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Resilient water solutions against climate change in Jordan and Lebanon

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More liveable cities, safer streets

Planning for future-proof urban spaces in the Arab region



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What if urban planning could improve our daily lives, while making our cities resilient to future climate risks?



Urban challenges in a changing climate



In cities across the Arab region, people face daily tangible struggles, including rising temperatures, chaotic traffic, unreliable water and energy services, and concrete-filled neighborhoods with almost no parks. Most streets are designed for cars, not people. Sidewalks are broken or missing, making daily life harder for persons with disabilities, older persons and parents with strollers. The result is car dependency, air pollution, social inequalities and exclusions, and climate vulnerability.

Rapid and unplanned urbanization has eaten away green spaces, replacing them with paved impermeable surfaces that trap heat and worsen flooding. Cities suffer from long periods of drought, but when rain finally comes, it floods the streets, paralyzes traffic, damages businesses and housing, and exposes a lack of proper infrastructure planning.

Planning for resilience

Climate-mainstreamed urban planning entails designing cities that account for heat, floods and climate change risks before construction begins, and incorporate climate adaptation to the already built space. This means using flood and heat risk maps to guide zoning and infrastructure decisions, protecting and expanding green spaces, and strategically planting trees to provide shade and cool streets. It also involves choosing permeable and heat-reflective materials and building drainage systems that prevent rainwater from flooding roads.

When streets flood, they do not just stall traffic, but also spread solid waste into homes and public spaces, pollute water sources and worsen health risks. By planning with climate in mind, cities can reduce these everyday disruptions, while improving walkability, public safety and access for people with reduced mobility.



60%

of people are urban residents in the Arab region today.

70%

of the Arab region's population will be urban by 2050.

75%

of buildings and infrastructure are at direct risk from climate change.

17/22 Arab countries

are affected by desertification and land degradation.

19/22 Arab countries

fall below the renewable water resources scarcity threshold of 1,000 m³/capita/year.

4–5°C

increase in mean temperatures is expected by 2100 under the high-emission scenario.

Source: UN-Habitat (n.d.) Arab States Region.

How to plan for urban climate resilience: step-by-step

1

Pinpoint issues and prioritize the needs of vulnerable groups.
Identify day-to-day problems
Q: What issues disrupt life most? Who is most affected?
Tools: current state and vulnerability assessments

2

Prevent costly mistakes and future displacement by steering developments away from high-risk areas.
Map current and future risks
Q: Where do floods, heatwaves and drought happen today and how will this change?
Tools: GIS risk maps, national climate services, RICCAR and World Bank Climate Knowledge Portal

3

Build shared ownership and ensure vulnerable voices are included.
Bring the right people to the table
Q: Which municipal departments, entities and communities must be involved? What efforts are already in place?
Tools: stakeholder mapping, local-national coordination platforms and participatory workshops

4

Deliver multiple co-benefits at once: cooler streets, reduced flooding, healthier spaces.
Co-create solutions that solve multiple problems
Q: Can one project solve multiple problems? Are we avoiding developments in areas at risk?
Tools: green-blue infrastructure systems, nature-based solutions, zoning reforms and pedestrian-friendly designs

5 **Focus resources on feasible, no-regret actions with high impact.**
Prioritize and act
Q: Is the action socially supported, affordable, environmentally sound, equitable, feasible, adaptive and aligned with policy?
Tools: cost-benefit analysis, multi-criteria analysis and prioritization matrix

6 **Reduce future costs and risks through continuous improvement.**
Review, learn and improve
Q: What is working, what is not and what is next?
Tools: monitoring and evaluation systems, observatories, indicators, success stories and best practices, and early warning systems

Who can help and how?

- Local governments and municipalities are primary actors in climate-resilient planning. They know local conditions best and should lead land-use, zoning and service planning, supported by decentralization and adequate resources.
- Regional networks and institutes:
  - RAED: NGO network advancing environmental sustainability and capacity building across Arab countries.
  - ARI: think tank producing policy research and analysis, including on governance and environmental justice.
  - AUDI: Arab Towns Organization research/training arm, supporting municipalities with urban development know-how.
  - CEDARE: centre offering technical cooperation on environment, water and climate resilience.
- Academic and design labs:
  - CatalyticAction: NGO using participatory design to co-create inclusive, climate-sensitive public spaces.
  - Design for Communities (D4C): engages young designers in community-based, participatory urban projects.
- Global networks and United Nations agencies:
  - Global Covenant of Mayors (regional branches): supports cities in climate commitments, providing frameworks, technical guidance and peer exchange.
  - UNDP, UNDRR, ESCWA and UN-Habitat: deliver technical assistance, vulnerability tools, regional policy advice and urban resilience programmes for local and national governments.



Climate-resilient territorial plan and development strategy for Zahle District in Lebanon, with local plans for eight of its municipalities

Context and rationale

As part of the Resilient Water Solutions Against Climate Change in Jordan and Lebanon project (coordinated by UN-Habitat, the Lebanese Ministry of Environment, ESCWA and UNICEF, and funded by the Adaptation Fund), the MORES-SETEC consortium prepared a climate-resilient territorial plan and development strategy for Zahle District.

Located in the fertile Bekaa Valley, Zahle combines rich agricultural lands, diverse ecosystems and abundant water resources. It also blends urban and rural environments and hosts a large number of displaced persons. The district faces mounting climate risks, including droughts, floods, heatwaves, desertification and land degradation, exacerbated by rapid urbanization and demographic pressures.

Assessment and methodology

The strategy was built on three pillars:

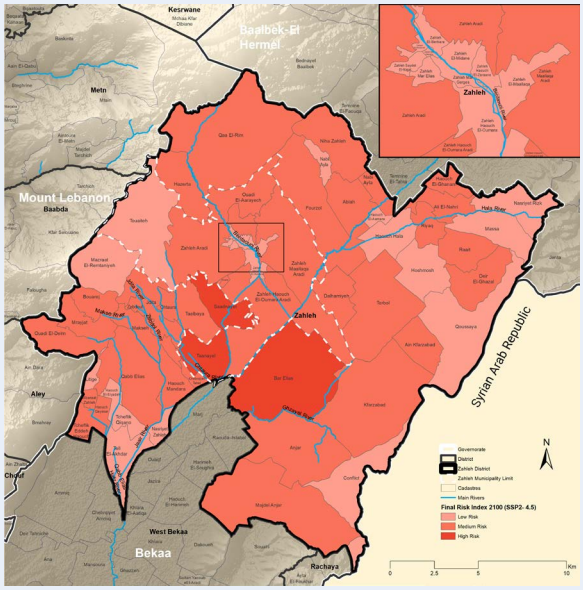
1. Data-driven climate risk assessment

- Applied GIS tools to spatially analyse hazards, exposure and vulnerabilities across municipalities.
- Used climate scenarios (SSP2-4.5 and SSP5-8.5) with AI-driven land use projections for 2050 to model climate risks under multiple futures.
- Integrated socioeconomic factors, including population density, vulnerable groups (displaced persons, disadvantaged communities) and critical infrastructure exposure.

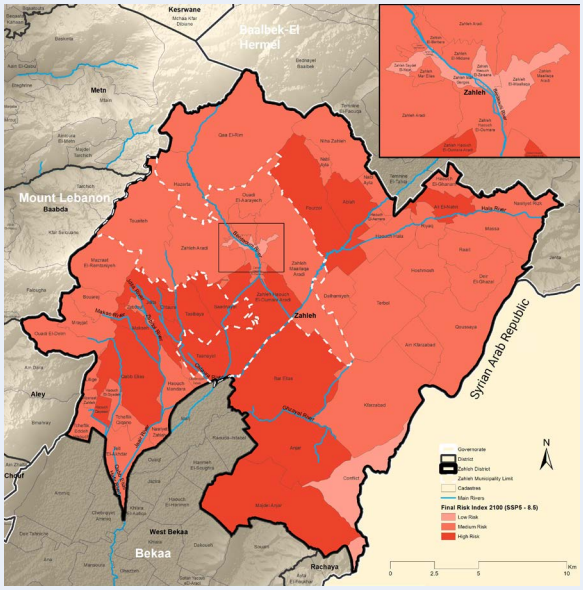
2. Participatory and inclusive methods

- Conducted interviews, workshops and consultations to capture local knowledge and priorities.
- Engaged municipalities, civil society, women, young people and displaced persons to co-create adaptation pathways.

Climate risk evolution in Zahle District



Scenario 1 (SSP2-RCP 4.5)



Scenario 2 (SSP5-RCP 8.5)

(i) This map was developed by UN-Habitat Lebanon and MORES/SETEC, in 2025.

(ii) The background map was provided by the National Council for Scientific Research in Lebanon (CNRS-L), a public research institution responsible for supporting and coordinating scientific research in Lebanon. The Digital Elevation Model (DEM) data were derived using ArcGIS tools.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

3. Integrated territorial and land-use planning

- Combined risk assessments with 2050 land use and land cover projections to identify hotspots and guide sustainable growth.
- Applied a three-pronged approach: landscape connectivity, sustainable livelihoods and participatory governance.
- Used scenario-based planning to prepare for multiple plausible futures.

Main project outcomes

1. Spatial risk assessment

Risk maps were produced to determine climate and natural hazard risk levels for each municipality within the district. These maps were developed by overlaying vulnerability factors with climate and natural hazards, including floods, landslides, wildfires, temperature increase, precipitation changes, drought, desertification and seismic risk.

- Mapping revealed municipalities like Saadnayel, Bar Elias and Zahle Haouch El-Oumara as highly vulnerable to floods, droughts, heatwaves and desertification.
- Risks are expected to intensify and expand, particularly across the plains.

2. Strategic territorial development and eight local plans

A vision was developed for the district to balance heritage, environment, social cohesion and resilience, articulated through four main goals: managing urban growth sustainably, restoring and protecting natural habitats, strengthening rural livelihoods through sustainable agriculture, and ensuring sustainable water management.

Based on this vision, a territorial plan for the district was developed, alongside eight local municipal plans. The selected municipalities were Majdel Anjar, Kfarzabad, Ain Kfarzabad, Terbol, Fourzol, Qaa El-Rim, Hazerta and Qabb Elias. Their prioritization was based on the conducted climate risk assessment, with the selected municipalities identified as among those facing higher levels of climate risk. The process also considered additional factors, including the existence of a master plan, the municipality's political will and commitment to develop a climate-mainstreamed local plan, landscape characteristics, the presence of key water features and other relevant considerations.

3. Urban observatory

An urban observatory at the district level was developed to host historical and real-time data generated by a national network of stakeholders across key thematic indicators, including environment, governance, water, agriculture, climate change and regulatory frameworks. It also serves as a dissemination platform, providing accessible data and insights to local authorities, researchers and practitioners.

4. Recommendations and interventions

The project resulted in a list of recommendations and territorial interventions:

- Adopt zoning and land-use policies to curb sprawl and protect farmland.
- Implement nature-based solutions, including green corridors and reforestation.
- Upgrade climate-resilient infrastructure and expand public transport.
- Support capacity-building and participatory governance for effective implementation.

The Zahle territorial plan and eight local plans illustrated how **data-driven analysis**, **inclusive engagement and scenario-based planning** can guide climate-resilient development in regions balancing **agriculture**, **urbanization** and **displacement pressures**. By linking **spatial risk assessments** with **strategic goals** and **targeted actions**, Zahle offers a replicable model for integrated resilience planning in Lebanon and beyond.

Irbid and Mafraq: building climate resilience in northern Jordan

Context and rationale

As part of the Resilient Water Solutions Against Climate Change in Jordan and Lebanon project (coordinated by UN-Habitat, ESCWA and UNICEF, and funded by the Adaptation Fund), the LDK and RSS consortium prepared a climate-resilient territorial plan and development strategy for the northern Jordanian cities of Irbid and Mafraq. These cities host 437,000 Syrian refugees. The influx has placed heavy pressure on water, sanitation, housing, education and healthcare systems, already fragile before the Syrian crisis.

Both cities face rising risks from flooding, heatwaves, water scarcity and ecosystem degradation.

Classified by the World Bank as “Type 2 Cities”, they combine high climate vulnerability with limited institutional capacity, making them priority sites for urban resilience interventions.

Assessment and methodology

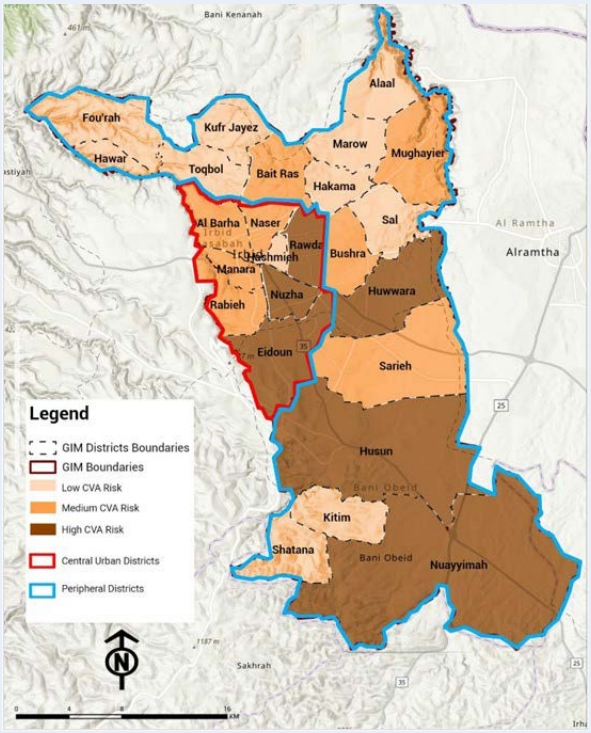
A two-tier sectoral assessment informed planning:

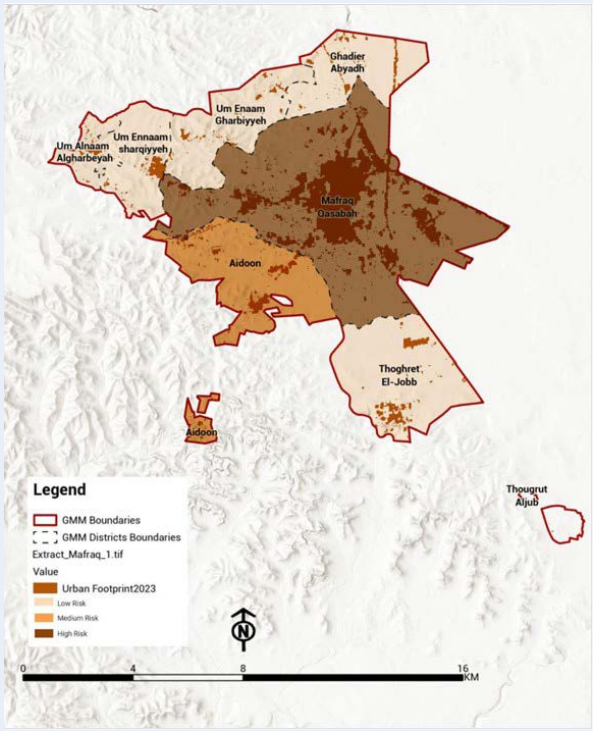
1. Natural and environmental characteristics, which included the categories: climate, geography and ecosystems.

2. Urban system, which included the categories: governance, infrastructure and socioeconomic vulnerabilities.

The results supported a climate resilient urban master plan, integrating sectoral analysis, spatial risk mapping and growth modelling.

2055 climate-risk and urban vulnerability conditions in Irbid and Mafraq





(i) This map was developed by UN-Habitat Jordan, LDK and RSS, in 2025.

(ii) The background map was provided by Ministry of Local Administration, in Jordan. The Digital Elevation Model (DEM) data were derived using ArcGIS tools.

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Urban growth scenarios

Three development pathways were explored:

- Business-as-usual: expansion without climate integration → growing service gaps and rising risks.
- Restricted growth: controlled development but with unregulated land use, limited flexibility and risk of exclusion for vulnerable groups.
- Climate-resilient growth: inclusive, forward-looking model promoting high-density, mixed-use development, while integrating climate adaptation and mitigation.

The main highlights of the compounded risk mapping

Mafraq highlights

- Qasabat Mafraq: highest-risk, exposed to flooding and heat → urgent need for resilient infrastructure and services.
- Thoghret El-Jobb and Ghadier Abyadh: refugee-dense areas with informal, unsafe housing and limited services.
- Aidoon: moderate risks but low density offers opportunities for proactive adaptation.

Irbid highlights

- Fou'rah, Hawar, Alaal, Mughayier: severe water scarcity, soil degradation and outdated infrastructure, worsened by deforestation and poor farming practices.
- Southern/eastern districts (Nuzha, Rawda, Nuayyimah, Husun, Eidoun, Huwwara): high exposure to flooding, heatwaves and weak infrastructure, requiring green and adaptive design.
- Women (48 per cent of residents): disproportionately affected by floods, droughts and agricultural disruptions, highlighting the importance of gender equality and social inclusion integration.

The process also identified priority districts requiring immediate actions, including strategic investment areas where improvements in housing, infrastructure and services would deliver high resilience and equity returns, and a balanced growth approach to prevent the concentration of wealth and opportunities in specific areas.

Project outcomes

A total of **98 climate resilience actions** were designed (47 in Irbid and 51 in Mafraq) across four pillars:

- Governance and institutions.
- Infrastructure and built environment.
- Environmental degradation.
- Vulnerable groups, and gender equality and social inclusion.

A cost-benefit analysis highlighted 14 priority actions, packaged into three spatial prototypes to attract co-funding and direct investment toward priority districts:

- Establishing urban forests: cooling, ecosystem restoration and carbon capture.
- Climate-resilient urban services: stronger systems for water, sanitation, energy and mobility.
- Integrated flood management systems: reducing flood risk and protecting vulnerable communities.

The present information sheet is part of a project entitled "Resilient water solutions against climate change in Jordan and Lebanon", led by UN-Habitat in partnership with ESCWA and UNICEF, and funded by the Adaptation Fund.

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