

ART FRONTIER

An International Art Journal / Vol.2, No.2 Apr.-Jun., 2024

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To cite this article: Jing Sun, Wanxing Lin, "Transforming the Los Angeles River: Using Nature's Tricks to Bring Wildlife and Plants Back to the Urban Stream," *Art Frontier* 2, no.2 (Juny 2024): 36-47, https://doi.org/10.64212/JRKE3157.

DOI: 10.64212/JRKE3157

ISSN: 2835-5490
EISSN: 2836-841X

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This article has undergone double-blind peer review.

Website: www.artfrontier.org
Email: artfrontier2023@outlook.com
Publishing Frequency: Quarterly (March, June, September, December)

Transforming the Los Angeles River: Using Nature' s Tricks to Bring Wildlife and Plants Back to the Urban Stream

Jing Sun, Wanxing Lin

Abstract

The Los Angeles River is a connector between the urban and the ecological, with challenges like biodiversity loss, flood risk, and the urban heat island effect. Trying to solve those challenges requires a balance between ecological restoration and flood protection. Recognizing this as an urgent situation, the LA River Ecosystem Restoration project has proposed changing this concrete channel into an ecological, resilient river channel. The proposal aims to bring wildlife back to increase biodiversity, enlarge the water surface, and reduce the flood risk by using geo-blocks. These geo-blocks, including tree structure, fiber structure, and bulk structure, can offer habitat for vegetation and wildlife, and create a green ecosystem in the river. Using the geo-blocks can cool the river and mimic the floodplain so that it can mitigate the urban heat island effect and create a comfortable environment for both wildlife and surrounding residents. Depending on different approaches, the Los Angeles River will perform various roles to solve the current problems and become a representative model of ecological restoration and community resilience.

Key Words

Cooling Strategies, habitat restoration, flood protection, geo-texture, concrete bank

1. Introduction

In the past, the Los Angeles River has been used as a drainage system. The concrete riverbanks have an impact on the channelization, environment, and undeveloped planning in surrounding areas. Revitalizing the Los Angeles River presents multiple challenges, such as ecological restoration, community engagement, aesthetic improvement, and mitigation of the urban heat island effect (figure 1). The ecosystem of the Los Angeles River has urgent challenges, including water pollution, biodiversity loss, increased urban temperatures compared to surrounding areas, and the river's influence on climate change.[1] Unsustainable land use influences the river's ecology. Additionally, the existing concrete which is used for the whole river channel can decrease water evaporation and increase the urban heat island effect. Depending on those existing challenges, efforts to restore the Los Angeles River and its surrounding ecosystem will be required from different stakeholders, including government agencies, communities, and local government organizations.

Currently proposed methods to address the challenges of revitalizing the Los Angeles River include river cleanup which can improve water quality and increase biodiversity,[2] community support through public education and events, and urban planning and design strategies that mainly focus on improving the river's aesthetic attractions and surrounding areas. Additionally, through enlarged water bodies, evaporation can occur and reduce urban heat island effects.[3] These methods require collaboration between various stakeholders to create a sustainable restoration and improve the whole ecosystem around the Los Angeles River; however, it's important to recognize that this procedure will take time and will not meet cost-efficiency requirements. In response to these complex challenges, the proposed LA River Ecosystem Restoration (LARER) project provides different strategies to improve the biodiversity around the river corridor and its surrounding communities.[4] This

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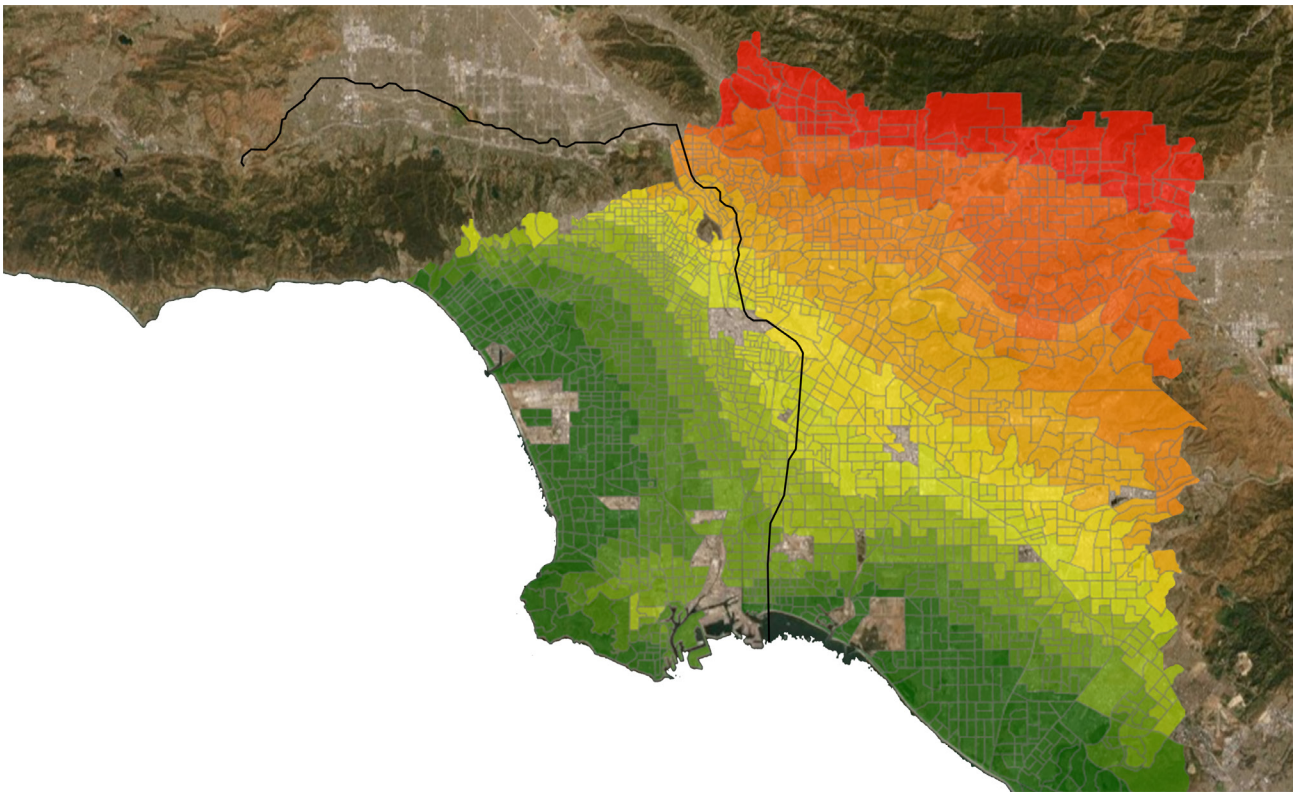


Figure 1. Urban Heat Island Interactive Maps in Southern California, 2020 (Jing Sun).

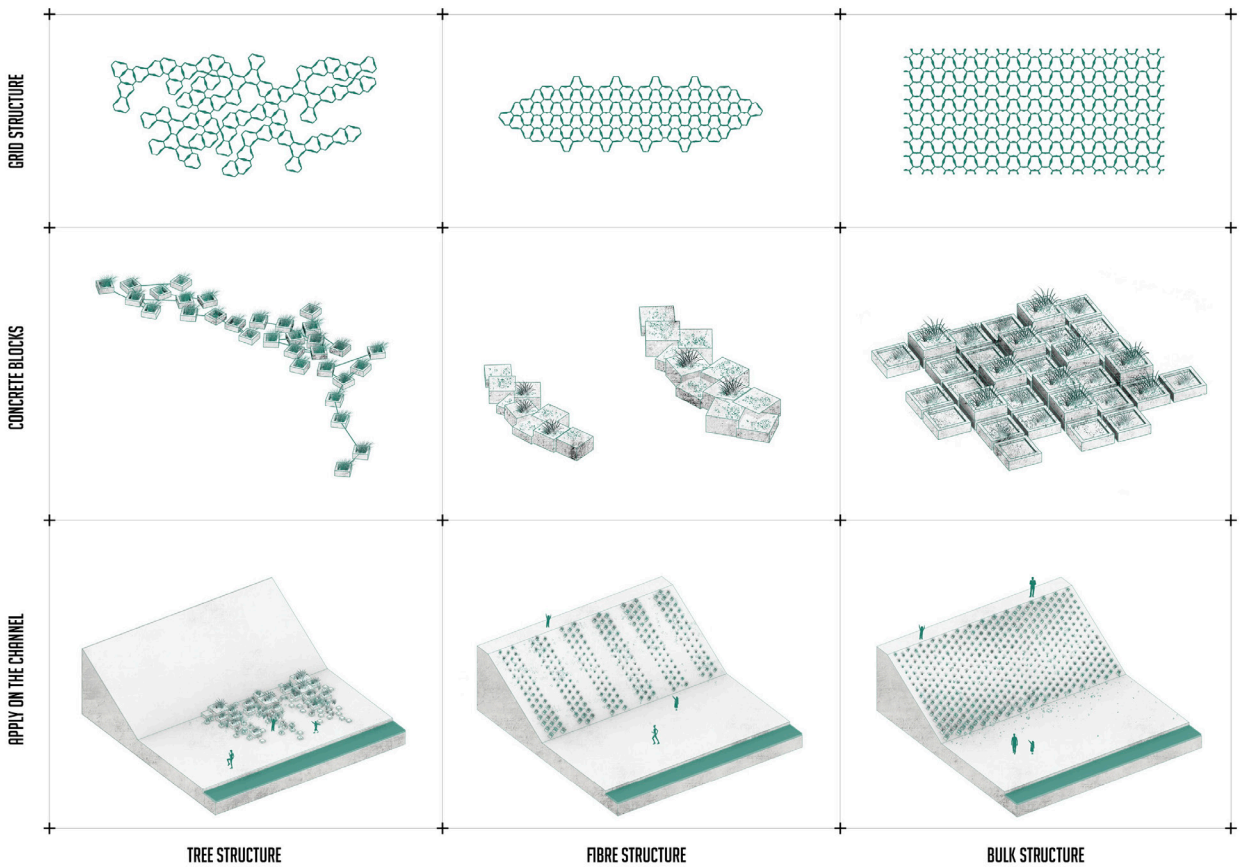


Figure 2. The morphology variations, origins, and usage methods of geo-blocks, 2020 (Wanxing Lin).

proposal aims to biomimic the floodplain habitat and green infrastructure to enhance the recreational and accessible experience at the concrete channel. Using geo-blocks, such as tree structure, fiber structure, and bulk structure (figure 2) has been proposed to slow down the water flow rate and provide habitats for local species, which can restore vegetation and wildlife and provide more spaces for human activities.[5] In addition, this project is trying to solve the exciting challenge of climate change along the river by using geotextile and geo-blocks to enlarge the water surface area and improve evaporation,[6] using softer materials instead of concrete to cover the existing surface and then importing native plants.[7] This can mitigate the impact of the urban heat island effect, cool the surrounding environments, and improve the habitat conditions along the river, which can help communities engage with the river's ecosystem.[8] The LARER project aims to create a resilient and biodiverse water channel and public space, and satisfy the different needs of local communities through ecological restoration, climate adaptation, and habitat creation.

2. Approaches

There are four approaches outlined in this section: the ecology approach, the program approach, the aesthetics approach, and the water resources and resilience approach. These four approaches provide different methods to help restore the ecosystem, mitigate the urban heat island effect, and increase biodiversity along the river. The ecology approach encourages human-beings to join the clean-up program to protect the existing habitats. The program approach analyzes different programs during the four seasons and different time periods during the day. The aesthetics approach proposes different viewpoints within the landscapes. Finally, the water resources and resilience approach uses green infrastructure and enlarged water systems within the Los Angeles River channel to manage stormwater, improve water quality, enhance flood resilience, and mitigate the urban heat island effect.[9]

2.1 Ecology Approach

2.1.1 Restore the River Ecosystem for Wildlife and Encourage People to Practice Stewardship

The first approach is to restore the river ecosystem for wildlife and encourage people to practice stewardship. The most important thing about ecology and the creative practice of landscape architecture comes from "traditional views created by people."

The Los Angeles River was a natural river that sheltered wildlife and people. When the river became a concrete channel in 1938 to help control flooding, the Los Angeles River no longer looked like a traditional river to visitors. In the past, the river was culturally and socially important for people living nearby. After the channel construction, most Los Angeles residents began to think negatively about the Los Angeles River. Also, the habitat next to the river was damaged by the concrete channel and caused ecological shortcomings. This is why we want to restore the natural habitat and use restoration to encourage people to participate in protecting the river.[10] In this proposed project, we recognize those ecological shortcomings of the Los Angeles River and try to address them through landscape design methods. Native plants can restore natural habitats and attract the animals that used to live in, and by, the river. It can also help conserve the existing species, such as snowy egrets, blue herons, and black-necked stilts that are still living in the river.[11] Also, habitat conservation needs people to work together and recreate a new river image that can change people's impressions of the river. However, the steep slope of the Los Angeles River channel is not suitable for human activities.

Our strategy includes terraced platforms with different functions on the channel to make space for human activities (figure 3), such as river clean-up events, bird protection events, and applied pathways to maintain the disturbance distance between humans and sensitive habitat areas.[12] In this way, the approach could provide a platform for professional stewardships. Additionally, we propose planting water-resistant vegetation to restore the ecological habitat of rivers. More importantly, this process would be involved with professional stewardship, such as a vegetation protection organization, to help qualify the design process as well.

Through human engagement and habitat management, this approach ensures decision-making and balanced access for recreation with habitat protection, creating a sustainable and resilient ecosystem along the Los Angeles River.

2.1.2 Habitat Restoration

The second approach focuses on habitat restoration as viewed by James Corner; "Conceptualized as cyborg landscapes, this approach embraces notions of change, adaptation, and feedback to create hybrid infrastructures of human and non-human systems, of living and nonliving entities, across a range of spatial and temporal scales."[13] Cyborg landscape is a kind of infrastructure landscape, and uses infrastructure to restore the ecological system and modify the current water surface to mitigate the flooding risk.[14] The flood control system

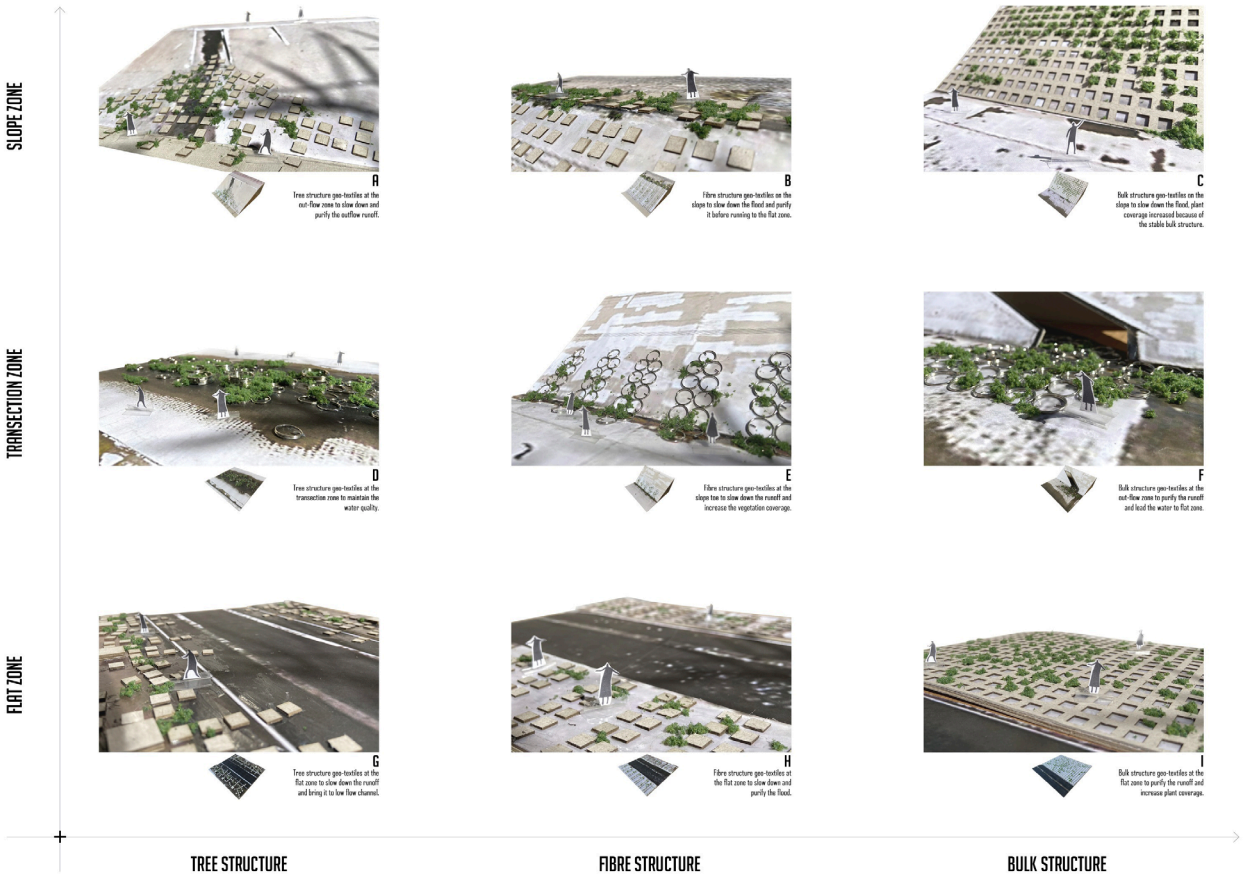


Figure 3. Different green platform technology applied on concrete riverbanks, 2020 (Wanxing Lin).

can be included in the cyborg landscape but it does not have the ecological function, and the new cyborg landscape will use the geo-blocks as the media to collect soil, support vegetation, purify water, and use the potential space to connect to the existing habitat to create a whole ecosystem along the river.

Los Angeles River Cleanup events will help communities engage with and help restore the habitat. By emphasizing the processes between human and ecological systems, this approach seeks to improve sustainability and management.

2.2 Program Approach

2.2.1 Seasonal Programs

This approach hopes to create a kind of new active visual and sensory experience for current bicyclists and pedestrians.[15] The program approach makes more space for active activities, such as cycling and walking, which are already happening in the river.[16] According to Stilgoe, "Today explorers must teach themselves the lessons of visual acuity long absent from grammar schools and universities, and they can learn only by looking hard. Out for a walk, out for a bicycle ride"—this means that our approach should look at the project's seasonal functions for visitors (figure 4).[17] Based on the field investigation, our approach hopes to attract those people living away from the Los Angeles River while still serving the river's neighboring communities.[18] This project will create more entertainment and cooling spaces for different activities, and it will become a new entrance point for the neighboring residents to bike and walk. This program will redesign ways for cyclists and walkers to experience the river; for instance, programs such as sensory gardens, seasonal boating stops, kayaking parks, and exercise machines will help people to enjoy themselves on their own or as part of an organized group activity, including seasonal events.[19] It also continuously provides new methods for people to appreciate the natural and surrounding communities of the river. According to this method, this approach will be envisioned as the focus of the linear and leisure gardens. At the same time, it also provides a replacement transport path crossing Los Angeles.

2.2.2 Recreational Program

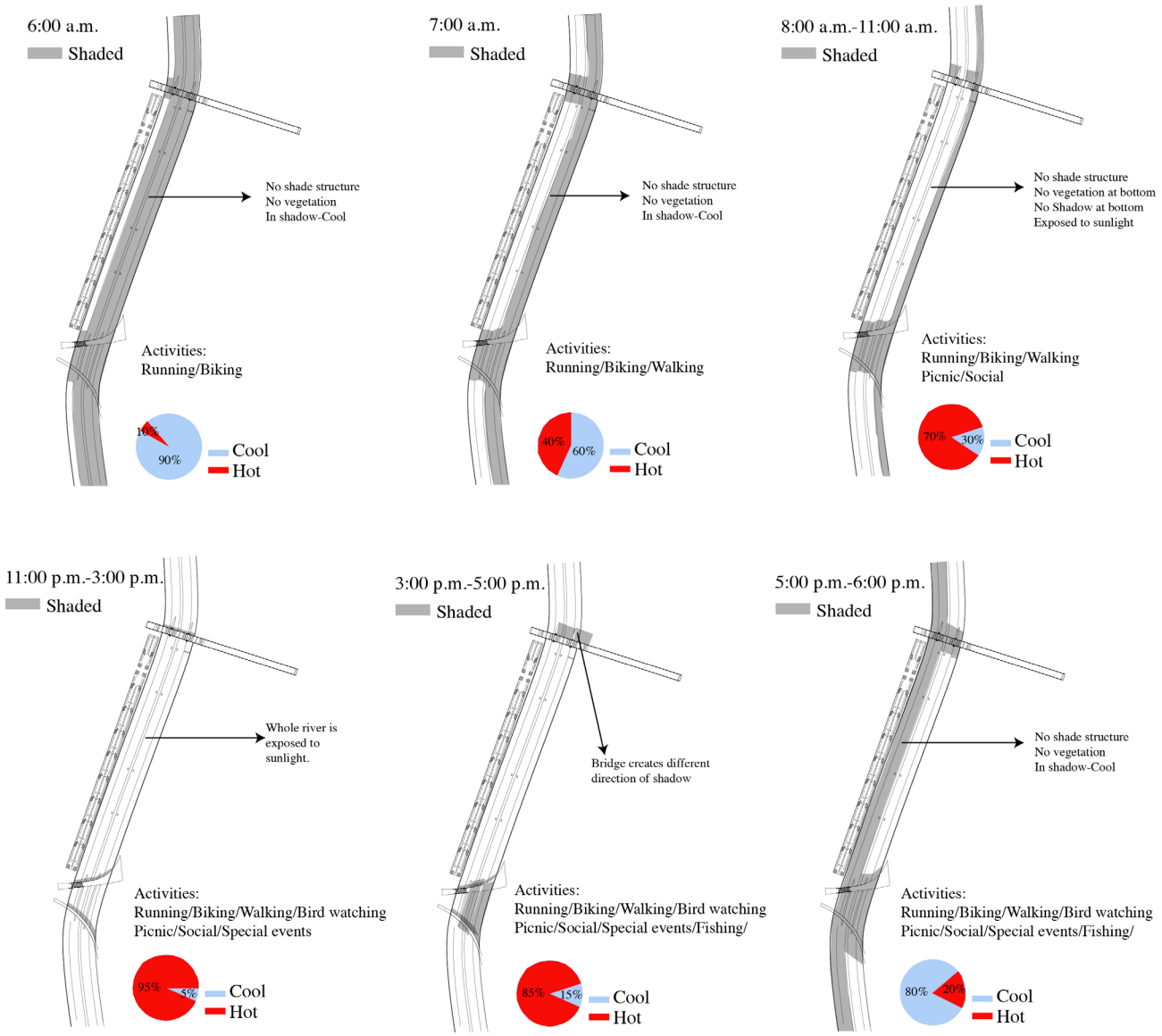


Figure 4. Shaded areas at different times will influence human activities, 2020 (Jing Sun).

In accordance with Schultz, “when walkers enter the flow mode, the space becomes a diffuse scenery and walks let their thoughts stray, following their intuition. Walking and awareness merge, and walkers become part of the landscape.” Enjoying a quiet space next to the river means enjoying the city and the community in a different way. A natural environment away from the built environment can inspire people to contemplate, meditate and slow down, or even do yoga or lay down under a tree to read a book. These activities, which we observed in field studies, can become programs for our design approach. Therefore, this approach looks at how spaces can fulfill people’s passive needs to enjoy quieter and cooler moments in an urban environment. Enjoying the river also means enjoying cities and communities as well as the natural and architectural environment. Leisure programs such as community gardens, yoga lawns, and viewing platforms can become part of the design. The water-themed passive program approach brings people new sensory experiences that are enjoyable and different from the busy Los Angeles lifestyle. Using water as the main character, this approach would bring plenty of opportunities for both the residents nearby and visitors to return and experience the restored river area and give them enjoyment by experiencing nature visually, acoustically, and olfactorily.

It can also become an educational opportunity to inspire people to care for and act as stewards for the samazing water resources.

2.3 Aesthetics Approach

2.3.1 Somatic Experience Through Varied Aesthetic Viewpoints

Focusing on improving how people experience the Los Angeles River includes the river's artistic elements. For example, there is wall art along the river which is a cultural art element for the community. However, these art elements are still not enough to attract visitors. In this aesthetic approach, the proposed programs would bring residents and visitors back to the river to experience Los Angeles culture through varied aesthetic viewpoints, which will make people feel more engaged in the river's culture through art and design along the river.[20] This program proposes the landscape structure of the Los Angeles riverbank according to the merging of the lifting and decreasing landscape and the formation of the plank road, bridges, and platforms—symbolizing the merging between water and local cultures from a performative point of view—which activates the specific power dynamics and configurations of subjectivities that a certain situation presents. The proposal aims to create a site-specific and visionary cultural art experience for the Los Angeles River. Through the inclusion of art and culture, the vibrancy of our public spaces will be enhanced.[21]

2.3.2 Engagement in the Hybrid Landscape

One of the current issues of the river aesthetic is that the existing artistic elements are not well integrated with the river's nature, which reduces the aesthetic value and human interaction. This approach aims to create an array of playful art programs to let the community experience art in nature.[22] For example, hosting riverfront art events and designing artworks can create a public space where the community can get involved in natural settings. The project will elevate playful art to its greatest potential, creating a public space where "nature is artful, art is playful, and play is natural." According to the insights of Gobster et al., humans can participate in the environmental phenomenon of the standard; that is to say, humans have experiences with the landscape's environment. This is the so-called perceptive field in which the interactive functions produce aesthetic experiences to influence humans, the changes in the landscapes, and the ecological system by proposing the enhancement of the existing infrastructure, improving accessibility to the river, providing visitors with a truly hybrid experience along the river, helping communities participate in natural scenes, and reimagining the river channel in different aspects.[23] In this approach the riverfront neighborhoods will be strengthened, and this place would become not just a scenic area, but also an area where you can feel and explore lively art and interesting cultural stories.

2.4 Water Resources and Resilience Approach

2.4.1 Green Infrastructure and Cleansed Water System

This approach aims to create and maintain a safer and cleaner water environment for the Los Angeles River and the neighboring communities. First, this approach will design a series of urban green infrastructure strategies, such as geotextile grids, floating islands, gabions, and bioswales along the river.[24] These strategies would help retain soil, purify the water, and enhance the river's flood control and stormwater management systems. There are water infiltration basins or rainwater storage devices that will enhance water collection from the Los Angeles River, which is a key element that needs to be considered. To maintain the water quality of this river, the underground infrastructure will be put into a suitable place to capture and store storm runoff from the surrounding areas.

These approaches can mitigate the urban heat island effects and improve the sustainability and biodiversity along the river and from surrounding communities.

2.4.2 Create Adaptive Flood Landscapes in the Los Angeles River Channel

To utilize the river's space, suitable landscapes will be proposed based on the existing landform, including rainwater collection and stormwater runoff reduction. Trying to use permeable materials can cool the river and allow water to be collected both on and near the river channel for habitat restoration purposes. The lowest area will be designed as a wetland, which can reduce the risks of flooding and can bring more benefits to communities. The highest area will be used for recreation and public enjoyment of the river space. The artificial wetlands will contribute to a safer and cleaner water environment for the river.

Through these strategies, this method aims to enhance water capture capabilities and promote sustainable management of the Los Angeles River ecosystem.

3. Experiments

3.1 Experiment 1: Integrated Geo-Block Mimicry—Enhancing Ecological Restoration while Balancing Flood Control in the Los Angeles River

This experiment involved using geo-blocks, which are ecological technologies, to study their shape and how they fit with concrete riverbanks (figure 5, figure 6). The goal was to replicate the structure of natural floodplain

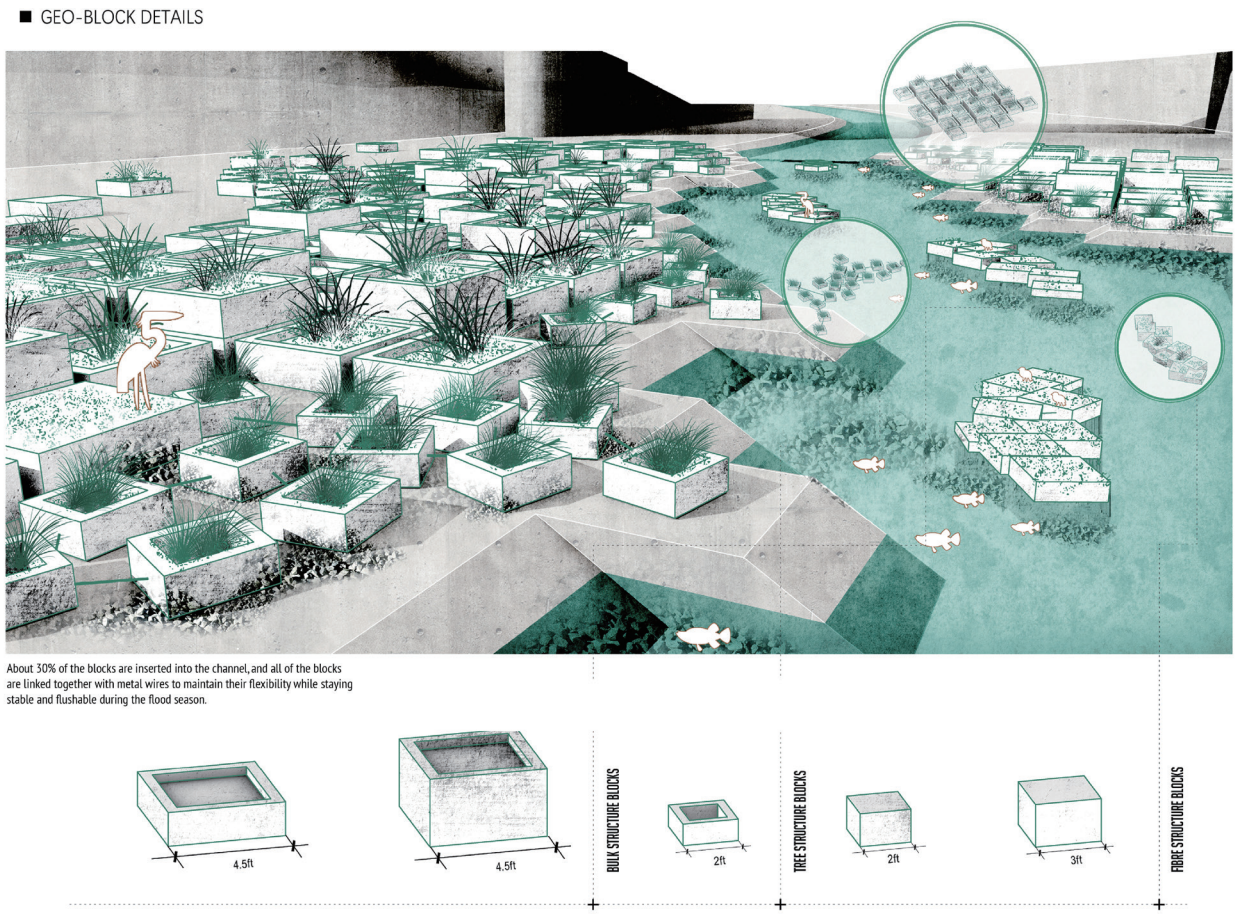


Figure 5. Geo-block detail and how it works for the Los Angeles River, 2020 (Wanxing Lin).

channels using these geo-blocks. They were designed to mimic different features found in natural river channels, such as inactive and active point bars, stable point bars, and ridges.

When these geo-blocks are covered with vegetation, they imitate natural levees and back basins. These features provide habitats and spaces for collecting sediment, which supports various species of plants and animals. Ultimately, this contributes to the efforts to restore the ecological balance of the river.

3.2 Experiment 2: Exploring Ecological Techniques for Water Edge Formation and Habitat Creation in the Los Angeles River

In Experiment 2, the focus was to mimic the natural floodplain channel by using geo-blocks to make the channel reminiscent of point bars and erosion patterns. This method can slow down the water flow rate, creating habitats for native species. and vegetation grown on the geo-blocks contributes to the formation of a natural riparian buffer along the Los Angeles River. Based on this, a series of experiments were conducted to examine how different ecological techniques influence water spread and pattern (figure 7). These ecological techniques, such as geotextile and eco-concrete, help water spread out, which can create a cooler and moister environment for the surrounding communities and wildlife.[25] In addition, it can support diverse habitats for drought-resistant and drought tolerant species. Moreover, this technology can be used as small retaining walls, facilitating the spreading of water across large areas and generating diverse water patterns and edges.

4. Results and Discussion

According to the results of those experiments, an alternative technology approach to the ecological restoration and flood control of the Los Angeles River should rely on geo-block mimicry, which suits itself to the ecological techniques for water edge formation but, based on our experiments, some of the unconventional water pattern technologies we put forward are not suitable

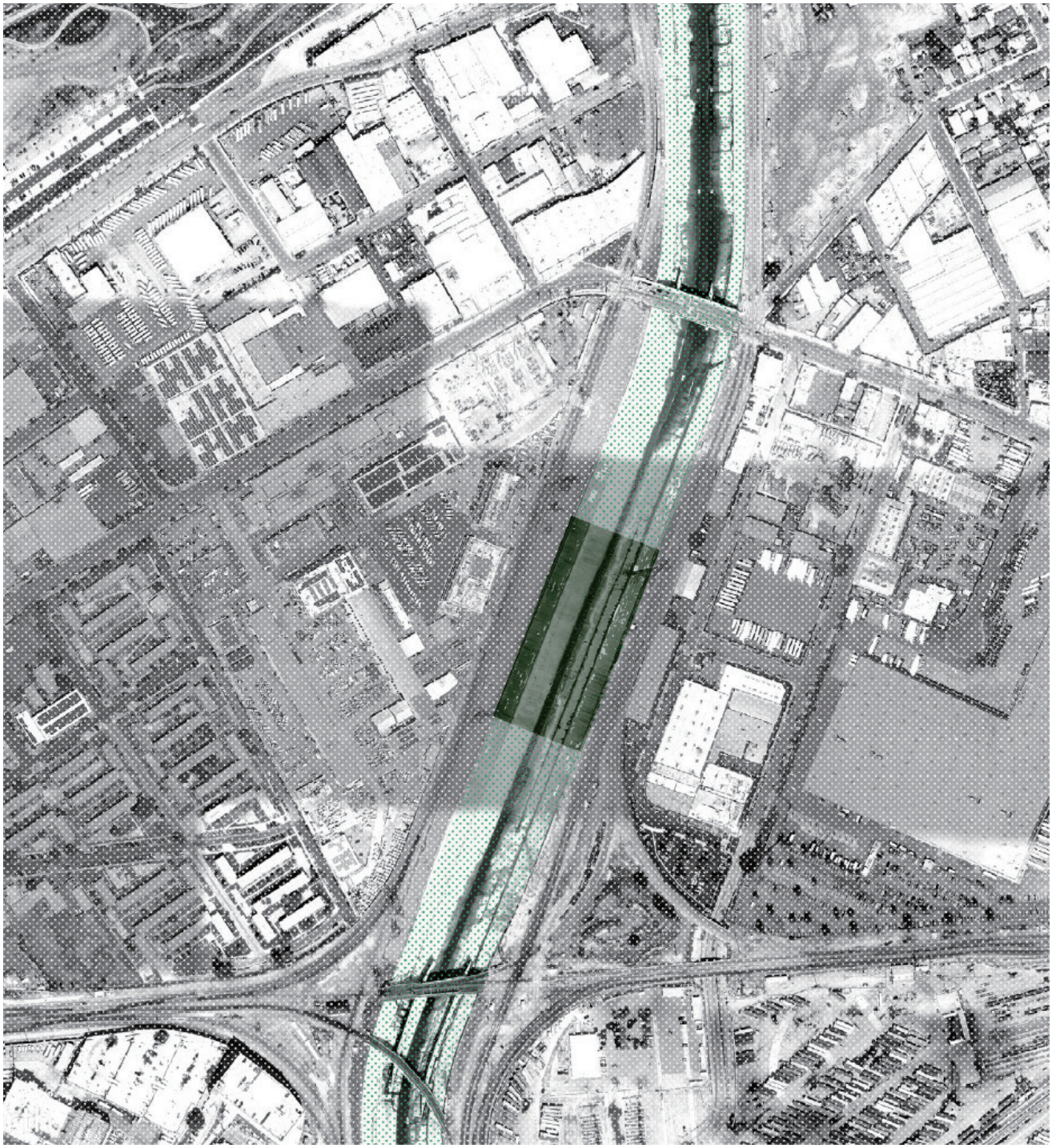


Figure 6. The experiment site is in the middle section of the river channel and measures 250 ft. by 500 ft., 2020 (Wanxing Lin).

in the fragile water environment of the Los Angeles River. One of the simple alternative technologies is small supporting rocks, called surge stone. At first glance, surge stone should be relatively feasible, however, surge stone have more counterproductive effects on the overall aim of the river's ecological restoration. First, the small rock materials are easy to move, bring no sediment collection effects, and are not conducive to growing vegetation on riverbanks, but add to the ecological body burden. The reason is that a large quantity of water can carry a large amount of pollutants, which will have a reverse effect on the river restoration if this transitional surface technology

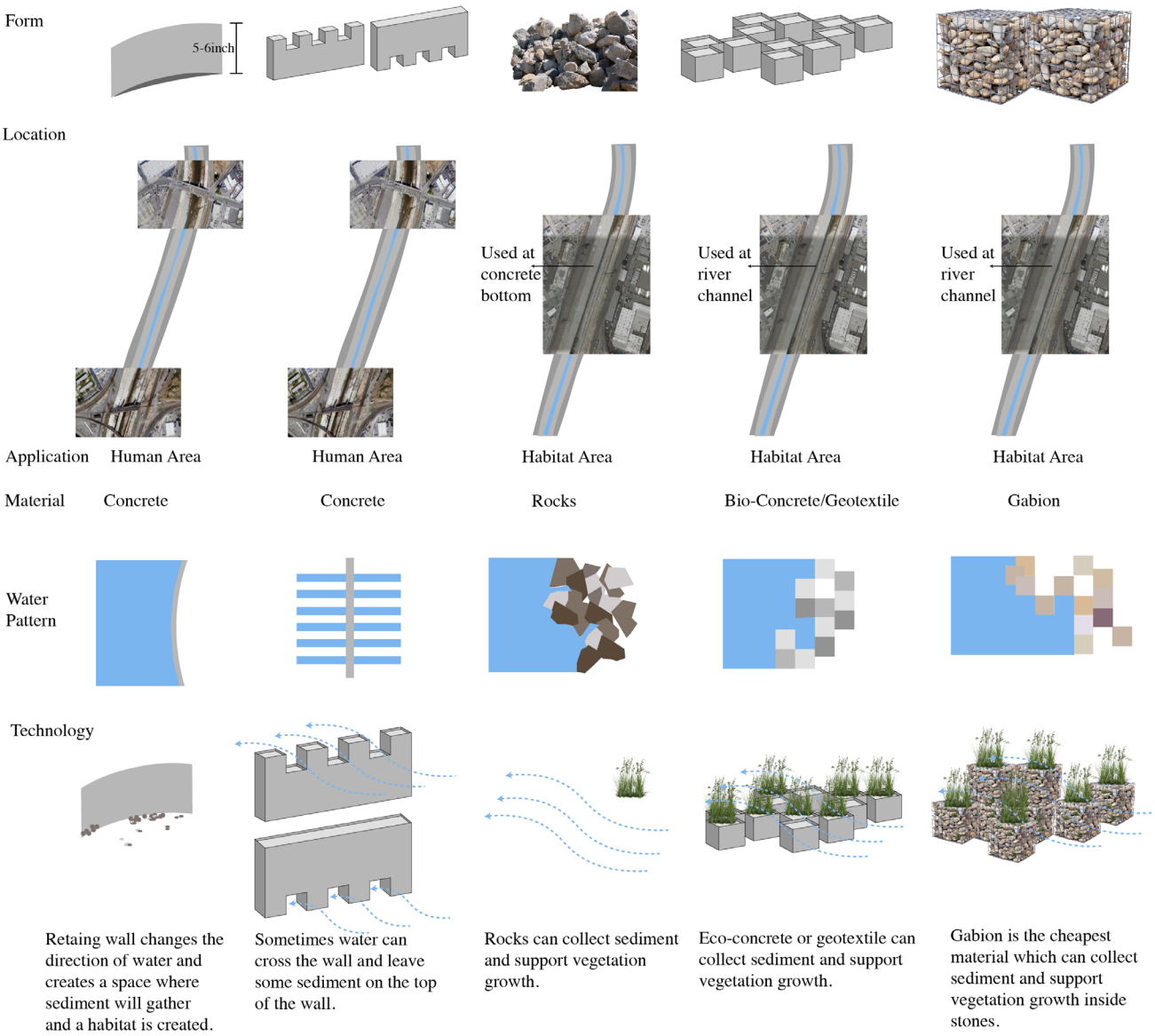


Figure 7. Different forms and technology influence sediment collection, water spread and vegetation growth, 2020 (Jing Sun).

is used. Second, surge stones are costly, time-consuming, and far from beautiful—they take away from the aesthetic value of the river. Third, the retaining walls can hardly play a role in habitat restoration and are not conducive to reductions in water surface entropy. Another technical idea to relieve the high surface entropy of the urban water body is to create a large water surface by destroying the original concrete water channel. This water surface with lower entropy and larger area might help reduce the urban heat island effects. However, this approach proves difficult to control. It cannot strike a balance between human activities and habitats along the river. The water surface area would become larger and larger, and it would become more and more difficult to have a definitive water edge with the nearly flat-water body.

Therefore, geo-blocks are the best technology to use in the Los Angeles River, and can be designed to mimic natural river features and be covered with vegetation, not only providing habitats for various species but also contributing to sediment collection and stabilization of the riverbanks. This, in turn, helps in reducing erosion and improving overall ecological health.

Furthermore, geotextile and eco-concrete can enhance the different formations of the existing water edges, creating diverse habitats for species (figure 8, figure 9). The water flow can enhance air circulation, creating a cooler and moister environment that is beneficial for both wildlife and humans alike.

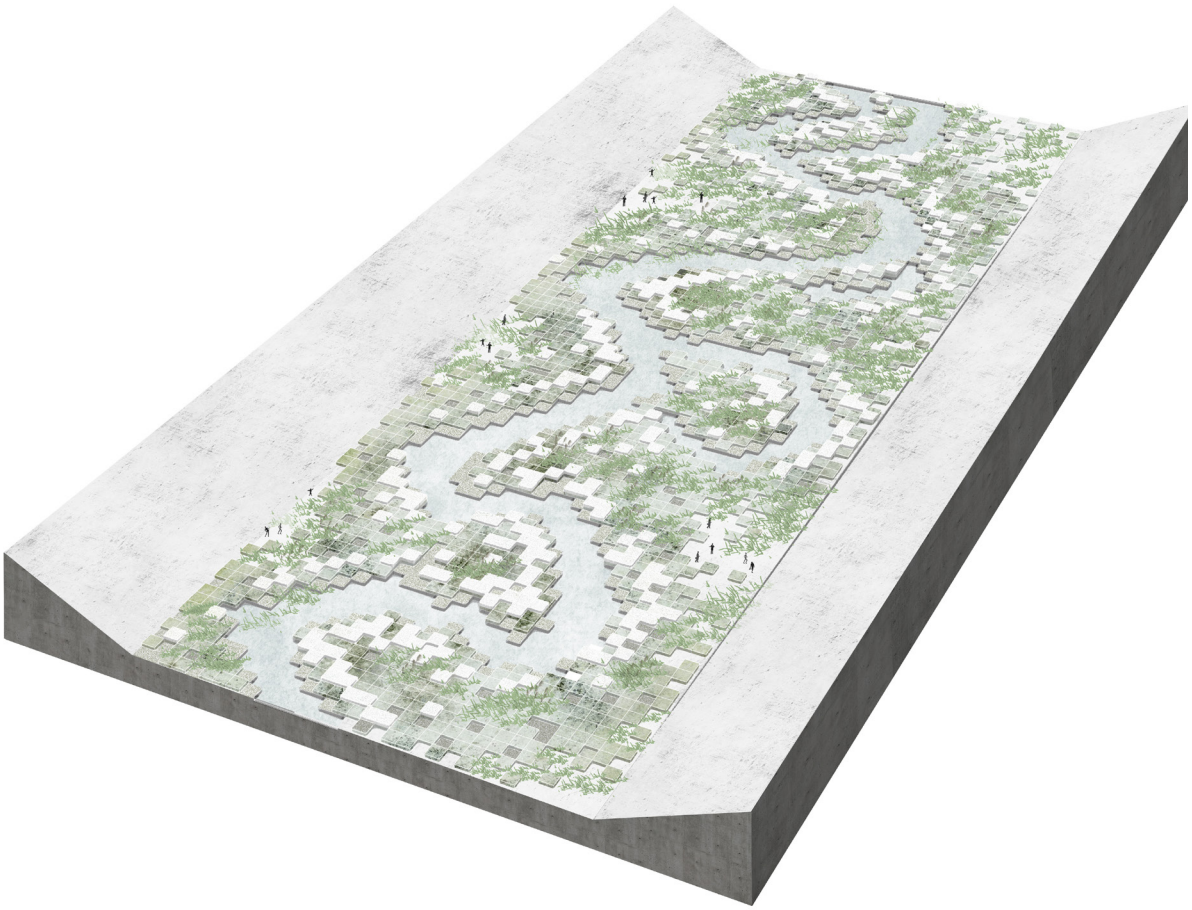


Figure 8. Geo-blocks create a floodplain channel, redirecting the water flow, 2020 (Wanxing Lin).

5. Conclusion

The overall project aims to achieve a cool microc-limate environment for the Los Angeles River. Since the flood control system of the Los Angeles River is not suitable for using large trees and shade structures as shade methods, it can be achieved by using geotextile, eco concrete, and retaining walls to help expand the water area to achieve a cooler environment. Therefore, the Los Angeles River can connect the surrounding parks to form an overall microclimate system and improve the Los Angeles microclimate.

The project introduces a variety of habitat creation and ecological restoration methods by utilizing geo-blocks to mimic the natural erosion patterns found in the Los Angeles River floodplain. Not only do these geo-blocks mimic physical structures, but they also help slow river flow, creating a greener, healthier environment for diverse species. Slow water speeds provide opportunities for native species to thrive and migrate, helping to increase the overall biodiversity of river ecosystems.

Not only that, but the vegetation growing on the geo-blocks is also multi-functional: it reduces erosion and helps to stabilize soil in the riverbed, thus helping to protect the integrity of the riverbanks; it serves as a natural riparian buffer along the Los Angeles River, providing habitat and food resources for wildlife; and it helps to absorb pollutants and restore water quality, thereby contributing to the ecological health of the river. Regarding the project's effect on the river's microclimate,

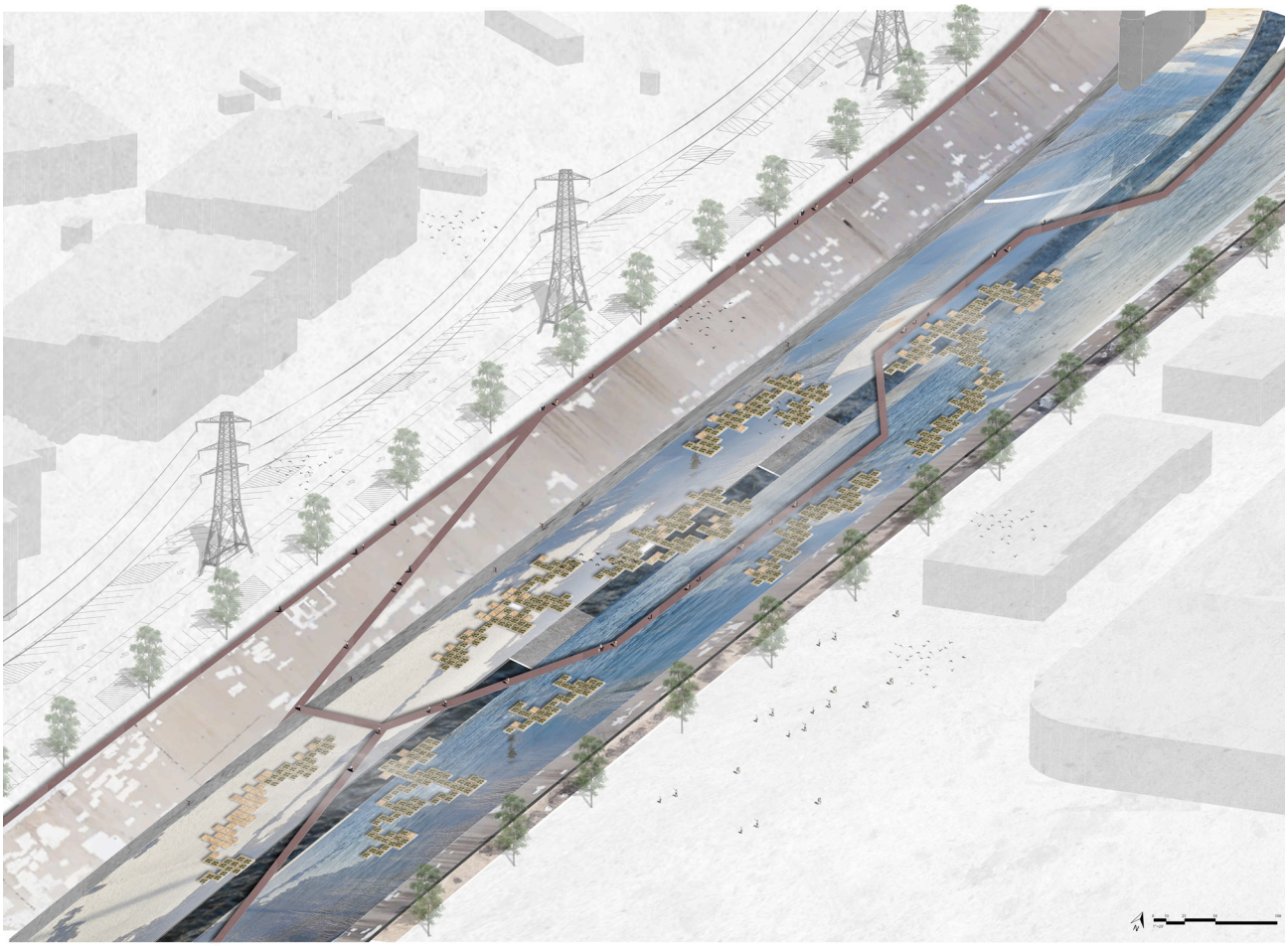


Figure 9. Geo-textiles change the water flow direction which helps enlarge the water surface, reduces the urban heat island effect, and restores habitats, 2020 (Jing Sun).

plantings and geo-blocks are both significant. Shade from the plantings mitigates the urban heat island effect, and the increased surface area of the geo-blocks leads to more evaporation that can mitigate air temperature and act as a cooling system for the Los Angeles River, making the environment more pleasant for humans and wildlife.

In conclusion, this network of geoblocks and vegetation treatments speaks to a type of ecosystem restoration that is uniquely geared towards building a more resilient and sustainable city on the human scale, utilizing microclimate management as an ecologically dyadic undertaking of mitigating climate change and revitalizing ecological function and biodiversity.

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改造洛杉磯河：利用大自然的技巧將野生動植物帶回城市河流

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摘　要：洛杉磯河是城市與生態之間的連接者，面臨著生物多樣性喪失、洪水風險和城市熱島效應等挑戰。解決這些挑戰需要在生態恢復和洪水防護之間找到平衡。鑒於當前的緊急形勢，“洛杉磯河生態系統恢復”提議將這條混凝土管道改造成生態復原、具有彈性的河流流域。該提議旨在通過使用“地質塊”將野生動植物帶回，增加生物多樣性，擴大水域面積，並減少洪水升高。這些地質塊包括“樹結構”“纖維結構”和“塊狀結構”，可以為植被和野生動物提供棲息地，並在河流中創建綠色生態系統。利用地質塊可以降低河流溫度，模擬洪泛平原，從而減緩城市熱島效應，為野生動物和周圍居民創造舒適的環境。根據不同的方法，洛杉磯河將扮演各種角色，解決當前問題，並成為生態恢復和社區彈性的典範。

關鍵詞：降溫策略；棲息地恢復；洪水防護；地質紋理；混凝土河岸