

# Green and Blue Infrastructure Investment Framework for Konya, Türkiye

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# Introduction: **What is Green and Blue Infrastructure (GI/BI)?**

- Protects from risk with ecological functions that are best suited to local conditions.
- For example, flood water may be infiltrated to increase potable groundwater supply, slowed and diverted by vegetation that increase habitat and urban cooling, etc.

## Examples

- Green streets
- River rehabilitation
- Public spaces rehabilitation
- Buildings and surrounding areas
- Rain gardens
- Groundwater infiltration ponds
- Permeable pavement



Cheonggyecheon Stream Restoration Project in Seoul, South Korea.

Image source: Green City Blog / Jiyoon Kim



Rain garden playground space in Columbia, Maryland.

Image source: Design Collective / Jennifer Hughes

# Approaches to Green and Blue Infrastructure

Understanding context and opportunities for  
Konya's ecological resilience



# 1. Analyzing Climate Risks in Konya

## Climate risks that Konya faces include

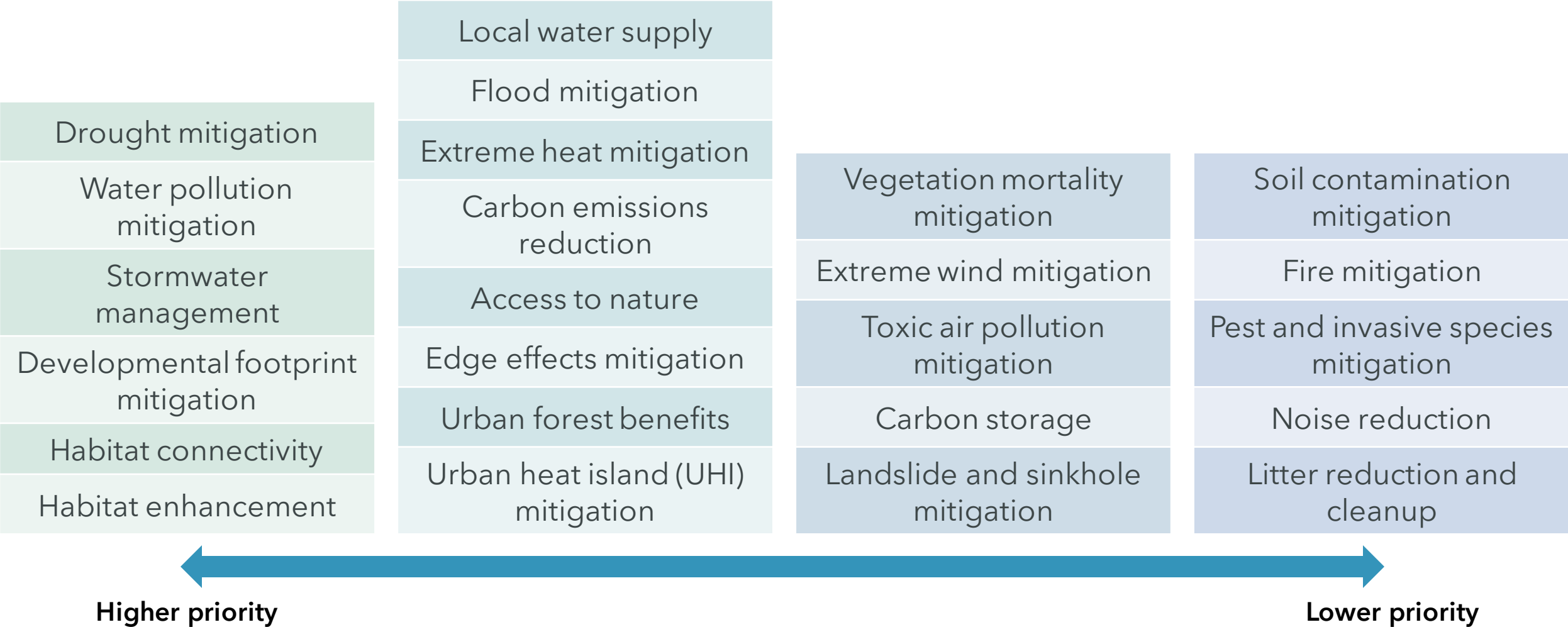
- Increased pluvial and fluvial **flooding** from stronger storms
- Increased **urban heat** – and increased air pollution and carbon emissions from air conditioning to compensate
- **Increased drought** due to higher evapotranspiration and higher water needs
- **Increased subsidence and sinkholes** due to groundwater overextraction
- Damage to economic and cultural assets related to **agriculture** and nature



Fall 2023 floods in Türkiye. Image source: First Channel News

# Konya's Preliminary Resilience Priorities

Analysis of the stakeholder-created *Climate Adaptation Actions for Konya* list (May 2022, from UNDP Enhancing Adaptation Action in Turkey workshop) and additional materials provided by the World Bank showed Konya's climate resilience priorities.



## 2. Spatial framework to understand the ecological context

Spatial analysis of Konya's ecological context informed five sets of **ecotopes**: spatial management units of similar conditions that can be used for effective city-scale resilience planning

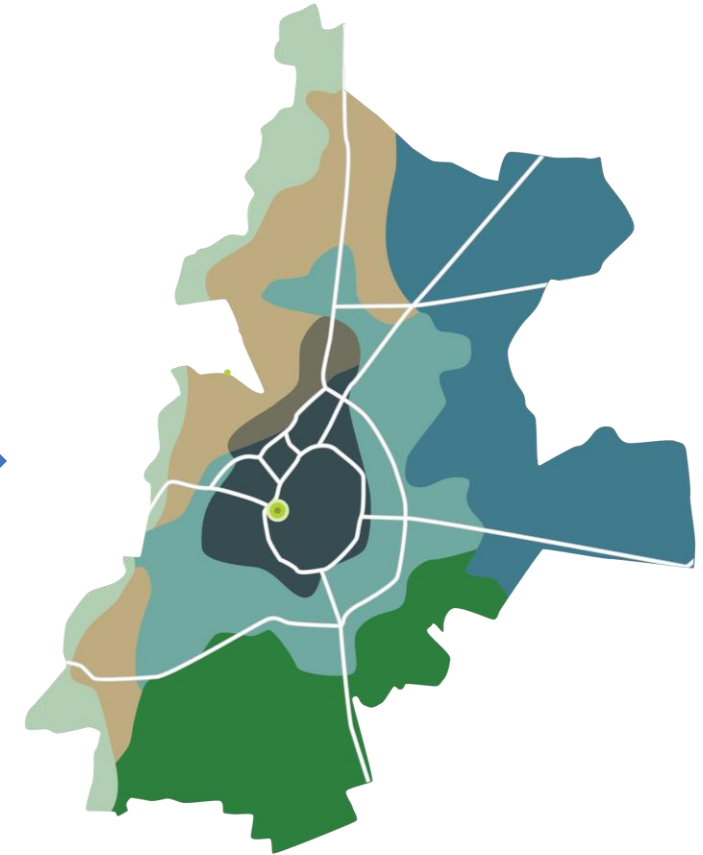
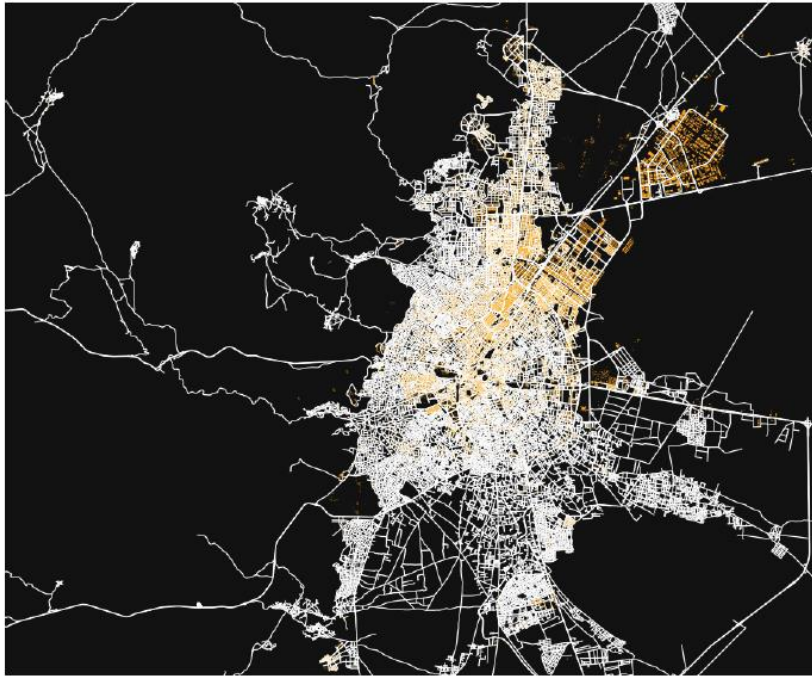


CITY SCAN  
KONYA  
TÜRKİYE  
FEBRUARY 2023



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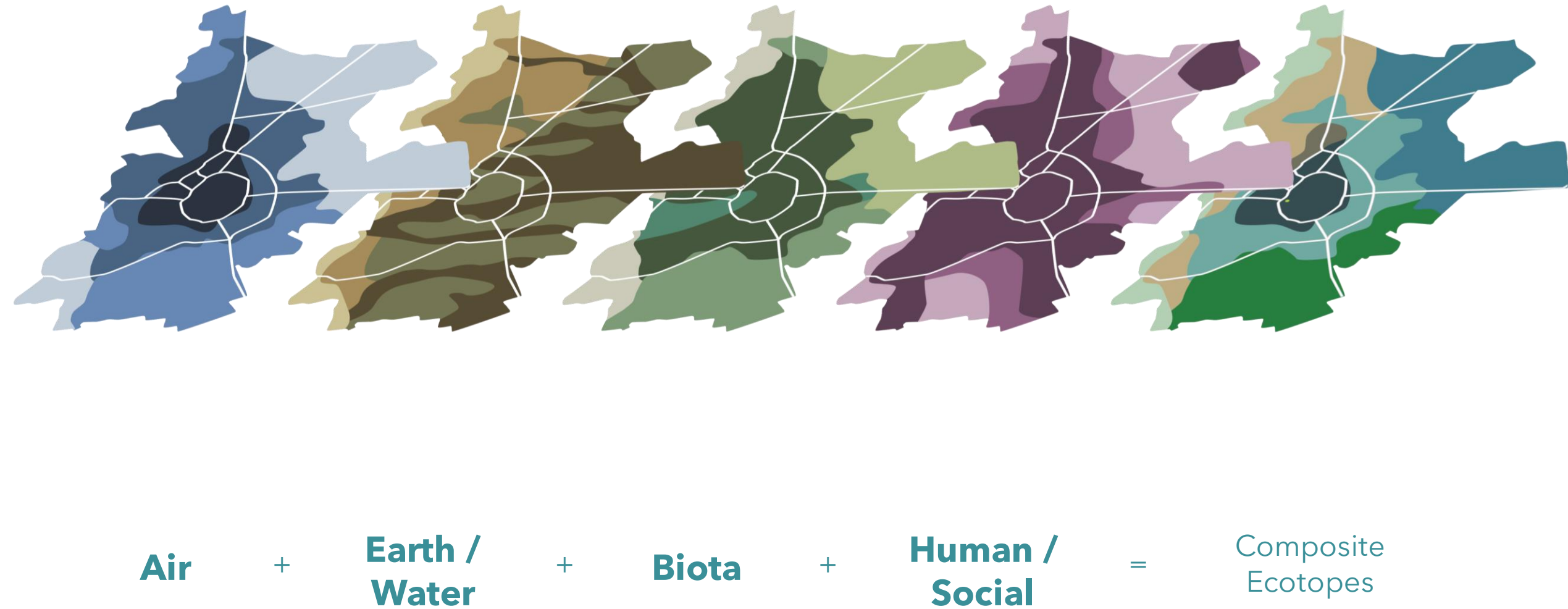
Özellikle Konya'da bulunan  
kültürel mirasın  
korunması ve  
yaşatılması için  
yapılan çalışmaların  
sonuçlarıdır.  
Türkiye Cumhuriyeti  
Kültür Varlıklarını  
Koruma Kanunu  
Kapsamında  
Yapılan Çalışmaların  
Sonuçlarıdır.



**Konya City Scan:** Existing spatial data related to ecological factors

**Ecotopes:** Preliminary proposed spatial management units of similar ecological conditions

### 3. Eotopes: Proposed spatial framework





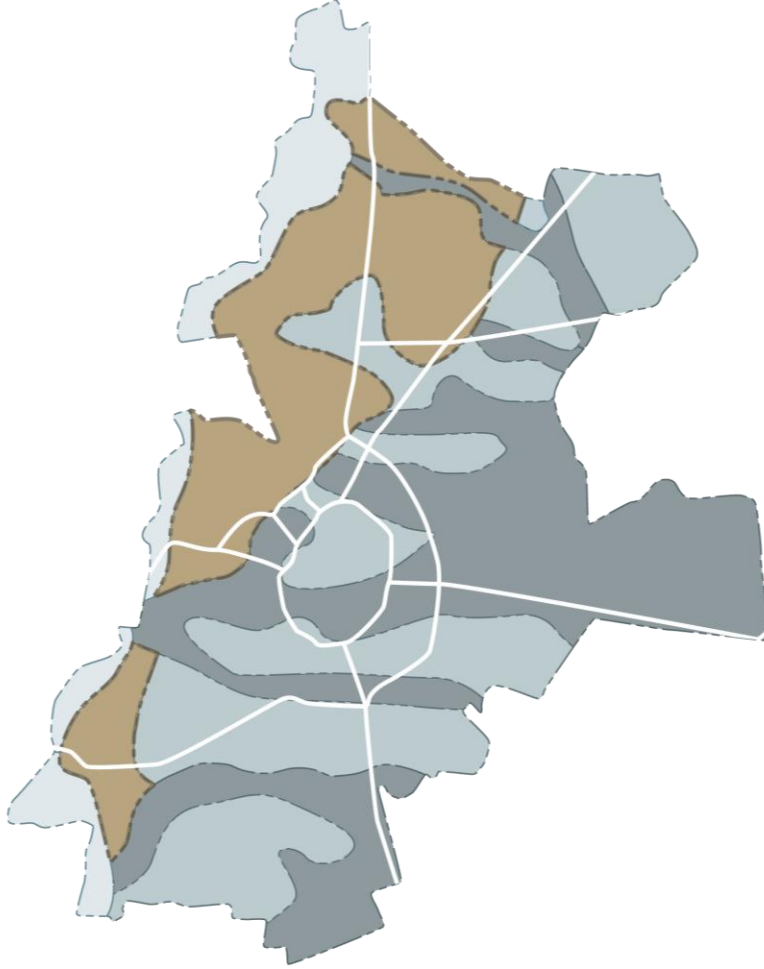
# Example Set of Ecotopes: Earth / Water



<b>Steep and erosion-prone</b>	Areas of high elevation and slope. Mostly low areas of flood risk, except for river paths and other low points.
<b>Infiltration potential</b>	Areas of moderate elevation and slope. Mostly built-up land cover, but some areas of grassland and agriculture. Likely ideal slope and soil conditions for groundwater recharge.
<b>Flat, dry urban</b>	Areas of relatively low elevation and slope, with some local high points and ridges. Mostly built-up land cover. Likely ideal for storm water conveyance and retention.
<b>Flat, flood-prone urban</b>	Areas of relatively low elevation and slope with relatively higher risk of storm water and river flooding. Likely to benefit from flood mitigation measures.
City Scan data layers used: River flood risk, storm water flood risk, elevation, slope, land cover, urban extent and change.	



## Example opportunity: Earth / Water

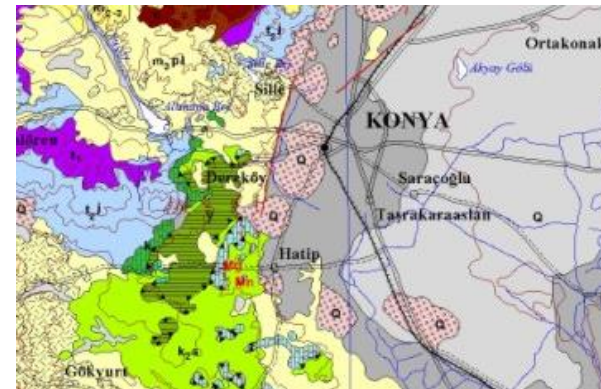


### Groundwater recharge

Create blue infrastructure on natural alluvial fan landforms with benefits such as:

- Improved groundwater water supply
- Reduced downstream flooding
- Urban cooling
- Additional open space

TÜRKİYE JEOLojİ HARİTASI / GEOLOGICAL MAP OF TURKEY  
KONYA



	Ayrılmamış Kuvaterner <i>Undifferentiated Quaternary</i>
	Alüvyon yelpazesi, yamaç malozu, birikinti konisi, moren vb. <i>Alluvial fan slope debris, cone of dejection, moraine etc.</i>
	Traverten <i>Travertine</i>
	Plaj ve kumul <i>Beach and dune</i>
	Ayrılmamış karasal kırıntılar <i>Undifferentiated continental clastic rocks</i>

# Input to an Investment Pilot Project

Tailored to Konya's unique urban ecosystem

# Input to Gedavet Park Ecological Corridor

- **Ecological characterization:** Located at Gedavet Pedestrian Road, in the city's center.
  - **Hazards:** High summer temperatures and air pollution. Low flood risk at site, but high flood risk in adjacent areas due to topographic differences.
  - **Opportunities:** Potential for **urban cooling** for high number of daily visitors, **ecological connectivity with adjacent green spaces** and regional **bird habitats**, and possible **groundwater infiltration**
- **Proposed management strategy:** Tailor GI/BI to support water supply, groundwater recharge, downslope flood control, and urban cooling. Treat as a habitat “stepping stone” for adjacent green space.





# ***Key Study Questions?***

- What is the watershed and groundwater infiltration potential?
- Have a shade study and/or ecological connectivity study been performed?
- What native plants are being used and have their growing needs been considered for local success?
- Does the current (subterranean) or historic alignment of Meram Creek coincide with some of the existing open spaces above ground, including Gedavet Park Ecological Corridor?



# Concept 01 | Opportunities for Improvement using Ecotopes

	Air	Earth/Water
Draft Characterizations	At the urban core, this area is hotter in the summer and experiences worse than average air quality. There appears to be some slope across the project site.	Project appears to be situated on high ground without flooding issues. Prepare watershed and drainage map to confirm.  Depending on the soils, there may be opportunities for groundwater infiltration.
Preliminary Recommendations	Summer shade mapping can be useful for additional optimization and identifying areas in need of cooling.  Produce an aspect map to identify further cooling needs/opportunities.	Maximize stormwater retention to reduce flooding downstream. Consider bioswales or cisterns.  Consider permeable paving materials, French drains.



# Concept 01 | Opportunities for Improvement using Ecotopes

	Biota	Human/Social
Draft Characterizations	The project site is in a highly-built up area, but with several larger green spaces nearby, including such as nearby Alaaddin Tepesi and Kültür Park.	Located by the city center, where there are many schools, resources, shops, restaurants, and cultural institutions. Currently a heavily-used area.
Preliminary Recommendations	<p>Identify urban biodiversity suitability. Optimize planting pattern and structure for target species.</p> <p>Evaluate urban wildlife connectivity with adjacent green spaces, develop connectivity strategy.</p> <p>Carbon sequestration: maximize tree size, tree longevity, minimize maintenance emissions, compost pruned material.</p> <p>Calculate air quality benefits. Select species that maximize benefits.</p>	<p>Include eco education programs to build awareness and conservation behavior. Integrate with local school curricula.</p> <p>Quantify human benefits to show value of the project: improved air quality, access to green space, flood reduction, etc.</p> <p>Explore opportunities for integrating tourism.</p> <p>Share exemplary application of urban ecological thinking through publications, awards, etc.</p>

# Applying adaptation actions

The actions below from the *Climate Adaptation Actions for Konya* list (May 2022, from UNDP Enhancing Adaptation Action in Turkey workshop) were identified as high-impact for local conditions and priorities.

Number	Category	Action	Opportunities
1	City	Neighborhood green space / green building pilot practices	Use Gedavet Ecological Corridor as a pilot to demonstrate the value of investing in urban green infrastructure.
2	Biodiversity and Ecosystem Services	Drought tolerant and halophyte urban vegetation planted as living windbreaks	Maximize longevity of plants within the challenging urban conditions of the project area by choosing resilient species. Create ecological value and provide a “stepping stone” to connect habitat in other nearby green space, as well as to habitat in the larger regional context.
3	Transportation	Permeable materials for streets, squares, and parking lots; Testing cool pavement material that reduces surface temperature on highways as a pilot application	Utilize permeable materials in plans for Gedavet Ecological Corridor to reduce stormwater runoff towards areas of higher flood risk. Explore ground cover materials that are not pavement to slow runoff.
4	Agriculture and Food	Rain harvesting	Include green infrastructure rain capture elements, such as cisterns and bioswales, in the project’s design.

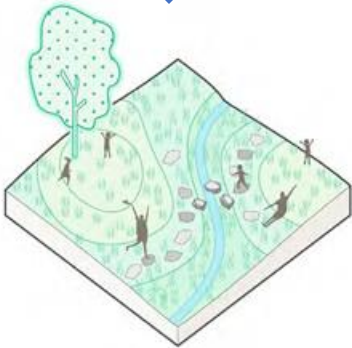


# Nature-Based Solutions Toolkit

## Opportunities and strategies



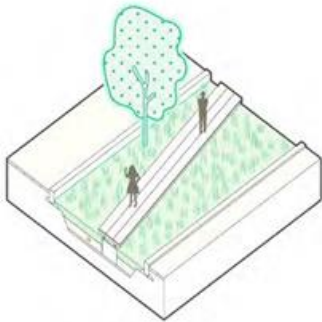
Ecological and social connectivity



Green-blue nature playgrounds and gardens



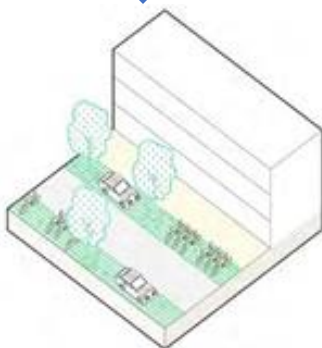
Plant for biodiversity and carbon sequestration



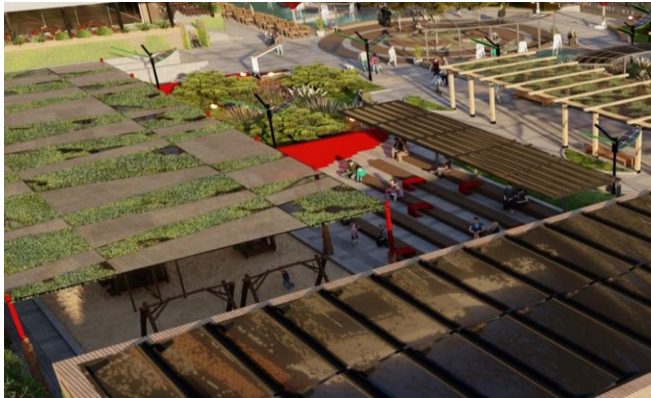
Bioswales



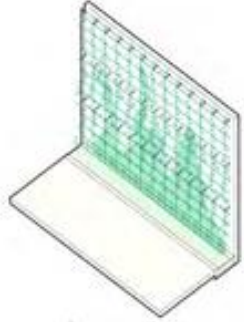
Maximize benefits of rainwater that falls within Gedavet watershed



Permeable pavement



Optimize cooling abilities



Ground-planted green facades



# Summary Table: Additional Pilot Project Concepts

Number	Main idea	Ecotopes	Strategies
2	Increasing Groundwater: Blue Infrastructure for Konya’s Alluvial Fans	Suburban uplands, Flood-prone suburban lowlands, urban uplands, flood-prone urban lowlands	Evaluate opportunities for restoration of natural alluvial fans and large-scale infiltration facilities.
3	Reduced Flooding: Protective Network of Green Streets and Parks	Flood-prone exurban lowlands, flood-prone suburban lowlands, flood-prone urban lowlands	Evaluate opportunities for developing blue-green infrastructure throughout flatter paved areas.
4	Eco-Tourism: Integrating Ecological Restoration and Socioeconomic Benefits	Five preliminary sites in a range of conditions	Evaluate opportunities for enhancing ecotourist destinations that support education programs, cultural heritage, biodiversity, agriculture, etc.
5	Biodiversity Stewardship: Restoration of Historic Akyay Lake	Flood-prone exurban lowlands	Restoring key elements of the natural hydrology while balancing other demands for the water that flows into Akyay Lake.

# Investment Recommendations and Next Steps

Planning, Governance, Implementation, and Positioning Konya as a Global Leader

# Key components of GI/BI Investment framework

Konya's need for climate resilience through Green and Blue Infrastructure

Frameworks for ecological opportunities and priorities

Analysis for for Green and Blue Infrastructure Pilot Projects

Investment recommendations

Advancing City of Konya as a global leader in Green and Blue Infrastructure

# Strategic Benefits of Pilot Projects

## Tangible benefits for residents of Konya

1. Due to their size and speed of implementation, pilot projects would be first to provide ecological benefits to the people.
2. Design and construction process creates local jobs.
3. Public engagement process is first opportunity for Konya residents to be informed, provide input, and potentially get involved in the project

## Testing strategies, targets, and evaluation methods

1. Opportunity to see how different nature-based solutions perform on-the-ground.
2. Monitoring process will show whether current evaluation methods are effective.
3. Results will show whether set targets are realistic, relevant, or ambitious enough.

## Building ownership and momentum for further planning and projects

1. Opportunity to engage stakeholders who are likely to be part of future planning efforts.
2. Build local ownership and advance regional priorities,
3. Surface additional opportunities for pilot projects by developing local networks.



# Planning and Governance Investment Recommendations for a Leading-Edge GI/BI Framework

Baseline Characterization	Visioning and Strategic Plan	Master Plan
<i>Understanding ecological context and opportunities</i>	<i>Aligning on priorities and strategies for further action</i>	<i>Specific steps towards implementation</i>
<div>Align with existing planning efforts</div> <div>Break down institutional silos</div> <div>Gather existing and raw data</div> <div>Fill data gaps</div> <div>Perform SWOT analysis</div> <div>Advance and refine the pilot project concepts</div>	<div>Build consensus and buy-in</div> <div>Establish a mission statement</div> <div>Define governance roles and responsibilities</div> <div>Develop a framework</div> <div>Establish priorities, goals, targets, and strategies</div> <div>Develop governance agreements and funding mechanisms</div>	<div>Build consensus and team dynamics</div> <div>Refine baseline characterization</div> <div>Visioning and performance targets</div> <div>Master plan concepts and alternative scenarios development</div> <div>Implementation and policy integration</div> <div>Monitoring and adaptive management</div>



## A key message

The impacts of climate change are already occurring and accelerating.

**Green and blue infrastructure are effective tools that cities can leverage to protect against climate risks and hazards.**