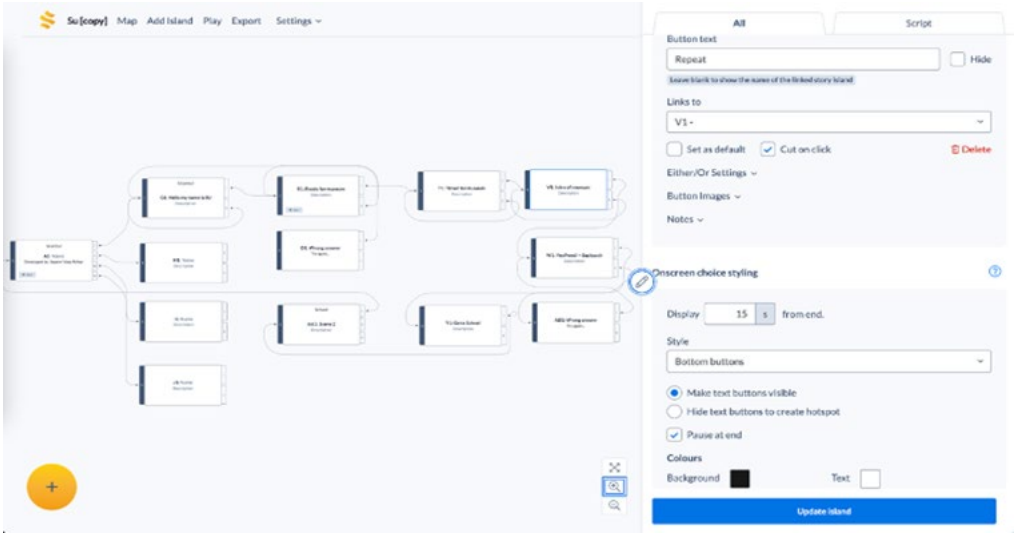

Figure 9: *Effect of correct answers on the environment in the game*

generations' life quality and economic growth, water management plays a crucial role in dealing with the water issue (Savun-Hekimoğlu et al., 2021). Water consumption of a region includes the used water for any type of production and its direct use as freshwater. Hence, production trade amongst countries enables a virtual water flow, an alternative solution regarding water scarcity in the arid regions (Hoekstra & Mekonnen, 2012). This study aims to deal with Istanbul's water management issue, a metropolitan city with a high population growth pace. Istanbul faced water-related threats during its history (Savun-Hekimoğlu et al., 2021; Van Leeuwen & Sjerps, 2016). The most recent drought in 2020 that the city experienced caused an extreme shrinkage in its reservoirs, falling to almost only 20% of their capacity (Yılmaz et al., 2020).

Public awareness has a crucial position regarding the sustainability of ecosystems. Hence it is vital to inform the citizens of the possible challenges, specifically from their early ages (Vaez Afshar et al., 2021). Additionally, UNESCO (1980) drives the attention of contemporary literature encompassing environmental education to endorse promising approaches towards public awareness. Educational software, also called edutainment, a term generated from education and entertainment, is a digital game designed for tutoring. It serves academic content to the user through a digital medium, using entertainment. These games, also called serious games, have been attracting players since 2002 (Eshaghi et al., 2021). Thus, this study introduces a serious game based in Istanbul to raise the upcoming generations' awareness concerning water shortage (Fig. 9).

While the scholars focused their studies on the serious games considering water management (Morley et al., 2017), the game developed in this study is explicitly based on Istanbul's reservoirs and their water level. Also, The game depicts Istanbul's future while suffering from a harsh drought (Fig. 10). It asks the players to survive despite the water shortage problem, and it demonstrates the effects of their decisions on the landscape and the environment. This research was presented at the SIGraDi 2021 conference (Vaez Afshar et al., 2021).

A documentary named 25 Liters (Dilara, 2019), cast by National Geographic Turkey, inspired the narrative of this game. The main intention of the game is to educate the children about the concepts of actual and virtual water usage, its efficient use, and the effect of its usage pattern on the environment.

Fig. 10 The development process of the game in the Stornaway.io platform. Source: www.stornaway.io

5.1.3.2 Rising Water Sinking Cities

According to the information obtained from the "Intergovernmental Panel on Climate Change (IPCC) Report on Oceans and Cryosphere in Changing Climate" (Pörtner et al., 2019), climate change causes ocean temperatures to rise, glaciers to melt, and sea levels to rise. It is predicted that the methane gas released into the atmosphere by the thawing of billions of tons of frozen land will rise ten times faster than the previous century by 2100 unless emissions in the world are reduced within the framework of combating climate change. As a result of the melting of the Greenland and Antarctic ice sheets, more than 400 billion tons of water is added to the ocean annually. According to the European Environment Agency, the sea level has risen by 3 millimeters every year since 1993. Studies show that sea level rose 19.5 centimeters in the last century, and this rise is not a gradual increase but a rapidly growing graph. How much water levels will increase after this day depends on how much we can reduce the progress of global warming from now on.

As a result of the literature review, the research focused on the cities expected to be flooded in

Figure 11: *Selection of The Cities*

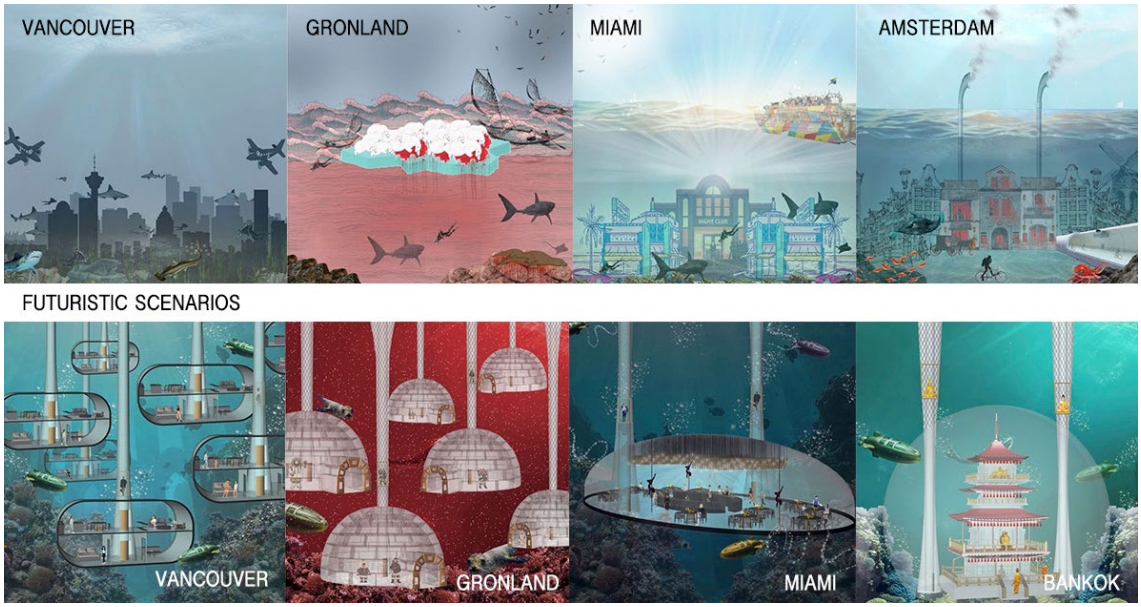

Figure 12: *Illustrations of The Cities*

the future, particularly 11 cities presented in Figure 12. In this context, why selected cities were predicted to sink and how they planned to deal with this situation in the future were investigated. This project aimed to raise awareness through dramatic visual information and projections about the flooded cities. The project, which tries to reflect excessively what we would see if the selected cities were flooded "right now", was aimed to increase the sensitivity and awareness of the subject by creating utopian visuals. In this aim, general topics such as climate change, melting of glaciers, the collapse of soils were mentioned, selected cities were researched, and then utopian underwater projects designed with future scenarios were examined.

As a result, awareness-raising visuals (Figure 12) were designed by being inspired by the literature research outputs and the cities' unique cultural structures and iconic features. In addition, the geomorphological systems of two towns, Maldives and Venice, were examined in detail, and the soil structures, formations, and geographical features were supplemented with descriptive visuals.

6. Conclusion

Within the scope of this study, carried out under the landscape architecture graduate-level studio of Istanbul Technical University, the theme *"Around Water" is to* increase the recognition of water in every stage and scale of our lives and encourage students to conduct research in this direction. It is precious that researchers from different disciplines, who value the environment and natural resources, aim to protect the environment and natural heritage, conduct research with social value, and generate solutions. In this study, designers aware of social and environmental needs concentrate on water and production.

Each project produced within the scope of this studio project has gone through the stages of identifying environmental problems in the context of water, researching and delivering solutions, and creating unique discussion platforms. Through the projects, how water was transported and shaped the city in ancient times was handled through the example of a city such as Miletus. In contrast, the course presented and discussed the development of water management systems over today's metropolises, such as New York and Istanbul. When the research subjects are handled specifically, "water" has been studied worldwide, from cisterns to sinking cities, from basins to water footprints, from the value of holy water to its technological aspect with game design. In addition, some studies have

been developed from student projects that started with this studio work, which have been developed into various international articles and international book chapters. These studies, which started and developed with studio work, reveal successful outcomes from this discussion, research, and
educational environment.

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Design Practices for Flood Resilience in Istanbul: Case of Kadiköy Waterfront

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Abstract: Extreme weather events, sea level rise and intensified tsunamis as causes of climate change are becoming major threats for coastal cities. Istanbul, one of the most populated built-up coastal cities in the world, is prone to urban, coastal, and riverine flooding according to studies. Spatial design measurements preparing the urban waterfronts for the consequences of hazardous flooding are adopted in several cities as part of their urban resilience strategies. This paper focuses on physical measurements to adapt Istanbul to the effects of coastal flooding that is neglected so far in urban agenda. In this regard, the paper aims to develop site specific spatial design proposals as possible measurements to increase Istanbul's waterfronts capacity for an effective flood resilience approach in case of storm events and tsunami intensified through climate change.

To achieve this, status analysis and spatial configuration of possible design measures for Istanbul waterfront in a representative study area at neighborhood scale are introduced. To answer how much the waterfronts are at risk and how spatially adaptive strategies can be implemented in the current situation following flood resilience approach, site specific spatial analysis and a strategic design framework are developed. Since a comprehensive district-based guideline for spatial adaptation is currently not embedded in the urban agenda of flood management in Istanbul, this study promotes preparation of multiple guidelines adopting contemporary design measures in flood management for the entire city's waterfronts by proposing one for Kadiköy.

Keywords: Flood resilience, design measures, spatial adaptation, coastal flooding, Istanbul .

1. Introduction

Disrupted natural events threaten coastal cities with low-lying waterfronts, rivers, and other water bodies. The climate problem becomes an everyday problem affecting urban and rural settlements' social, economic, and political environment. Cities, experienced in mitigating regular tidal and storm surge events, with their existing flood management strategies face a new challenge due to the impact of climate change (Liao, 2014). Alternative approaches, therefore, are developed. Adaptive, flexible, proactive planning is recognized as a priority in today's urban agenda for effective response to uncertainty (Radhakrishnan et al., 2018; Restemeyer et al., 2017). Flood resilience as a new approach in flood risk management is part of this new response strategy. Flexibility is the core idea for decision makers to create responsive living environments where cities can tolerate the impact of changing patterns in natural events in terms of cost, time, and performance (Radhakrishnan et al., 2018).

In Turkey, with the rising climate crisis, several incidents such as erosion, flooding, inundation, and saltwater intrusion become significant problems concerning the country's coasts. Istanbul, one of the major coastal cities in the world and the largest coastal city of Turkey, is strongly affected by events of severe weather conditions. The city is amongst the

most vulnerable areas in sea level rise due to dense urban development and low-lying beaches along the coastline (Kuleli, 2010). In the disaster management agenda, flooding is the second hazardous natural incident after earthquakes in Turkey (Kadıoğlu, 2019). Although Istanbul's earthquake disaster management has top priority, flooding caused by tsunamis will have a devastating impact with increasing sea levels due to climate change, recent studies show (Virginia Tech, 2018).

Istanbul Metropolitan Municipality (IBB), as part of international agreements concerning climate change, has started to develop the Istanbul Climate Change Action Plan (ICCAP) based on principles such as flexibility, holistic approach, operationalization, considering multiple benefits as the leading city in Turkey preparing its first local action plan (IBB, 2018d). Under mitigation and adaptation approaches, planned and prioritized actions are defined. However, these actions remain in macro scale (IBB, 2018c). To achieve effective management under a holistic approach, local and neighborhood scales need to be considered simultaneously (McClymont et al., 2020; Serre et al., 2018). Additionally, contemporary flood management strategies tend to shift from a reactive to a proactive approach where flexibility, adaptation and transformability become dominating concerns. Flood resilience as a new concept in disaster literature needs to be operationalized in contemporary action schemes to tackle the impacts of climate change.

Therefore, this study concentrates on flood resilience operationalization in the physical environment as part of district-based strategy implementations in Istanbul's coasts. By considering site-specific features, constraints, and risks, transmitting strategies to physical interventions will be the focus of this study. Resilience specific action plans and site-specific measures will be presented with a district-based approach, in the case of Kadıköy district.

2. Flood risk management and flood resilience:

There are different types of floods as is mentioned in the literature (Hegger et al., 2016) and summarized in the manual of the World Meteorological Organization (2011) where climate change is addressed as the cause of changing habits in flood regimes:

- Flash floods, caused by intense rainfall and often occur in areas with steep slopes;
- Riverine floods, caused by long-term rain events, melting snow or flow blockage leading to riverbank overflows where dikes or dams can be damaged;
- Coastal floods, caused by windstorms and other atmospheric events leading to high water levels flooding the coast; tsunamis are also considered as a cause of coastal flooding;
- Estuarine floods, caused by inland moving tidal bore;
- Drainage floods (urban floods), caused by extreme amounts of stormwater runoff blocking drainage infrastructure in urban areas.

Coastal floods are the main objective of this study. Mean sea levels are on rise according to the projections which result in extreme coastal flooding due to storm surges and tsunamis. Sea level rise is causing risk for coastal zones which need to be managed. Conventional measures for protection such as dams, storm surge barriers and flood walls are only one side of this management agenda; adaptation measurements such as using ecosystem services, land-use planning and adapting buildings and spatial planning regulations are some of the efforts to be adopted in contemporary flood risk management policies (World Meteorological Organization, 2013).

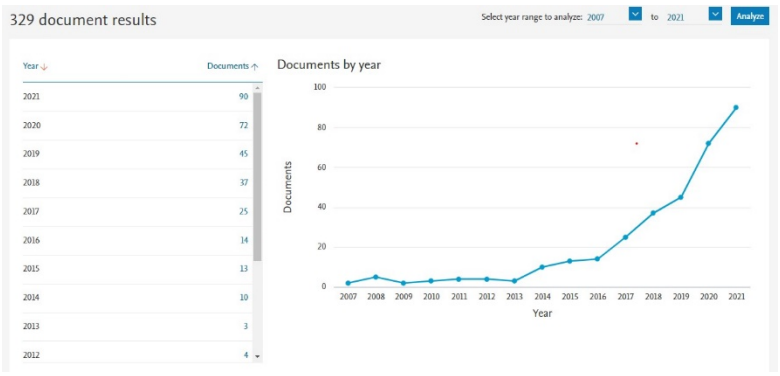

***Figure 1**: Scopus search with keyword Flood resilience*

Herein, flood resilience on urban coasts as an alternative concept within flood management has increased in popularity. The concept has only come up in academic research in the last 15 years. A Scopus search with keyword flood resilience shows 329 papers published in journals between 2007 and 2021 (Fig. 1) and a significant increase in flood resilience research in academic literature. The flood resilience concept is described as a paradigm "… shift from fighting the water to living with water" (Restemeyer et al., 2017) and from resistance to resilience, from flood control to flood adaptation (Liao, 2014). Hegger et al. (2016) define the operationalization of flood resilience under three ability factors: resist (flood defence and mitigation), absorb and recover (flood preparation through natural ways), transform, and adapt (coping with consequences/ability to tolerate change). Spatial planning, community preparedness and communication planning are designated aspects of resilience (Schelfaut et al., 2011). McClymont et. al. (2020) indicate in their review of flood resilience literature that despite the differences how to relate resilience and flood risk management, the studies agree upon the aspect of transformation, suggesting that once the flood occurs, the capacity to tolerate the impact is the key for building resilience. Getting used to the small disturbances paves the way for increased capacity to cope with larger events which is introduced in the same review as a step for "shedding a new perspective on FRM [flood risk management] for flexibility and reorganization". It is therefore necessary for coastal cities to investigate how to reinforce adaptive strategies to build resiliency.

3. Methods and materials:

Coastal floods in Istanbul are the central concern of this paper. According to the microzonation maps[1] conducted by IBB in 2009 focusing on flooding caused by a tsunami, several parts of the Marmara coast of Istanbul are prone to waves of 0.5 m and 3m high (IBB, 2009a). In 2018, another report[2] published by IBB calculated tsunami risk assessment out of hazard levels and vulnerability analysis according to seismic and landslide tsunami scenarios in Istanbul's Marmara coasts (IBB, 2018a). For Istanbul waterfronts prone to earthquake and earthquake-related coastal flooding, it is necessary to review the current risks, existing site potentials and constraints which paves the way for taking visible action to strengthen waterfronts' adaptability to change with rising climate crises. Design is seen as a driving force for turning an obstacle into an advantage; it contributes to redefining flood protection as a new relationship between cities and waterbodies (Hegger et al., 2016).

Given that resilience suggests both recovery and adaptation, this paper tries to constitute a framework of technical adjustments serving as

[1] Istanbul Mikrobölgeleme Projesi Anadolu Yakası *(Istanbul Microzonation Project Anatolian Side)*

[2] Istanbul İli Marmara Kıyıları Tsunami Modelleme, Hasar Görebilirlik ve Tehlike Analizi Güncelleme Projesi Sonuç Raporu *(Istanbul Marmara Coasts Tsunami Modeling, Vulnerability and Hazard Analysis Update Project conducted by IBB in collaboration with Middle East Technical University)*

a design guideline to optimize coastal waterfronts' capacity to be prepared for flood events. Its purpose is to open a discussion on the possibility of how spatial measures can contribute to the production of an adaptive built environment on a neighborhood scale. Therefore, the objectives of the study are as follows:

- Defining design measures regarding the flood resilience of urban waterfronts through literature and best-practice examples
- Detecting vulnerable zones in the case-study area through overlay maps
- Integration of the design measures into the case-study area

The study consists of two phases. In the first phase, design strategies in recent flood risk management are introduced through a brief review of literature and of international best practice examples integrating flood resilience approach into their agenda. A matrix of design measures based on this will be presented as an overview for physical representation of flood resilience. The second phase, after briefly introducing the flood risk in Istanbul and recent efforts to prepare the city's coasts, focuses on the case study area in Kadıköy. A site analysis is conducted for Kadıköy's waterfronts through overlay maps by combining the features such as flood risk areas, land cover data, landfill zones and site observations. For this purpose, open-source Google maps, Urban Atlas 2018, Kadıköy disaster information system data, base maps and data obtained through site visits are used. Through the outcome of this analysis phase, a conceptual design framework as a base guideline for flood resilience is developed at the neighborhood level which is illustrated in the form of maps. All the maps in the manuscript are produced by the author.

3.1. Design strategies in flood risk management literature:

There are two different perspectives regarding the implementation of flood-related measures in the design process as one study suggests. According to the interviews with practitioners, Hobeica & Hobeica (2019) state, flood management is considered as an issue tackled only with hard-engineering techniques. In contrast, some take the issue as the main component shaping their design. In the report of the International Panel on Climate Change – IPCC- response to sea-level rise is being handled under three different strategies: retreat, accommodation, and protection (Dronkers et al., 1990). In the report, retreat is described as abounding risk areas whereas accommodation is illustrated as measures allowing flooding to a certain degree; protection on the other hand is regarded as an individual category consisting of hard and soft measures. Building defensive structures such as dikes, floodwalls, revetments, groins; elevating infrastructural elements such as bridges, roads; modification of drainage systems and adjustable flood gates are options presented as hard solutions. Building dunes, wetlands and mangroves are described as soft structures.

Floating buildings, amphibious transportation infrastructure, adapting open spaces to flood are mentioned by Liao (2014) emphasizing creative design's role in establishing urban open spaces that act as functional units for floodwater storage while serving as recreational and aesthetic utilities. Restemeyer et al. (2017) emphasize the need for flexibility of strategies for increasing capability of cities to cope with uncertainty in the long run. Combination of systems is therefore necessary for the case if one fails the other remains as backup protection.

Green infrastructure provides an additional measure option regarded as an essential investment for many benefits. The European Environment Agency (2017) report shows, a list of green infrastructure measures for flood risk reduction where green roofs, permeable surfaces, swales, infiltration trenches, rain gardens and retention ponds are introduced as high-level beneficial measures for flood management in urban areas. These components of green infrastructure are not defense measures but act as forces reducing the impact of flood on the natural and built environment.

Schelfaut et al. (2011) distinguish measures increasing flood resilience into three groups - communication & perception, policy, and management – and define residents' and authorities' roles and tasks accordingly. Some of the roles defined for authorities are the guidance of residents, involving stakeholders, political and legal guidance, providing technical tools, measures, and constructions, planning hard and soft structures and resource management.

3.2. Boston and Hamburg – design strategies for resilient coasts:

Boston and Hamburg, both two major coastal cities, are globally outstanding examples of how to be prepared for the effects of climate change regarding flood management. Located in different continents, Hamburg and Boston show the need and ability of coastal cities to tolerate the impact of flooding by adopting resilient strategies in design and governance. Waterfronts of both cities are consisting of densely built residential, commercial, and touristic areas like Istanbul; the paper therefore examines both cities' flood resilience approach for being pioneering examples for the case in Istanbul.

Hamburg is regularly affected by high tides; however, recent reports show that rising sea level is a significant threat for 10% of the population living in potential risk areas (van Coppenolle & Temmerman, 2019). The city develops innovative approaches in flood management tactics to increase the adaptability to the new circumstances caused by climate change. HafenCity project, in the center of Hamburg, adopting innovative physical and governance measures due to the changing climate delivers resilience prone environmental and planning aspects (Restemeyer et al., 2015). Building on elevated plots, promenades of different dimensions, terraced plazas ensuring the connection between flood safe basement level and waterfront level are some of these measures that do not withstand the flood; on the contrary that allows the water to flood areas temporarily - an aspect, encouraging to create new normal for mitigating uncertainty. HafenCity uses the advantage of being a new development to test adaptive measures reinforcing flood resilience (HafenCity Hamburg GmbH, 2020).

Boston, an experienced coastal city with high tide flooding, is also affected by severe storm surges due to rising sea levels (City of Boston, 2016). City of Boston has created a new program for flood resiliency and published several documents defining how spatially, socially, and economically the city is preparing its waterfronts for flood resilience. Cooperation with design offices, local communities and citizens is the backbone of the management strategy. Like HafenCity, similar measures in physical dimension can be discovered in the design guideline called "Coastal Flood Resilience Design Guidelines" prepared by Boston Planning & Development Agency. Concentrated on adaptive measures for existing and new buildings, such as elevating buildings on piles, piers or posts, repurposing/relocating ground floor use, wet and dry flood-proofing and using flood-resistant materials, there are also measures for open space dimension; vegetated berms, waterfront parks, temporary flood barriers, seawalls, raised roadways, using flood damage-resistant landscape materials, integrating green infrastructure elements (permeable pavements, rain gardens, bioswales, green roofs, retention basins) are some of them (Boston Planning & Development Agency, 2019).

Given the best practice examples and research on flood risk strategies, a list of spatial measures is generated (Table 1). Dams, dikes, and sea walls are hard infrastructure measures to keep water away from the cities which are grouped as hard engineering infrastructure as mentioned in literature (Vitale et al, 2020; Zandvoort et al, 2019). Accommodating measures support safety by offering building adjustments and retreat from the risk area. Green-blue infrastructure as third main category of measures is ecology-based and focuses on enhancing landscape as part of building resilience (Boston Planning & Development Agency, 2019).

Table 1: *List of design measures increasing flood resilience prepared by the author based on literature review and best-practice examples*

Measurements	
Hard engineering infrastructure	Dwelling mounds/Land elevation
	Flood wall
	Sea wall
	Revetments
	Dikes
	Storm surge barriers
Accommodating	Waterproof materials
	Flood-proofing buildings
	Retreat
Green-blue infrastructure	Beach nourishment
	Floodable waterfront park
	Vegetated berm
	Green streets with rain gardens
	Saltwater tolerant planting
	Green roofs
	Retention basins
	Permeable Pavements

Some of these strategies shaping design framework will be chosen and applied in the study area to understand how spatial configuration flood resilience strategies can be operationalized on neighborhood scale and integrated into the existing urban waterfront landscape This serves as a guideline for practitioners and decision-makers focusing on physical resilience while approaching a sustainable and healthy urban environment.

3.3. Flood risk management in İstanbul:

As one of the major coastal cities, Istanbul has been experiencing hazardous floods in recent decades because of extreme weather events due to climate change. Kuleli (2010) studies the risk assessment of sea-level rise for coastal zones in Turkey at city-level. The research's calculated risk is determined by using parameters such as population, settlements, land use, wetlands, agricultural production, and taxes. According to the findings Istanbul has a risk value of 8.5 (where 1 indicates most risky and 28 indicates the least risky areas) and is among the high vulnerability areas since the city's coasts are low-lying and densely populated.

Another study indicates the flood risk more comprehensively, with maps showing the risk on the district level and neighborhood levels based on flood vulnerability and hazard criteria. Ekmekcioğlu et al. (2020) developed the flood risk assessment for all the 39 districts of Istanbul by linking both the hazard and vulnerability criteria distinctive for each district. Their findings show that land use, population and vulnerable structures play decisive roles in determining vulnerability. In Istanbul multiple risk factors can be considered

as the cause of the flood, namely extreme rain events, extreme storms, and earthquake-based tsunami. The study is a valuable resource to visualize the flood risk situation in Istanbul, emphasizing empirical data and district scale.

On an institutional level, Istanbul Metropolitan Municipality has prepared a document on flood risk for the European side[3]; however, it considers only the risk for riverine flooding and analyzes river areas (IBB, 2009b). Other reports focusing on flooding due to tsunamis and the risk Marmara coasts face (IBB, 2009a; IBB 2018a) reveal, that Istanbul urgently needs to develop strategies for disaster adaptation and mitigation for its coasts. IBB has published a scenario and action plan for responding to climate change using an adaptive approach. In the document, Istanbul Climate Change Action Plan Climate Scenarios[4] (IBB, 2018b), Uskudar coastal zone, Port of Istanbul, Kadıköy coastal zone, parts of Golden Horn, Yenikapi, Zeytinburnu, Ataköy, Maltepe, Pendik and Tuzla are some of the low-lying zones presumed to be affected by the rise of sea level. These areas are also mentioned as high-risk zones in the report Istanbul Marmara Coasts Tsunami Modelling, Vulnerability and Hazard Analysis Update Project conducted by IBB in collaboration with Middle East Technical University (IBB, 2018a). In the Climate Change Action Plan Final report (IBB, 2018c), IBB declares adaptation measures in a general scope. For urban areas, increasing permeability, planting trees, rainwater management, improving the rainwater drainage system, increasing climate resistance of buildings, and increasing the number of recreational areas, are many strategies of integrated spatial planning for flood adaptation. However, compared with international examples as presented previously, Istanbul as a major coastal city needs detailed analysis and assessment measures covering different aspects of climate change and a district-based road map presenting data on budget, timeline, and socio-spatial options of adaptation scenarios. Thus, the paper contributes to the climate change action plan emphasizing coastal flooding through physical design guidelines based on analysis at the neighborhood level. Kadıköy is selected as the case study area since it is one of the vulnerable coastal districts in Istanbul estimated to be affected heavily by coastal flooding due to climate change.

3.4. Case study area Kadiköy:

Kadıköy is one of the oldest districts of Istanbul located in the Anatolian/Asian side and has an area of appr. 25km² with a population of 482.713. The district has 21 neighborhoods and a 21 km long shoreline along the Marmara Sea in the south. The coastline runs from Haydarpaşa neighborhood to Bostancı neighborhood in northwest-southeast direction. Besides recreational green spaces, the shoreline also has dense residential uses making the area quite vulnerable to flooding events. In recent events, dominant windstorms caused a hazardous impact on the built environment, where the main transportation artery connecting Kadıköy with the other districts along the shoreline and major sea transportation hubs were affected. For instance, in February 2015 a strong southwest wind caused large waves washing the shoreline and flooding the coastal road entirely. There is no concrete data about the assessment of the flood damage; information gathered from the secondary sources reveals that people needed to be rescued from trapped cars in flood water; waves reaching appr. 7m brought rocks to the inland (Deniz sahil şeridini yuttu, 2015). Measurements such as risk projections, land use regulations and disaster management still need significant research and implementation effort in flood risk management.

In 2018, Kadıköy District Municipality conducted the project Integrated and Participatory Climate Action for Kadıköy Municipality[5] with funding from the European Union. According to project report (Kadıköy Belediyesi, 2018) there is a risk for the

[3] Istanbul Avrupa Yakası Sel Felaketi İnceleme Çalışması *(Istanbul European Side Flood Disaster Investigation Study)*

[4] İstanbul İklim Değişikliği Eylem Planı İklim Senaryoları *(Istanbul Climate Change Action Plan Scenarios)*

[5] Kadıköy Belediyesi Bütüncül ve Katılımcı İklim Eylemi

coastline buildings in the middle and long term due to the projected sea level rise. In the action plan, retreat from the coast is suggested for the new buildings, while flood proofing strategies such as using flood resistant materials or secondary drainage systems are recommended as additional measures. Moreover, stormwater harvesting and building roof gardens are additional measures for property-based flood resilience.

The study area for this paper consists of waterfronts of four neighborhoods, Fenerbahçe, Caddebostan, Suadiye and Bostancı. It focuses on a shore zone 300m wide and appr. 5.5km long along with four neighborhoods where the conducted analysis is based on map overlays combining the intersecting features such as flood risk areas from Kadıköy Disaster Information System, land-use data from Urban Atlas 2018 and Google maps, historical maps showing the waterfront line before landfill from IBB City Maps. Through the findings, plans with spatial strategies for flood resilience are created. The entire study area focusing on publicly accessible recreational shoreline runs through four neighborhoods - Fenerbahçe, Caddebostan, Suadiye and Bostanci - and is divided into three zones with approximately 2,5km long shore of each to ease the analysis and proposal approach conducted in 1/2000 scale (Figure 2).

The GIS-based Disaster Information System of Kadıköy (Kadıköy Belediyesi, n.d.) is accessible on the web portal of the district's municipality. It shows areas of importance suitable for settlement considering the risk situation regarding flooding and earthquake.

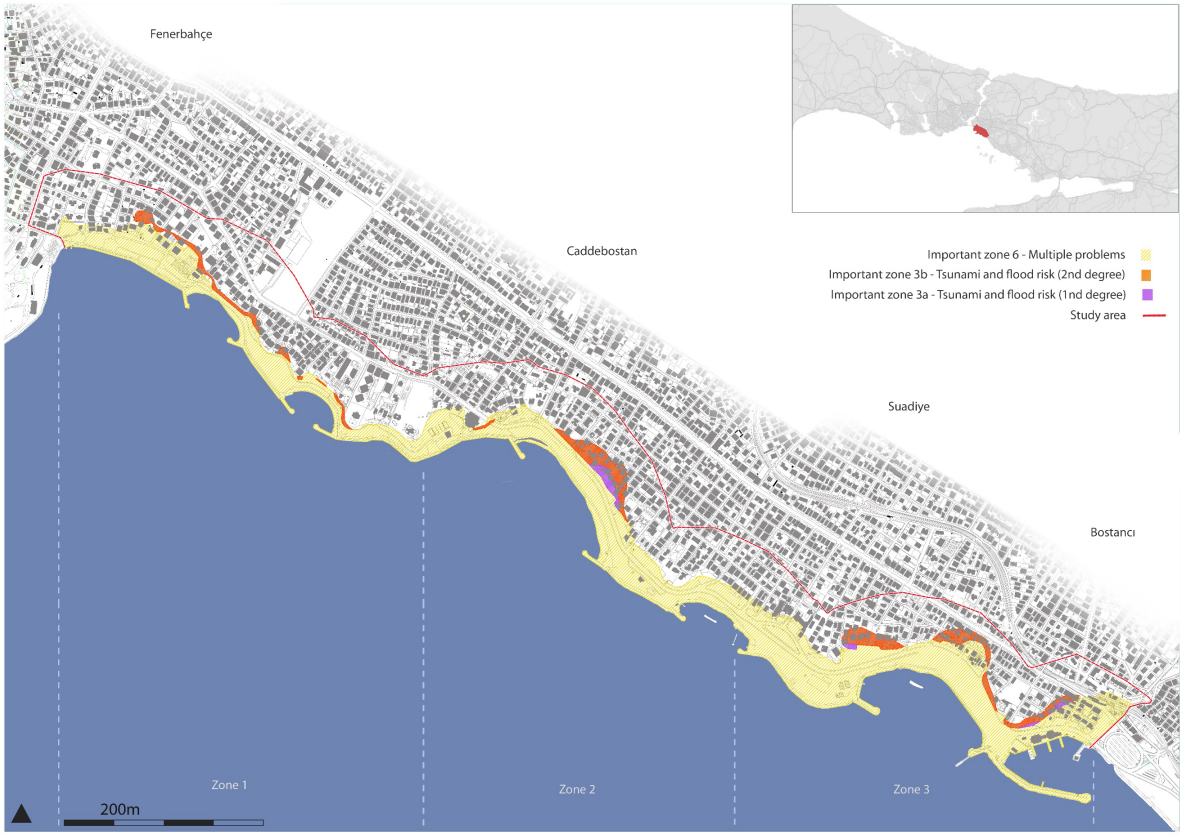

Figure 2: *The study area in Kadiköy Waterfront shows three important zones of flooding caused by tsunami-affected waves. Important zone 6 with 62 ha, important zone 3b with 6.8ha and important zone 3a with 0.8ha are shown.*

The data for Kadiköy in this system is based on the microzonation studies for the Asian side conducted by IBB and adopts the areas shown in the Flooding Hazard Distribution Map prepared in 2009 as part of the microzonation studies. Areas belonging to the categories "Important zones in terms of flooding due to heavy rain and tsunami" and also "Important zones of multiple problems" are detected within the study area. These are integrated into the analysis maps of all three zones respectively (Figure 2).

In Zone 1, the location of the old waterfront line from the 1970s and coastal buildings show that landfill area is exposed to multiple problems (Figure 3). There is a 1.5ha area of flood risk (important zone 3b) where buildings of residential social and educational use are located. The study area is part of a large landfill which was constructed between the years 1984-87 with a coastal road longer than 5 km (T.C. Kadıköy Kaymakamlığı, n.d.) which makes the area extra vulnerable to disaster risks. Another crucial issue is the presence of two historically important buildings close to the risk zone. Both Tevhide Hanım Mansion and Ragıp Paşa Mansion can be affected by flood water due to their location on low lying land. Along the waterfront park hard engineering structures composed of a rock armour and seawall are conventional infrastructural bodies imposing engineering resilience. There are two sand beaches in the area which are popular recreation areas especially in warm seasons.

Figure 3: *Overlay maps showing risk areas, topography with contours every 1m (top), and land cover (bottom) in Zone 1*

Zone 2 located in Caddebostan neighbourhood and contains areas of important zones category of 3a (appr. 0.5ha) and 3b (appr. 0.27ha), showing tsunami and flood risk with primary and secondary degree (Fig. 4). Several residential units are built within this area. Unlike Zone 1, areas located within multiple problems zone 6 does not contain any buildings reducing the vulnerability degree of

the area. However, a large supermarket with car parking is close to the shoreline to the west without any floodproof measures detected (Figure 4). Other uses, such as Istanbul Wind Surf Center located in one of the beaches where surf courses and summer schools take place, and two major children's playgrounds are to be found in the waterfront park. Contradictory to flood mitigation strategies two central car parking spaces with impermeable surfaces of appr. 0.7ha. are detected along the coastal road.

In Zone 3, the coastal roadway runs through the important zone of multiple problems putting the main transportation artery in a risky position (Figure 5). There is a 3.4ha area (important zones 3a and 3b) detected as flood risk zones containing several residential buildings. A commercial zone to the west

Figure 4: Overlay maps showing risk areas, topography with contours every 1m (top), and land cover (bottom) in Zone 2

where a hotel and several restaurant facilities are located, is partially within the zone of multiple problems (Important zone 6). On the east, Suadiye marina harboring small sized boats and Bostancı ferry terminal are to be found as important uses in this area (Figure 5). A large sports field with football and tennis facilities is located between the marina and ferry station. A large car parking space of 1ha size in the waterfront park close to the ferry station serves the ferry users. Additionally, another car parking space of 0.9ha is to be found in the waterfront which increases the vulnerability to flooding due to extended

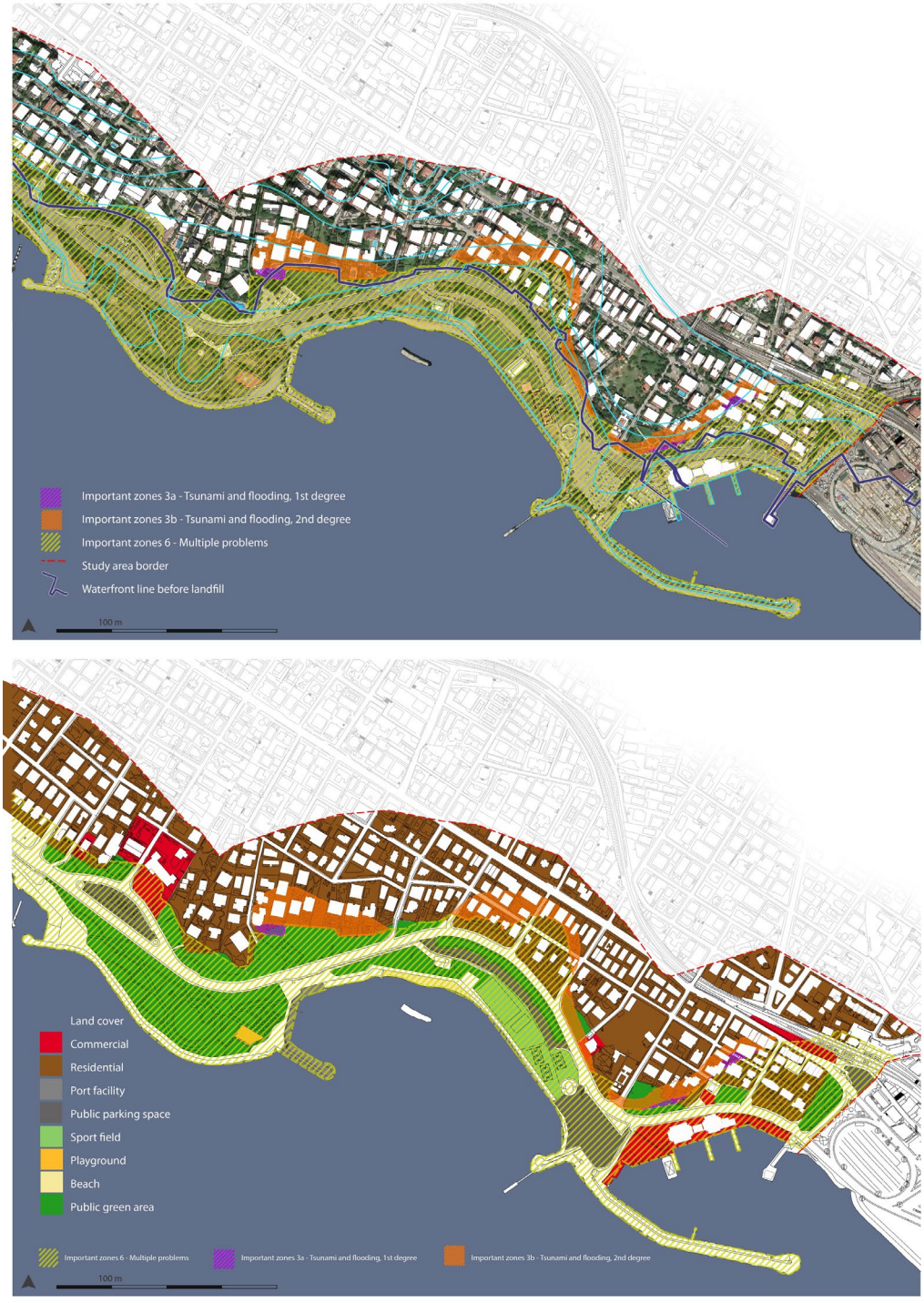

Figure 5: *Overlay maps showing risk areas, topography with contours every 1m (top), and land cover (bottom) in Zone 3*

impermeable surfaces. In Bostancı neighborhood Camasirci stream, the natural border between Kadıköy and Maltepe districts, has its mouth reaching the Marmara Sea in a covered caisson whereby part of it can be seen as open caisson (Dinç & Bölen, 2014). With a new roadway project by IBB connecting Bostancı with northern neighborhoods, Camasirci Stream is planned to be part of a large-scale rehabilitation project announced as one of the 15 Valley of Life projects.

4. Results: The design guideline

In the design scheme, part of the strategies listed in Table 1 are integrated into the zones according to the circumstances revealed through the analysis phase. Areas that seem to be vulnerable in terms of flooding, are in focus.

ZONE 1

For Zone 1, the design scheme suggests mobile flood walls as protection strategies for the placement in the edge of the parcels facing the shoreline (Fig. 6). The concern of limiting the view to the water is here not relevant since the properties themselves have walls for privacy issues. Considering the lack of permeable areas within the boundaries of important zones, a new material with greater permeability is proposed for the pavement of the tennis courts within the social facility Cercle d'Orient (Büyük Kulüp) and the car park nearby. A vegetated berm is proposed as a landscape element to protect the high-risk area in the inland section that can be hit heavily by waves caused through a tsunami or extreme storm surges (Figure 6). The area therefore becomes a landscape attraction in dry seasons for recreational activities. More towards the east,

***Figure 6**: Proposal for design guideline in Zone 1*

Figure 7: *Proposal for design guideline in Zone 2*

for the historical buildings Tevhide Hanım Mansion and the Ragıp Paşa Mansion flood wall construction is suggested which can be integrated into the buildings' landscape from southern and eastern parcel edges.

ZONE 2

In Zone 2, multiple measures are integrated for flood resilience (Figure 7). Some of these strategies are increasing green surfaces for more space to absorb flood water, increasing permeability of hard surfaces and elevated topography for flood protection. Zone 2 is located both within the borders of Caddebostan and Suadiye neighborhoods. As one of the major design strategies for the long term, it is proposed that the supermarket site will be relocated, and the area is redeveloped as part of the urban green along the shoreline which increases the amount of the floodable area as a natural defense. As a short-term measure for this area flood proofing the supermarket building with additional defense structures for instance flood gates, clearance of ground floor use, flood resistance material usage can be proposed in the guideline. Beyond this location, a 2m wide section of the coastal road is designed as a green street that absorbs flood water as part of a green infrastructure to prevent flooding of the coastal road and protect Caddebostan's dense urban residential area within the risky zones according to the analysis. Another important measure as an adaptation strategy is to develop an elevated green surface built along the green area in the waterfront allowing recreational use. When reaching the berm, the shoreline promenade becomes an elevated walk that functions on the one hand as a barrier against the waves and on the other hand as a new landscape experience. Additionally, greening parking lots with grass paver and extending green surfaces along the waterfront park are other measures developed for Zone 2.

ZONE 3

Zone 3 consists of two neighborhoods, Suadiye and Bostancı's waterfronts. Unlike two other zones, here a central transportation hub, the Bostancı ferry station is in the eastern part close to the neighborhood border; therefore, large car parking areas are to be found close to the shore. The design scheme proposes multiple measures focusing on the waterfront

Figure 8: *Proposal for design guideline in Zone 3*

park and inland area (Fig. 8). Two separate car parking areas are merged into one single space next to the coastal road following the waterfront line to design flood resilient landscapes. A large concrete surface west of the ferry station becomes part of the green infrastructure. And again, permeable paving of the car parking area allows runoff water to be drained locally without overwhelming the sewage system to help reduce the site's vulnerability

Between the parking space and waterfront, a dike-like topography is created to protect vulnerable areas from the risk of a flood (Figure 8). The new surface is terraced to sit and relax reinforcing an adaptive landscape with rising sea level. Current sport fields need to be relocated to a new place westward to build the new waterfront. A similar structure in the form of an elevated green area located on the inland side of the coastal road will protect several properties from a risky flood incident. Since there is a limited area near the ferry station to implement soft strategies for flood resilience, a flood wall is a crucial infrastructure to help the properties be protected; it is located on the edge of the property parcels close to the ferry station. To achieve a fully rehabilitated Camasirci stream bed, a concrete analysis in terms of areas at risk needs to be conducted and transformed into open spaces to avoid hazardous impacts on human health and revive the diverse riverine ecosystem.

In the project report of Integrated and Participatory Climate Action for Kadıköy Municipality (Kadıköy Belediyesi, 2018), increasing green areas is introduced as one of the measures for tackling climate change impacts on urban areas. In three locations within the waterfront park, structures such as elevated islands as playful landscapes are proposed to ensure protection for inland flooding by providing an attractive waterfront experience at the same time. Here, the design proposal intends to constitute a new landscape layer by integrating green infrastructure measures into the existing fabric for realizing an adaptive and resilient urban setting.

In the document of the district municipality IBB Kadıköy Tsunami Risk Analysis and

Action Plan Report (IBB, 2020), it is recommended that the waterfront should be free of flood walls because of the undesired outcome as blocking the view. In this study, mobile flood walls as a design strategy are part of the program; however, considering the report's concern, they are proposed not in the waterfront park but for properties in the inland area that have already walls for security issues.
As an overall design measure, the vegetation character is also redefined since it is critical in terms of salination. Using salinity tolerant plants is essential to generate resilient landscapes (Yener, 2020). It is recommended to use species such as Ailanthus altissima, Eleagnus angustifolia, Fraxinus excelsior, Gleditsia triacanthos, Platanus orientalis, Populus alba, Robinia pseudoacacia 'Umbraculifera', Salix alba and Salix babylonica species to ensure sustainable vegetation management.

Kadıköy, having the status commercial, cultural, touristic, and residential district of Istanbul, is prone to several risk factors and needs therefore strategies tackling the complex problems waterfronts are exposed to. Climate change as a triggering factor for sea level rise intensifying storm surge and tsunamis (Li et al., 2018) should be considered from a resilient spectrum to adapt cities to coastal flooding. Flood resilience in this regard opens a wide range of possibilities for operationalization of physical measurements on a local scale more effectively and quicker than in larger scale implementations (McClymont et al., 2020). This study is a tool for the place-based understanding of flood resilience strategies, for opening the path to the spatial implication of climate action plan and for thinking on district and neighborhood scale in disaster management.

Further research concentrated on sea level rise impact on Kadıköy coasts is necessary. Data on wave depth, simulations regarding 50- and 100-years projections on sea level and tsunami inundation maps under sea level rise need to be presented via deeper examination since simulations, spatial modeling and generating risk maps are essential in preparation, response, and recovery for urban infrastructure flooding as it is increasing with sea level rise (Allen et al., 2019). Technical measures need to be broadened and conducted locally through collaborative workshops with experts, residents, and private stakeholders since good communication and cooperation between the public and private stakeholders are essential for trustful relationships and effective flood resilience (Restemeyer et al., 2015).

5. Conclusion:

Considering Istanbul, the need for research on the economic, social, and spatial risk of sea level rise is alarming. As one of the important coastal cities of the world, Istanbul lacks a holistic approach to flood management, the study demonstrates. Prone to flooding and tsunami, climate change is a priority issue on the city's urban agenda. Regarding the risk analysis, tsunamis are comprehensively handled whereas action plan strategies need more concrete steps to fulfill the mission for a flood resilient urban environment. In this regard, this paper explores the opportunities for spatial integration of flood resilience measures. In further research it is necessary to generate flood maps and simulations to understand the risk better. With rising concerns on sea level rise, studies regarding the risk of tsunamis need to be revised and recalculated according to the changing pattern of natural events.

This study strongly recommends a district-based approach about short-term and long-term options with relevant low and high-cost alternatives of design strategies. Hereof, adaptive planning and governance approach with a transdisciplinary collaboration of private and public sectors is necessary. It is crucial to include schemes created through spatial adaptation of planned strategies by considering site-specific features into flood resilience policy.

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New Approaches on Urban Agriculture: A Case Study in Ataköy

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Abstract: In today's world, cities are developing and expanding rapidly. One of the critical factors of this growth is migration from rural areas to cities. As migration to the urban areas increases, the city needs to grow its resources to be sufficient. According to the 2019 statements made by TUIK (Türkiye İstatistik Kurumu), the city that received the most immigration in Turkey was Istanbul with a rate of 42.5%. Urban agriculture is enhancing the capacity of urban resilience. This study aims to examine the concept of urban agriculture in the context of sustainability and examine practical examples especially from Ataköy, Bakırköy in a comparable style. Idle industrial areas or vacant lots and urban agriculture potentials are examined based on the R-URBAN strategy through methodologies of literature review and feasibility and field studies that carried out in Ataköy. A scenario produced and an implementation model has been developed for Ataköy in the context of urban agriculture at the basis of R-URBAN strategy.

Keywords: Urban Agriculture, R-URBAN strategy, Sustainability, Ataköy, Industrial Area Transformation

1.Introduction

As migration to urban environment increases and resources are consumed more, urban resistance decreases. This situation brings the issue of urban sustainability. The ability of a city to be self-sufficient is a crucial factor. An independent city that produces its energy and food can be developed in terms of sustainability. When it comes to producing own food in the city, the concept of urban agriculture appears. Urban agriculture includes private and community gardens and contains fruit, vegetable, fowl production, and fish farming activities for local consumption and sale (Rasouli, 2012; Wei and Jones 2022; Jansma and Werteim-Heck, 2021; Kontothanasis, 2017).

Cities that are economically and ecologically dependent on external sources fail in terms of sustainability. Considerable losses occur during the transportation of external food products. These losses are reflected in the carbon footprint, the price of the product, and the consumer. According to Aslan and Demir (2016), Istanbul can produce only 19% of its annual plant food consumption. This can be considered as proof that Istanbul is dependent in the food sector. Food coming to the city passes through more than one point. In this chain orderly manufacturer, intermediary, broker for the 1st region, shipper, broker in the 2nd region, market and finally the customer comes. The price of the product increases by 2.8 times (Figure1).

Figure 1: *Product Price Chain from Manufacturer to Consumer (modified from URL-2, 2017)*

The carbon dioxide gas emitted during the transportation of the products should also be taken into account.26% of the world's emissions originate from the Food Industry. 18% of this is due to the transportation of food to cities (Poore and Nemecek, 2018). The figure 1 above schematizing the adding cost processes from producerer to customer.

conception and a life style initiatedas "produce what we consume and consume what we produce" by the philosopher Andre Gorz. Self-food production and consumption, social collaboration and local networks are formed through those activities with an emphasis on sustainability (URL-3, 2021). The results of a research study by Roles-Valencia et al. (2011), also validates our explanations above. According to the study, enormous advantages

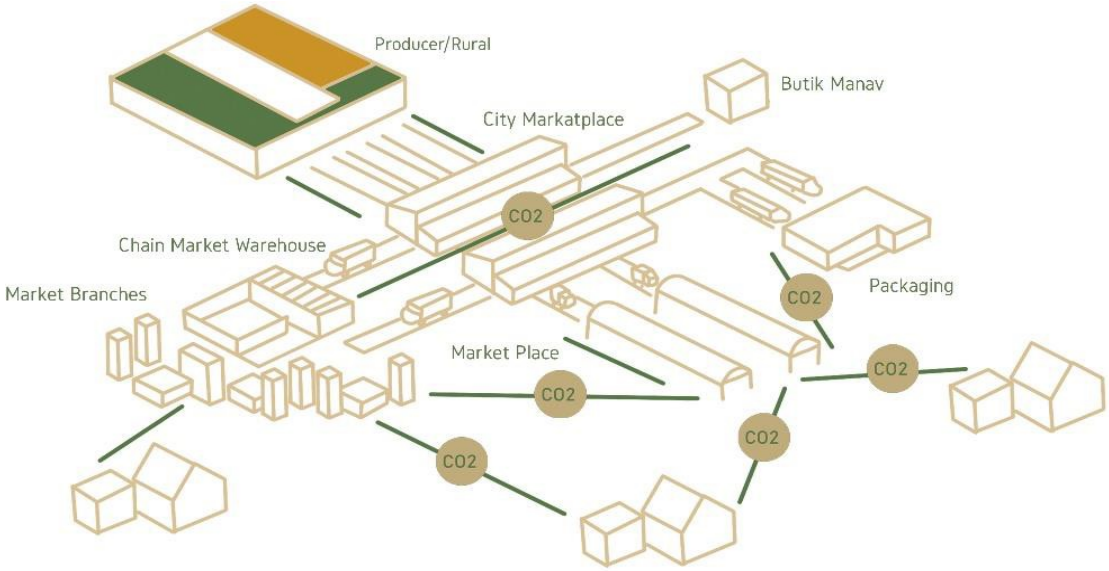

Figure 2: *From Production to Consumption in Food/State Axis (Modified from Okudan and Gürcan,2018)*

According to TUIK (URL-1,2019), the total greenhouse gas emission in Turkey was 506.1 Mt CO_2. When calculated in percentages, it appears that only 23.1 Mt CO_2 was emitted in food sector transportation. When all this information is considered, it is a fact that the concept of urban agriculture will contribute to sustainability both economically and ecologically. In this manner a new

were noted in the practice of urban agriculture techniques in a residential dwelling in Ohio, U.S. They lead to the selective recycling of waste materials that are generated by the ton, in the production of high quality 100% organic food (Roles-Valencia et al., 2011). This new approach is called as "R-URBAN" strategy. R-URBAN is a strategy that explores the possibilities of enhancing the capacity of

urban resilience by introducing network of residents in economy, housing, urban agriculture and culture (URL-3, 2021). This new approach is interiorized for sustainability also. There are 4 main issues that R-URBAN containing. AgroCite that we focused on for this study is including urban.

- AgroCité – a unit of urban agriculture which consists of a micro-experimental farm, community gardens, educational and cultural spaces and devices for energy production, composting and rainwater recycling (URL-3, 2021; Roles-Valencia et al., 2011).
- RecyLab – a recycling and green building constructed around a series of equipment for the recycling of urban waste and turning them into materials for eco-construction (URL-3, 2021).
- EcoHab – a residential unit, cooperative and ecological consisting of a number of experimental units and community spaces which in part are self-built (URL-3, 2021).
- AnimaLab – a domestic farm located in the Agrocité, bend of micro-structure like beehive and chicken coop. The productions are integrating in the local distribution network through the store local shop of the agroCité (URL-3, 2021).

R-URBAN enables the citizens to come together socially with production and creates recreation areas. No substanceis wasted in the ecologically created input-output cycle. The products are sold in local markets, the residues of the products are composted in the recycling areas and sent back to the soil for reproducing stage on the field. The cycle is obviously self-sufficient in a city network.

2.Material and the Methodology

Ataköy is the material of this case study. Ataköy located in Bakırköy Municipality, close to Bosphorus canal at the south east part of European side in İstanbul (Figure 3). In Ataköy the resident plan including different kinds of settlements as different block apartments. Mostly green areas take place at the layout of Ataköy and public spaces take place in a considerable amount (Figure 4).

There are two main subjects of the methodology, that are literature review and field

Figure 3: *Ataköy's location in İstanbul (Ezgi Duman, 2022)*

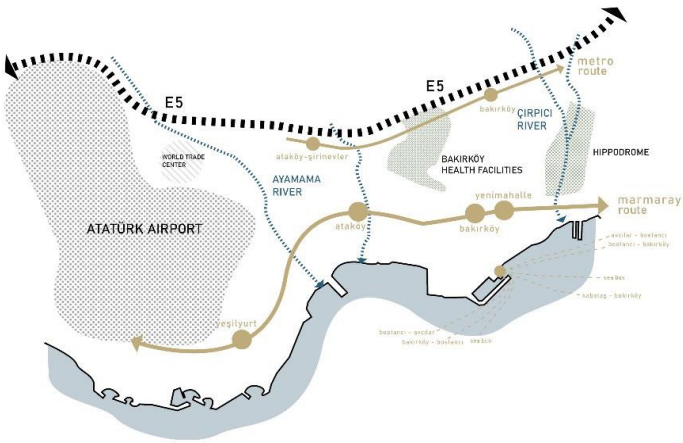

Figure 4: *Ataköy's layout plan (Ezgi Duman, 2022)*

study at the Ataköy. Literature review contains urban agriculture state both in Turkey and in the world and their processes in time. The field study examines the urban agriculture activities in Ataköy and vacant lots that are examined and feasibility studies conducted at the field study which are suitable for urban agriculture activities. Especially at pandemic situation it was obvious that urban agriculture activities increased and gained more importance with the food production reason and relaxation reason. Mostly local and individual attempts attracted attention in this field. A scenario produced for practices by considering R-URBAN strategy to create a model for future applications of urban agriculture by considering sustainability.

3.Literature Review

3.1.Urban Agriculture Examples and Practices from the World

Urban agriculture was first defined as agriculture producing perishable products as vegetables, animal products, and flowers, in the peri-urban area. As the world is undergoing rapid urbanization, great pressure is being placed on the food supply and urban environment, especially in fast-developing cities (Yan et al., 2022). Urban agriculture studies in recent years show that urban agriculture not only focuses on food production and different styles but also on how to realize the various functions of urban agriculture. In addition, urban agriculture related sustainability and the water-energy-food nexus have become emerging research topics. Besides, The University of Kassel, Chinese Academy of Sciences, and University of Freiburg are the most productive research institutions in the field of urban agriculture. The top-five most influential countries on urban agriculture activities are the Unites States, Germany, the United Kingdom, Italy, and China, of which the Unites States plays a central role in the cooperative linkage between countries.

Different types of urban agriculture are tried as new approaches as soilless techniques as in the example of vertical agriculture. Today, examples of vertical farming can be seen all over the world. The idea of farming in city centers has begun to appeal to most people. Although the idea of producing in skyscrapers in metropolises, which is one of the goals of vertical agriculture, has not yet received enough attention at the industrial level, the systems used in vertical agriculture are constantly renewing themselves with the continuous development of technology and reveals that the idea may be realized in different ways in the future (Bingöl, 2015). Skygreens Singapur is a kind of vertical agriculture project that had been implemented in 2012. A giant agricultural skyscraper consisting of 38 floors and 120 gardens. 500 kilograms of vegetables are produced per day with hydroponic, soilless farming methodology, which corresponds to a total of 3.65 hectares of land. While the fresh products collected are sent to supermarkets and markets without waiting, they are served to the public and the gases emitted by the plants are eliminated. Skygreens' officials and the Municipality of Singapore, who are very pleased with the results they have achieved, aim to increase the production capacity to 2 tons by building three more garden towers in the near future and then sell the vegetables they produce to the countries in the nearby region (Figure 5).

Figure 5: *Skygreens (URL-4, 2018)*

Another urban agriculture example from the U.S. is Gotham Greens. Gotham Greens offers its products for sale in 40 different states. The enterprise produces food 365 days a year with hydroponic system in locations close to the city

center. Gotham Greens presents different solutions according to the difficulties of indoor spaces in the production process. Growing agricultural products indoors, Gotham Greens produces with less energy consumption and less waste. Instead of using pesticides or chemical pesticides, Gotham Greens prefers to benefit from permaculture. In this sense, ladybugs and worms are also involved in the process. It currently offers packaged greens, salads, dressings and salad bowls to its users (Figure 6)

Figure 6: *Gotham Greens (URL-5,2022)*

3.2.Urban Agriculture Examples and Practices from Turkey-İstanbul

There are areas where urban agriculture is carried out in Istanbul. Istanbul has still preserved gardens as Fenerbahçe Community Garden, Şenay and Gülsüman Public Garden and orchards as Yedikule Gardens, Roma Gardens, Kuzguncuk Gardens (Figure 7-8). Although these initiatives do not have the potential to make an effective contribution to Istanbul's food consumption; they can inspire new projects to be developed to strengthen urban agriculture (GreenPeace, 2020). Kuzguncuk Bostan is a protected area and it is one of the last gardens of Istanbul, which has survived until today with its history of approximately seven hundred years. An environmental project for the bostan, which was last rented by Üsküdar Municipality in 2014; was prepared and implemented as a result of the meetings between the residents of the neighbourhood, the local authority's office, and the municipality officials. (Ademoğlu, 2016). In 2015, the 16.5-decare sized Kuzguncuk Garden was opened garden to visits of both Kuzguncuk and Istanbul residents. Bostan is divided into 115 separate parcels and 50 parcels of which are reserved for the use of the people of Kuzguncuk. The remaining parcels were given to schools and information offices. It also includes walking paths around the bostan area. Besides the garden, there is an area where children play and families socialize. In fact, open-air cinema screenings take place on some nights in Kuzguncuk Bostan. The agricultural lands in the garden are cultivated for food purposes in accordance with the traditional garden idea. At the Kuzguncuk Bostan, localseeds are used and chemical fertilizers and supports are not used. In Kuzguncuk Bostan, authorities try to combine ecologic methodologies with economy and socialization to achieve sustainability.

Figure 7: *Kuzguncuk Gardens (URL-6, 2021)*

Figure 8: *Roma Gardens in Cihangir (Photo: Şat, 2022)*

Yedikule City Gardens, named after the seven towers at the southern end of Theodosius' old city walls, can be considered as one of the remaining important green areas of the densely built and populated historical peninsula in Istanbul (Figure 9). Yedikule City Gardens are critical part of the universally protected UNESCO World Heritage Istanbul, along the Theodosian Walls, has managed to survive until today as theoldest agricultural land with a history of more than 1500 years. Production within Yedikule City Gardens links with many retail markets and city bazaars such as Fatih, Kocamustafapaşa, Karagümrük, Şehremini, as well as several local neighborhoods. This connection forms a kind of socio-economic and commercial network of daily life. The operation of Yedikule's present-day city gardens and the collection of products are similar to the traditional methods of the past. Especially the famous local products which are peculiar to the area are Yedikule lettuce and Langa cucumber are still produced as well as cabbage, beetroot, carrot, and onion. As an important cultural landscape, Yedikule City Gardens provide important information about agricultural technology, human relations, and how they treated nature in Byzantine and Ottoman times. (Durusoy and Cihanger, 2016)

4.Field study Results

4.1.Urban Agriculture Practices in Ataköy

The project area Ataköy is a settlement in Bakırköy district of Istanbul. It can be considered as one of the first settlements established by planning from the past to the present. Ataköy, that is closed to Atatürk International Airport, has been developing since 1950, became a popular settlement. In the scope of the field study urban agriculture alternatives in Ataköy is investigated. old hobby gardens and unused vacant lands as a

Figure 9: *Yedikule Gardens (URL-7, 2017)*

part from industrial areas are examined with their urban agricultural area potential.

When we look at the urban agriculture history of Ataköy, the significant application is hobby gardens. The hobby gardens established by the Municipality in 2001 have become the focus of attention of the public. Ataköy residents cultivated vegetables/fruits such as tomatoes, peppers, eggplant, lettuce, and strawberries in these 25 square meters of gardens with a capacity of approximately 1500 people (Figure 10). These gardens, which have users of all ages and socio-economic cultures, have succeeded in both socializing and supporting the city ecologically. However, with the decision taken in 2009, the gardens were demolished and today it stands as a vacant lot. In retrospect, with the huge green public areas, between block apartment lives and with the higher population of retirees; it is an undeniable fact that Ataköy residents needed those areas for urban agriculture practices.

Figure 10: *Ataköy Hobby Gardens (URL-8, 2009)*

Figure 11: *Agricultural production at the public space of the block apartments (Photo: Şat, 2022)*

4.2.Urban Agricultural Potentials of Ataköy and the Idle areas

Ataköy and Bakırköy have hosted many production areas from past to present. These production areas were not only on agriculture but also on the industry. In this part of the study, these production areas in Ataköy that can be used for the urban agriculture (Figure 12).

The structures of some of the industrial buildings in Ataköy are still standing, while the structures of some of them are in ruins. Ispirtohane and Baruthane are areas that were later restored and their buildings are still standing. Today, Ispirtohane is open to use as a cultural center, while Baruthane is available to use as a Nation's Garden. The buildings of the Acid and Oil factories were demolished, and a shopping mall was built in place of the oil factory. The Basmahane, textile, and yarn factory, on the other hand, are structures whose

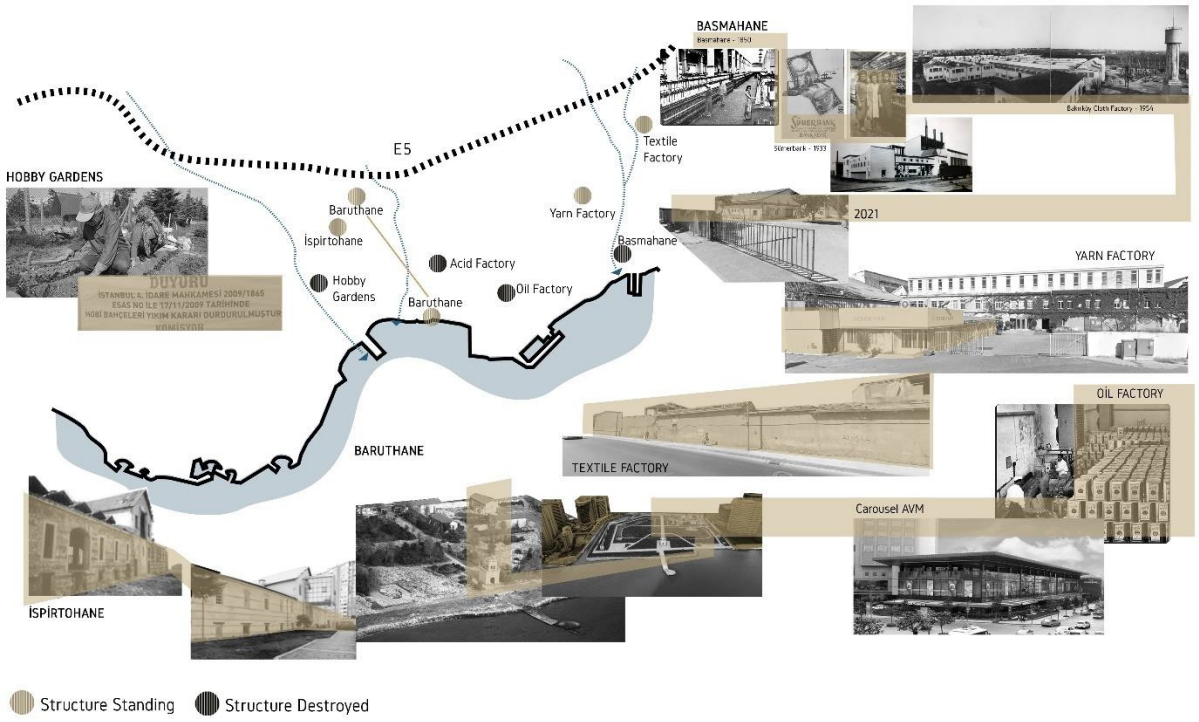

Figure 12: *Production Pattern texture of Bakırköy and Ataköy (Modified from URL-9, 2020)*

buildings are still standing. These 3 areas are critical for the proposal because the strategies were found to be correct to apply especially to these points. In Figure 12, brief information about the places and past of the areas in Ataköy is seen.

Ataköy has a potential for R-URBAN agriculture activities. Before the idle areas had been settled, the relationship with water was considered. The activity areas in the R-URBAN strategy are adapted to those idle areas and vacant lots in Ataköy and wanted to modified for urban agriculture activities as in the R-URBAN strategy. The most significant issue for the R-URBAN strategy was the cycle that the inputs and outputs follow themselves in a repetitive way which is sustainable. The cycle with its details is explained in the image below (Figure 13).

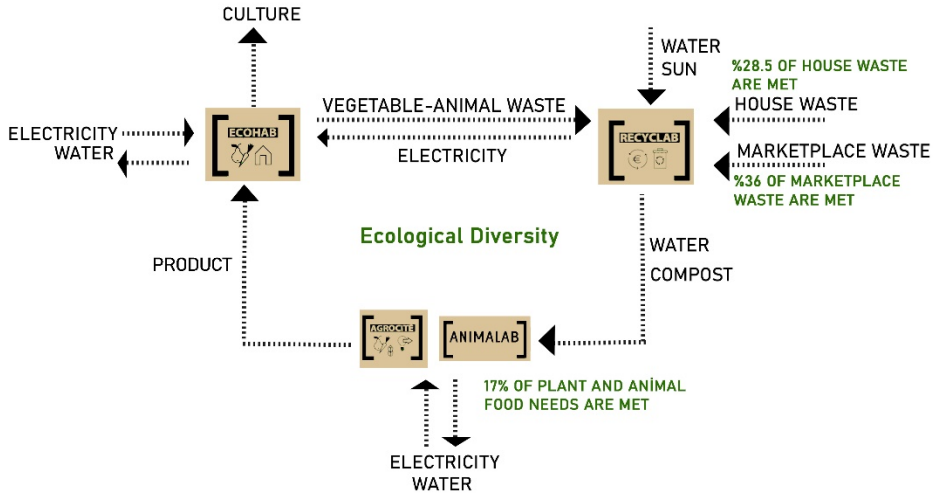

Figure 13: *Urban Ecological Cycle Diagram (modified from R-URBAN Strategies)*

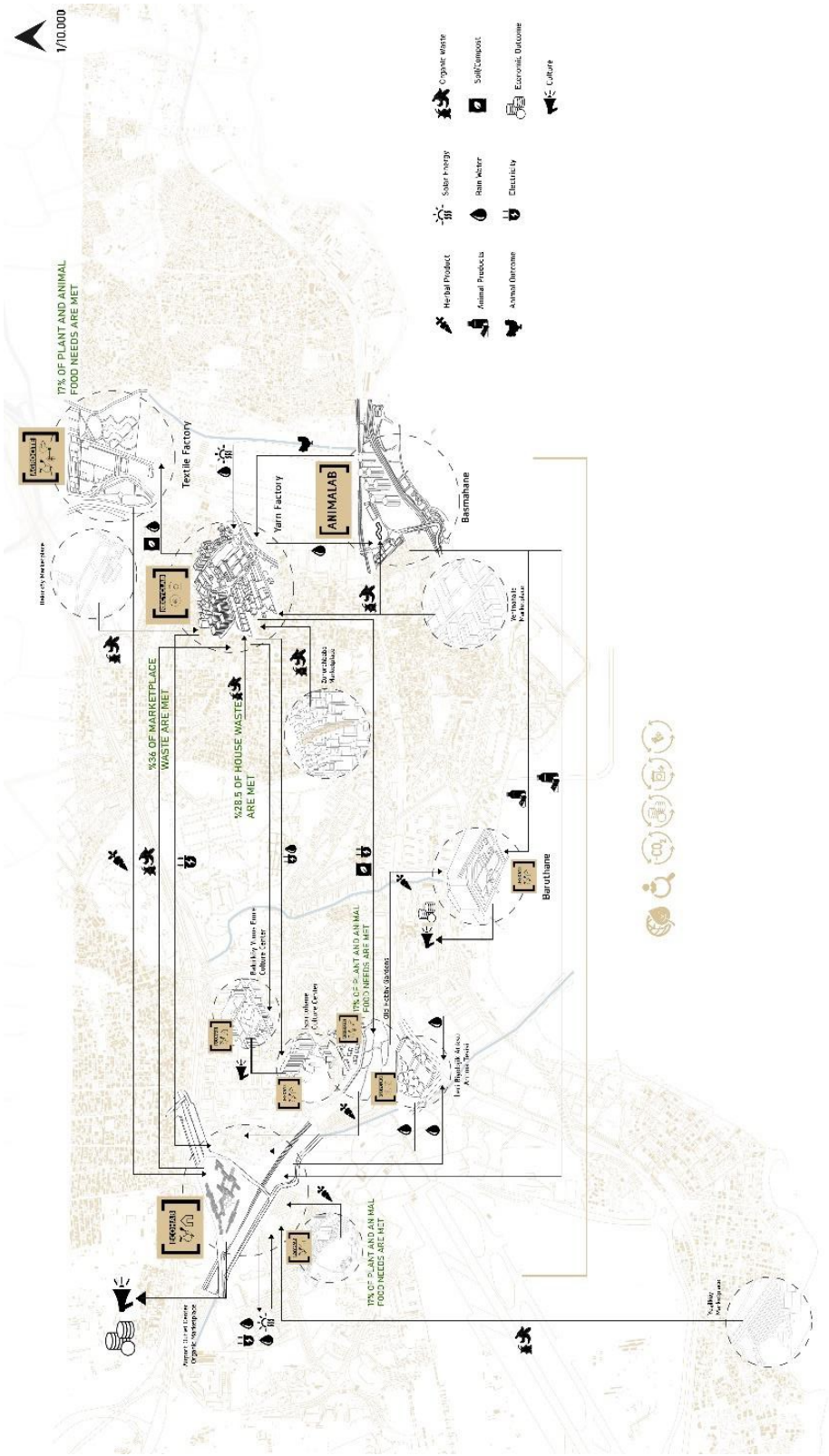

Figure 14: *Mind set of Ataköy Scenario based on R-URBAN*

The textile factory has seen suitable for AgroCite. It was decided that it would be more appropriate to produce in this area due to its relationship with the creek and the parks on both sides. AgroCité is designed to promote and support the dynamics of urban agriculture. Provides production for market areas. The area may include an urban agricultural farm, common gardens for neighborhood residents, an educational garden, a common greenhouse for plants and seedlings, rainwater harvesting equipment, crop treatment, solar energy and biogas, aquaculture crops and agricultural short circuits. The field's inputs include compost from Recycle lab. The outputs of the field are agricultural products that are produced and sent to the market.

Anima lab is located in the printing room. Anima lab is a micro-scale domestic farm that produces milk and dairy products, eggs. It includes a chicken coop, an area for milk producing animals, worm farm for feeding chickens, a dairy production area, storage area. Animal lab was developed with a pedagogical and ecological purpose. Animal production is integrated into the local distribution network and reused or sold through Markets. The yarn factory will be used for recycle lab. In addition to the R-URBAN strategy, recycle lab is designed to compost for the recycling of household waste into the soil to produce composts. Wastes from surrounding markets and homes are collected and recycled at this point. Tons of organic fertilizer to be obtained are distributed to AgroCite, citizens, parks, and gardens. These points have been determined as the main points for agricultural activities and prototypes can be reproduced in Ataköy and Bakırköy. For example, AgroCite can be applied to the point where the old hobby gardens are located. Production can be started in the idle and vacant lots near the Atatürk Airport.

5. Discussion

When we examine the scientific papers on urban agriculture; total of 605 papers were published from 2001 to 2021 (Yan et al., 2022). The number of published papers increased substantially year by year. Even this increasing demand can show this subject's importance especially for the future. Some negative effects also observed by the research groups from the aspect of urban agriculture. Some urban agriculture productions need more energy especially for lighting and temperature regulation than the conventional food production.

You can see the trends on urban agriculture and findings comparable at the table below (Dorr et al., 2021).

Table 1: *Some key trends and findings on different types of Urban Agriculture (UA) (Modified from Dorret al., 2021).*

UA types andelements	**Findings**
Indoor systems	Higher yield, higher climate change impact, higher energy use. Energy for lighting and temperature regulation, and greenhouse structure, were large sources of impact. Most results for herbs, tomatoes, vegetables, and leafy greens. Results varied based on ground–rooftop setting.
Open-air systems	Lower yield, lower climate change impact, lower energy use. Larger range of important sources of impact.
Intra-urban agriculture	Larger range of production system types. Smaller range of crop types. More resultsfrom UA case studies.
Peri-urban agriculture	Less varied production system types (mostly open-air, soil-based, ground-based). Larger range of crop types. More results from the literature and from conventional agriculture.
Research systems	Higher yield, higher climate change impacts. Almost the only system type with very large impacts. High quality and reliable data, but innovative, sub-optimized, and unrepresentative systems often studied.
Water use	Direct water use (mostly irrigation) was available for about 25% of systems. Water use was often higher for UA than conventional agriculture, although results varied widely.
Energy use	Cumulative energy demand was relatively high. Open-air, soil-based systems had the lowest energy demand

Despite positive or negative results, urban agriculture developing with new trends and try to find out a solution for healthy food supply especially for the citizens in a sustainable way. On the other hand, as the new trend of vertical farming, soilless farming or aquaponics production; including the risk of contamination. In this point hygiene issues come forth and the water used at the production should under control and be detected regularly for its mineral and chemical contents.

6. Recommendations and Conclusion

Different scenarios should be considered in the city to minimize the destructions in the development and growth of the city to increase the urban resilience. One of these scenarios/strategies is the concept of urban agriculture. When we examined the R-URBAN application, which is one of the best examples of the approach of urban agriculture, it is definite that the strategy can improve the city in economic ecologic and social ways. It reduces external dependency economically, and at this point, it balances the price gap from producer to consumer and creates new job opportunities. It enables the citizens to come together socially with production and creates recreation areas. No substance is wasted in the ecologically created input-output cycle. The products are sold in local markets, the residues of the products are composted in the recycling areas and sent back to the soil for reproducing stage on the field. The cycle is obviously self-sufficient in a city network. When Ataköy is examined at this point, it is suitable with its vacant lot areas also. The scenario for Ataköy is proposed in vacant lots that are linked to the strategy. According to the conclusions of wei and Jones' research (2022); urban agricultural practices which viewed as a socio-material assemblage respond to urban pressures and livelihood demands, and importantly, catalyze and drive innovative thinking on urban governance in terms of integrating urban agriculture into local development practices and outcomes (Wei and Jones, 2022). Urban agriculture practices enhancing the relation between food and people (Wei and Jones, 2022; Kontothanasis, 2017). Also ın R-URBAN approach, recycling and reusing methodology is adopted with an increasing demand, as the results of a research study of Rojas-Valencia et al. (2011); some organic waste solids and waste waters that successfully used in the production of %100 organic food which is suitable with the sustainable implementation (Rojas-Valencia et al. (2011). Taking everything into account, it is crucial to make applications for sustainability in ecologic, economic and social aspects on urban agriculture in Ataköy. To achieve this; local management teams with local government should provide education programs for practisers in order to help them on their productions, planning vacant lots as the practice areas, minimizing the negative environmental effects such as poor drainage and negative impacts from the use of fertilizers.

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