CLIMAGINE Workshop III Report

Integrated Management Plan for the Damour Area in Lebanon
GEF MedProgramme, Child Project 2.1.

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2.1
Mediterranean
Coastal Zones Climate
Resilience Water Security
and Habitat Protection"

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List of Acronyms and Abbreviations

BAU: Business-as-Usual
BoE: Band of Equilibrium
CBA: Cost-Benefit Analysis
CVI: Coastal Vulnerability Index
DSS: Decision Support System
EbA: Ecosystem-based Adaptation
EBML: Beirut and Mount Lebanon Water Establishment
ETc: Crop evapotranspiration
GAP: Good Agricultural Practices
GDEs: Groundwater-Dependent Ecosystems
GDHER: General Directorate of Hydraulic and Electrical Resources
GEF: Global Environment Facility
GWP-Med: Global Water Partnership – Mediterranean
ICZM: Integrated Coastal Zone Management
IMP: Integrated Management Plan
IPM: Integrated Pest Management
LARI: Agricultural Research Institute of Lebanon
MAR: Managed Aquifer Recharge
MCA: Multi-Criteria Analysis
MoA: Ministry of Agriculture
MoE: Ministry of Environment
MoEW: Ministry of Energy and Water
MoI: Ministry of Industry
NbS: Nature-based Solutions
NGOs: Non-Governmental Organizations
OM: Operation and Maintenance
PAP/RAC: Programme for the Application of the Participatory Approach in Integrated Coastal Management
SI: Sustainability Indicators
SGD: Submarine Groundwater Discharge
SWM: Solid Waste Management
TDS: Total Dissolved Solids
UNEP/MAP: United Nations Environment Programme / Mediterranean Action Plan
UNESCO-IHP: UNESCO International Hydrological Programme
WWTP: Wastewater Treatment Plant
WUA: Water User Association

1. Introduction

Under the framework of the MedProgramme Child Project 2.1, implemented by Plan Bleu, PAP/RAC, GWP-Med and UNESCO-IHP within the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP) system and funded by the Global Environment Facility, the third Climagine workshop for the Integrated Management Plan for the Damour Area in Lebanon was held on 5 February 2026. The meeting was the final step in the Climagine participatory process that brought together municipalities, institutions, and experts to collectively define a sustainable future for the Damour area.

Building on the outcomes of the first two workshops, where key challenges were identified and a consolidated set of sustainability indicators was developed, this final session focused on **translating these indicators into practical decision-making tools.** The objective was no longer to diagnose problems, but to **define what constitutes acceptable conditions for the Damour area** and to establish a **shared vision for its future.**

To achieve this, the workshop introduced two central tools: the **Band of Equilibrium (BoE)** and the **Amoeba diagram.** Together, these tools enabled participants to move beyond abstract discussions and engage in defining concrete limits, targets, and priorities for action. In doing so, the workshop played an important role in bridging the gap between analysis and implementation, providing direct input to the forthcoming Integrated Management Plan for the Damour Area.

5 February 2026, Crowne Plaza Beirut

2. Workshop summary

2.1 Workshop Structure

The workshop was designed as an interactive and expert-driven process, combining plenary discussions with thematic group work. Participants were first guided through a **recap of the Climagine process**, highlighting the progression from identifying challenges (Workshop 1), to refining and prioritizing indicators (Workshop 2), and finally to defining thresholds and targets in Workshop 3. The core of the workshop was structured around thematic group discussions to assess current conditions, define acceptable limits, and identify desired future states. Rather than aiming for precise numerical values, the exercise encouraged reasoned judgment, drawing on both available data and local expertise. Building on the outcomes of the previous workshops, it engaged national governmental bodies, local authorities, and technical experts to discuss and validate the Sustainability Indicators (SI). It brought together a diverse group of stakeholders, including municipal representatives, national authorities, technical experts, and civil society organizations, ensuring that discussions reflected both local realities and sectoral expertise.

A central element of these discussions was the introduction of the Band of Equilibrium, a concept used to define the range within which an indicator can vary while remaining within acceptable sustainability limits. For each indicator, participants were asked to determine a minimum acceptable level, below which the situation becomes critical and a desired level representing improved conditions in the medium to long term.

In the context of the Damour area, where **data gaps remain significant,** this exercise was necessarily qualitative. However, it proved effective in **anchoring discussions around concrete thresholds** and **facilitating consensus among stakeholders.** By defining what is acceptable and what is not, participants were able to articulate a shared understanding of the **Damour area's "safe operating space."** This notion of a safe operating space was closely linked to broader reflections on **sustainability**. Participants emphasized that resource management must not only respond to current needs but also ensure that water, land, and ecosystems remain available for future generations. This required a careful balance between development pressures, environmental protection, and social demands across the area.

To complement the BoE exercise, participants used Amoeba diagrams to visualize both the current state of the system and a desired future configuration. These diagrams provided a simple yet effective way to **represent multiple indicators simultaneously, highlighting imbalances and priority areas for intervention**. Although time constraints limited the level of quantification, the diagrams served as valuable tools for discussion, enabling participants to **compare business-as-usual trajectories with more sustainable pathways.**

Thematic group work sessions focusing on:

- Water supply and wastewater
- Agriculture and irrigation
- Environment and biodiversity
- Urban planning
- Governance

2.1.1 From Indicators to Decision Thresholds: The Band of Equilibrium

A central component of the workshop was the definition of the Band of Equilibrium (BoE) for each priority indicator. The **BoE represents the range within which an indicator can vary while remaining within acceptable sustainability limits.**

Participants were invited to define:

- A minimum acceptable level, below which the situation is considered critical;
- A desired target level, reflecting improved conditions in the medium to long term (2030–2050).

Given the limited availability of consistent quantitative data, the exercise relied on a combination of expert judgment, stakeholder knowledge, and available evidence. This qualitative yet structured approach allowed participants to move beyond general discussions and define concrete sustainability boundaries. The process also highlighted that these thresholds are not fixed, but will need to be refined over time as monitoring systems improve and more data becomes available.

Colour	Number	Ranking of the SI on the Band of Equilibrium
	1	Unsustainable by default
	2	Low sustainability by default
	3	Lower sustainability threshold
	4	Sustainable
	5	Upper sustainability threshold
	6	Unsustainable by excess
	7	Very unsustainable by excess

During the workshop, participants used a 1 to 7 scoring scale to define the Band of Equilibrium (BoE) numbers. On this scale, scores of 1-2 generally indicate a critical absence or failure of systems (unsustainability by default), 3-5 represent the optimal sustainable operating space (the equilibrium band), and 6-7 indicate excessive pressure or overexploitation of resources (unsustainability by excess). Categories **3-5 represent the acceptable 'safe operating space', with 4 being the ideal situation.** Including this clear explanation allows for the removal of the redundant "Min/Max" columns in the indicator matrices, making the content and the resulting Amoeba diagrams much more visible and readable. A detailed explanatory sheet outlining this methodology and the scoring criteria distributed during the workshop is included in Annex 4.

2.1.2 Defining the Safe Operating Space

Through the BoE exercise, participants collectively defined a **"safe operating space"** for the Damour area. This concept reflects the **need to maintain a balance between resource use and ecosystem capacity,** ensuring that environmental systems remain functional while supporting socio-economic activities. Discussions emphasized that sustainability must account for:

- Long-term resource availability;
- Intergenerational equity;
- The balance between development needs and environmental limits.

2.1.3 Amoeba Diagrams and Scenario Exploration

The Amoeba diagram was introduced as a visual tool to represent multiple indicators simultaneously and to compare current conditions with desired future states.

- Each thematic group used Amoeba diagrams to:
- Illustrate the current situation across key indicators;
- Define a target configuration representing a sustainable pathway;
- Compare this with a Business-as-Usual scenario.

Due to time constraints, the diagrams were not fully quantified and should be interpreted as indicative representations rather than precise analytical outputs. Nevertheless, they provided valuable **insights into system imbalances and priority areas for intervention.**

2.2 Workshop Summary

This section anchors those findings in the actual Band of Equilibrium (BoE) scoring and Amoeba diagram outputs generated during Workshop 3.

This alignment serves two purposes:

- to validate that the narrative reflects the quantified workshop results
- to ensure transparency between qualitative interpretation and indicator-based scoring

It is important to note that BoE values were derived through a combination of:

- stakeholder inputs
- expert judgment
- proxy estimations where data gaps exist

As such, the results should be interpreted as robust but indicative, rather than strictly quantitative.

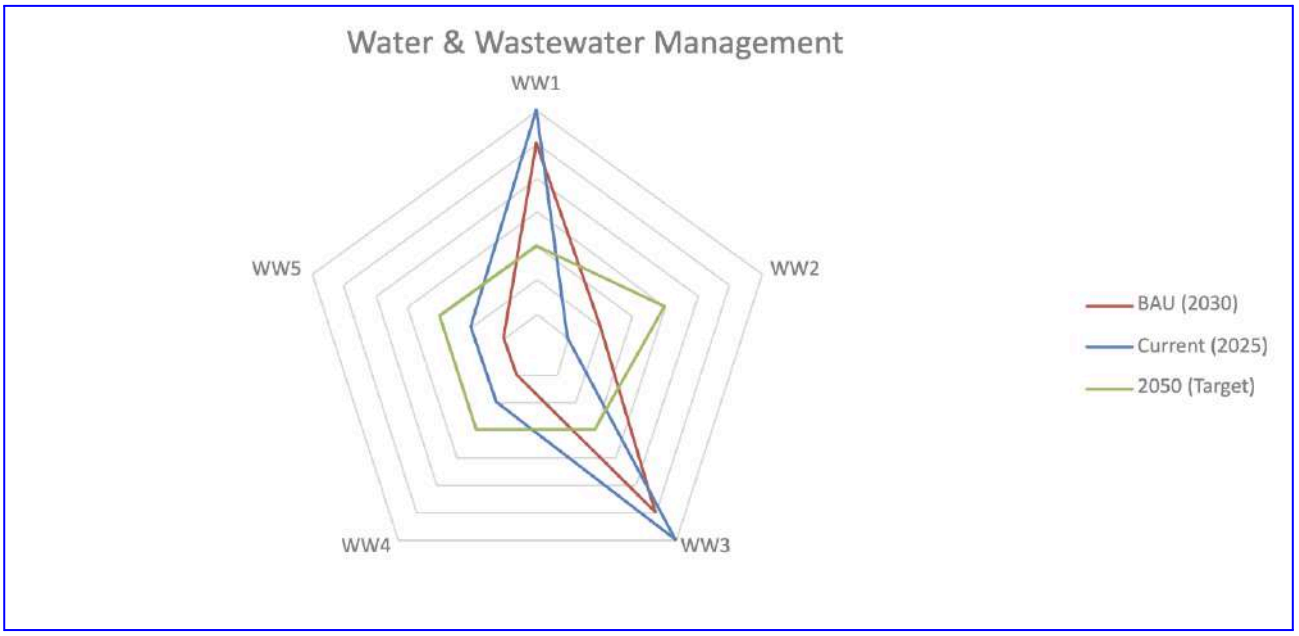
2.2.1 Water Supply and Wastewater: Confirmed Structural Imbalance

The BoE scoring for water supply and wastewater confirms a polarized distribution of indicators, with values concentrated at both extremes of the scale.

Group Water Supply and Wastewater Management										
#	**Indicator**	**Unit**	**Baseline**	**BAU Value**	**Alternative Value**	**Sustainable Minimum**	**Sustainable Maximum**	**Current (2025)**	**BAU (2030)**	**2050 (Target)**
WW1	Seawater intrusion index	Chlorides mg/L or Total dissolved solids (TDS) (mg/L)	Critical Chlorides >200 mg/L ≈ 435–1,163 mg/L (TDS)	> 1,500 mg/L (Increasing)	< 250 mg/L	0 mg/L	250 mg/L	6	7	3
WW2	Groundwater Level Trend	m/year	Declining ≈ - 0.5 to 7.6m/year	< -7.6 m/year	0 to +0.5 m/year	0 m/year	+0.5 m/year	2	1	4
WW3	Groundwater Abstraction	MCM/year	High Pressure ≈ 13,5 MCM/year	> 15 MCM/year	< 10 MCM/year (Safe Yield)	5 MCM/year	Safe Yield Limit	6	7	3
WW4	Households connected to a functioning WWTP	% of households	< 10%	10%	80%	60%	100%	1	2	3
WW5	Wastewater effectively treated	% = m³/day vs design capacity	Low Efficiency. ≈ 21%	15%	80%	60%	100%	1	2	3

Indicator	**Current situation and BAU scenario in the Damour area**	**Recommendations - alternative scenario**
WW1. Seawater intrusion index	Currently, the Damour priority coastal aquifer experiences severe over-exploitation, driving significant seawater intrusion with TDS reaching up to 1,163 mg/L. The Business-As-Usual (BAU) scenario points to a continued, irreversible salinization of the coastal aquifer (BoE 7), rendering the freshwater lens unusable for domestic or agricultural purposes.	The alternative scenario requires **immediately reducing coastal pumping and enforcing strict well licensing**. Furthermore, implementing **Managed Aquifer Recharge (MAR) systems** should be prioritized to restore the freshwater-saltwater interface and push salinity safely below the 250 mg/L maximum durable threshold.
WW2. Groundwater Level Trend	Groundwater levels are declining at an alarming rate (between -0.5 and -7.6 m/year) due to the proliferation of unregulated	It is crucial to install **continuous monitoring networks using piezometers with data**

	wells and climate variability reducing natural recharge. In a BAU scenario, aquifer depletion will accelerate, leading to the complete drying of wells and springs (BoE 1).	**loggers**. The alternative scenario requires **enforcing strict extraction caps** and **protecting major recharge zones** to stabilize water levels, ensuring a sustainable zero or positive recharge trend
WW3. Groundwater Abstraction	Current abstraction exerts extreme pressure on the system (≈ 13.5 MCM/year), far exceeding natural safe yields. Unmetered and unregulated pumping dominates the area. The BAU scenario assumes continued uncontrolled abstraction (BoE 1), heavily degrading the water balance.	To reach the sustainable target, a **comprehensive well inventory must be completed**, coupled with **mandatory metering for both public and major private wells**. Groundwater abstraction must be strictly capped within sustainable safe yield limits, and illegal wells in critical zones must be closed.
WW4. Households connected to a functioning WWTP	Less than 10% of households are currently connected to a functioning wastewater treatment plant. Most rely on un-engineered, leaking septic tanks, and raw sewage is frequently discharged into the Damour River. BAU predicts only marginal improvements due to fragmented infrastructure (BoE 2).	**Significant investments** are required to complete collection networks, rehabilitate existing pumping stations, and effectively connect unserved rural and urban settlements to functional WWTPs, aiming for an alternative scenario target of at least an 80% effective connection rate.
WW5. Wastewater effectively treated	The actual treatment efficiency is critically low (≈ 21%). Most constructed WWTPs and pumping stations are non-operational due to chronic power shortages and lack of maintenance. The BAU trend shows continued structural failure (BoE 2), leading to severe pollution of surface and groundwater.	The alternative scenario demands **securing Operation & Maintenance (O&M) budgets, solarizing WWTPs** to provide backup energy, and **strictly enforcing pre-treatment for industrial and commercial discharges**. This will allow the facilities to reach an 80% functional treatment capacity.



Observed Pattern

- Indicators related to infrastructure functionality and service delivery (e.g. wastewater treatment, sewer connectivity, monitoring systems) are predominantly positioned within BoE 1–2, indicating unsustainability by default.
- Indicators related to resource pressure and system inefficiency (e.g. groundwater abstraction, non-revenue water) are positioned within BoE 6–7, indicating unsustainability by excess.

Interpretation

This distribution validates the amoeba shape observed during the workshop:

- a **strong inward collapse across service-related indicators**
- outward **spikes in pressure-related indicators**

The system therefore exhibits a dual failure condition, where:

- basic systems are not functioning
- existing resources are simultaneously overexploited

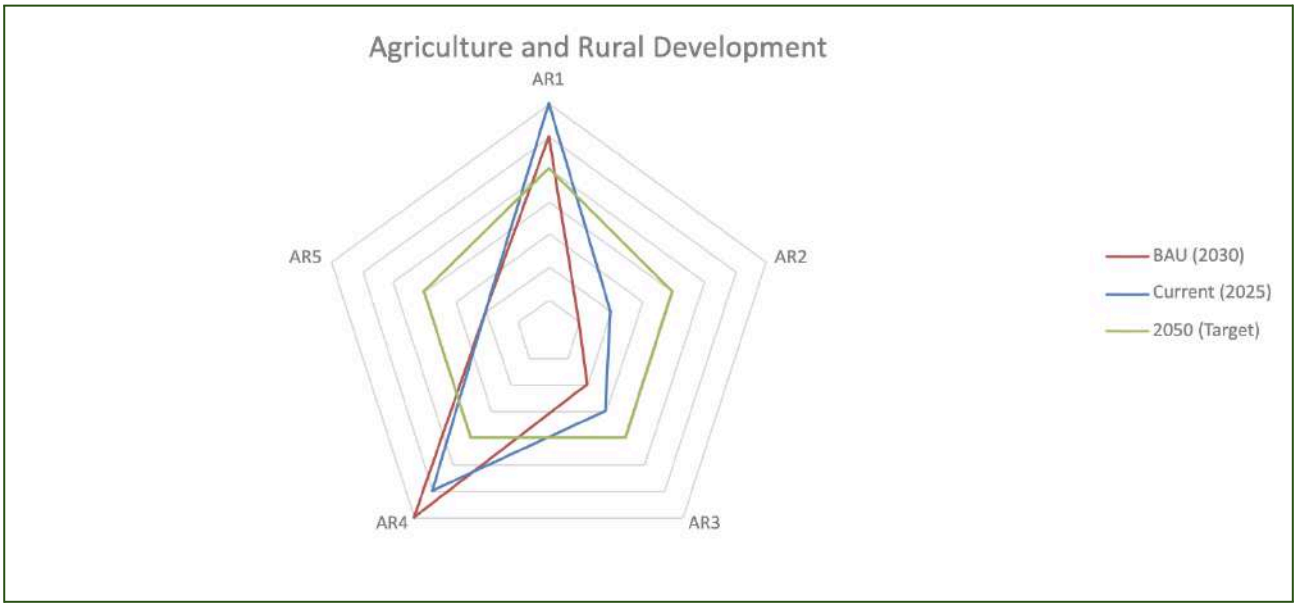
This confirms that the characterization of the water sector as a primary leverage point is fully supported by the BoE results. It also reinforces the need to **address both infrastructure rehabilitation and resource regulation simultaneously**. These findings are directly reflected in the indicator set presented in Annex 3.1, particularly through indicators related to groundwater abstraction versus level trends, wastewater treatment effectiveness, and monitoring coverage. The clustering of these indicators at the lower and upper ends of the Band of Equilibrium confirms the structural imbalance described above.

2.2.2 Agriculture and Irrigation: Pressure Without Regulation

The BoE results for agriculture show a system operating beyond sustainable resource limits, but without corresponding governance mechanisms.

Group Agriculture and Rural Development										
#	**Indicator**	**Unit**	**Baseline**	**BAU Value**	**Alternative Value**	**Sustainable Minimum**	**Sustainable Maximum**	**Current (2025)**	**BAU (2030)**	**2050 (Target)**
AR1	Agricultural Water Demand	Million Cubic Meters (MCM)/year	≈ 4.3 MCM/year	> 5.0 MCM/year	< 3.5 MCM/year	1.0 MCM/year	3.5 MCM/year	**6**	**7**	**5**
AR2	Efficient irrigation coverage	% of agricultural land	Low Efficiency ≈ 11-15% (Drip Irrigation)	< 15%	> 60%	50%	100%	**1**	**2**	**4**
AR3	Farmers applying Good Agricultural Practices – GAP	% of farmers	Nationally low and likely <10% in Damour; no basin-specific quantified baseline yet.	< 10%	> 50%	40%	100%	**2**	**3**	**4**
AR4	Irrigated land using polluted water	% of irrigated land	Significant. Due to water shortages and untreated sewage discharge, farmers in the lower basin often use polluted river water.	Increasing (>30%)	0%	0%	5%	**7**	**6**	**4**
AR5	Active Water User Associations – WUAs	# active	Few / Inactive. Management is largely individualistic	< 3 active	> 3 active	2	5	**2**	**2**	**4**
Indicator			**Current situation and BAU scenario in the Damour area**				**Recommendations - alternative scenario**			

AR1. Agricultural Water Demand	The current demand (≈ 4.3 MCM/year) puts a severe strain on water resources. It is crucial to note that high water use does not necessarily equate to high agricultural production. This demand is largely driven by the widespread cultivation of climate-vulnerable, high-water-demand crops (e.g., bananas, citrus) near the coast. The BAU scenario (BoE 7) predicts escalating water stress and aquifer depletion.	Interventions should not focus on restricting agricultural activity itself, but rather on **restricting high irrigation-demand crops**. The alternative scenario requires **shifting toward climate-resilient crops and adopting soil moisture retention techniques** (e.g., mulching, compost) and **ETc-based scheduling** to safely lower demand below 3.5 MCM/year.
AR2. Efficient irrigation coverage	Irrigation efficiency is critically low (11-15% drip irrigation), with over 50% of farmers still relying on heavily consumptive flood irrigation methods. In a BAU scenario (BoE 2), this will continue to drive massive water waste and agricultural runoff, exacerbating both water scarcity and soil erosion.	The alternative scenario requires a **massive transition from surface/flood irrigation to drip and micro-sprinkler systems**. **Financial incentives and technical support** must be provided to farmers to reach a sustainable minimum coverage of 50% across the Damour area.
AR3. Farmers applying Good Agricultural Practices (GAP)	Less than 10% of farmers currently apply GAP. Due to a lack of impartial agricultural guidance, farmers heavily rely on commercial pharmacies, prioritizing profit over environmental health through the excessive use of chemical fertilizers. The BAU trend shows continued poor practices (BoE 3).	It is necessary to **strengthen extension services and implement training programs focused on Integrated Pest Management (IPM), agro-ecology**, and the **development of nutrient management plans**. The target is to have over 50% of farmers adopting these sustainable practices.
AR4. Irrigated land using polluted water	Due to prolonged droughts, reduced river flow, and the failure of wastewater treatment plants, farmers in the lower basin frequently resort to using raw sewage or polluted river water for irrigation. The BAU scenario (BoE 6) points to escalating public health risks and soil contamination.	The use of polluted water must be strictly eliminated. The alternative scenario relies on the **rehabilitation of upstream WWTPs** to stop raw sewage discharge, combined with the **promotion of safe, treated wastewater reuse standards** and **on-farm runoff collection systems** (e.g., tailwater ponds).
AR5. Active Water User Associations (WUAs)	Agricultural water management in Damour is highly individualistic. WUAs are either non-existent or inactive, leading to conflicts over water allocation (especially between upstream and downstream users). The BAU scenario (BoE 2) leaves farmers fragmented and unable to maintain shared infrastructure.	Formalizing and **empowering local Water User Associations** is a critical governance response. Active WUAs will be essential to manage collective water allocations, resolve disputes, enforce pumping limits, and maintain efficient irrigation networks collaboratively.



Observed Pattern:

- Indicators related to water use intensity and abstraction tend toward BoE 6–7, reflecting overuse of water resources.
- Indicators related to institutional organization and efficiency (e.g. irrigation management, water user coordination) fall within BoE 2–3, indicating weak or emerging structures.

Interpretation:

The amoeba reflects this imbalance:

- outward extension in production and water use
- inward collapse in governance and efficiency

This confirms that agriculture is:

- not failing in productivity terms
- but operating in a structurally unsustainable manner

While the Damour area experiences **high agricultural water demand, this increased use does not necessarily equate to high agricultural production.** Rather, the high water consumption is largely driven by **inefficient traditional irrigation methods** and the **widespread cultivation of high-water-demand crops**. Therefore, priority measures should focus on the restriction of high irrigation-demand crops and the transition to water-saving technologies, but not on the restriction of agricultural activity, ensuring that interventions reflect no failing in farmer productivity. The narrative conclusion that **agriculture is a pressure amplifier rather than a root failure is consistent** with the BoE results. Interventions should therefore focus on **efficiency and governance, rather than restricting production alone.** The patterns described above are consistent with the indicator framework presented in Annex 3.2, particularly indicators on irrigation efficiency, agricultural water demand, and collective irrigation governance structures.

2.2.3 Environment and Ecosystems: Transitional Degradation

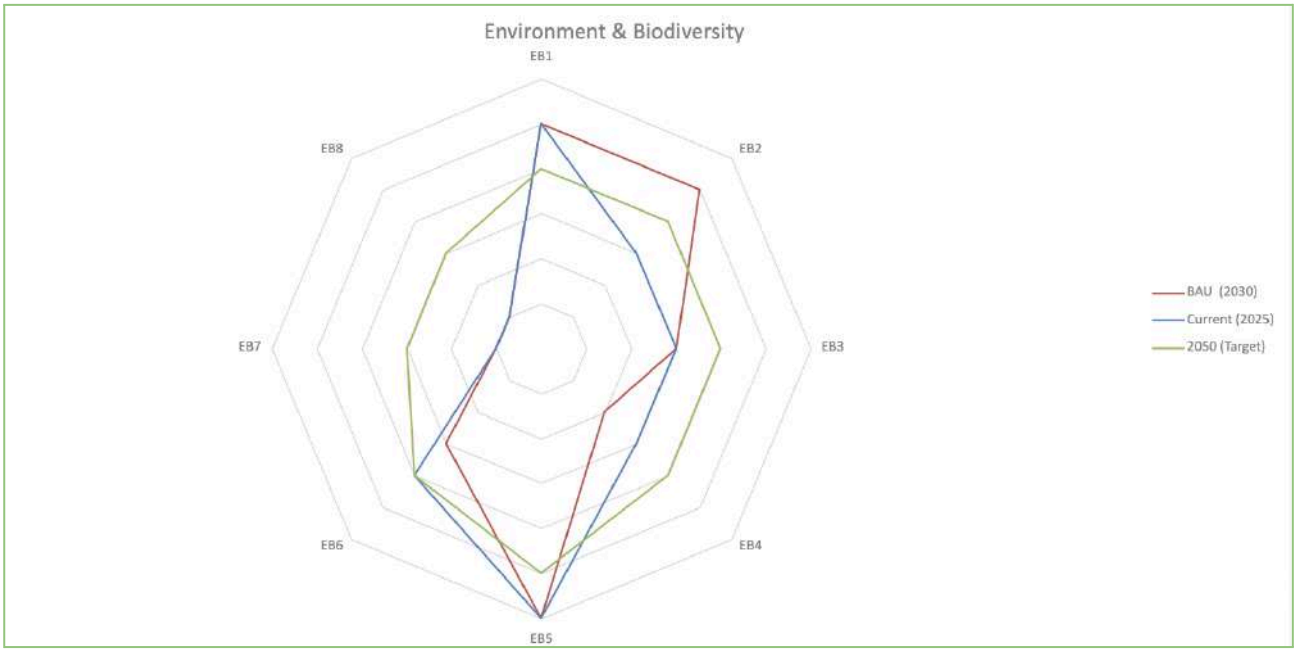
The BoE results for the environmental sector indicate a system that is under stress but not uniformly degraded.

Group Environment and Biodiversity										
#	**Indicator**	**Unit**	**Baseline**	**BAU Value**	**Alternative Value**	**Sustainable Minimum**	**Sustainable Maximum**	**Current (2025)**	**BAU (2030)**	**2050 (Target)**
EB1	Coastal Vulnerability Index (CVI)	Index Value	4.56 (Moderate Vulnerability).	> 5.0 (High)	< 4.0	0	4.5	**5**	**5**	**4**
EB2	Riparian, Coastal, and Forest Ecosystem Coverage under Protection	% of the Damour area	≈ 41.3% Wooded Cover	< 35%	> 45%	30%	50%	**5**	**3**	**4**
EB3	Species Conservation Status	Count	≈ 4-10 threatened species	> 12 species	< 4 species	0	4	**3**	**3**	**4**

EB4	Environmental flow compliance	m3/s	Critical Failure (Almost Dry) ≈ 0.85 m3/s (need to be 0.1-0.5 m³/s for aquatic life) - Current Value (August 2023): 0.005m3/s at Sea Mouth and 0.206 m3/s at the upstream flow ≈ 0.201 m3/s (97% of the flow) is extracted or lost	< 0.005 m3/s (Dry)	0.1 - 0.5 m3/s	0.1 m3/s	Natural Flow	**2**	**3**	**4**
EB5	Riverbank erosion	m/year	≈ 0.5 m/year (Historical Proxy)	> 0.8 m/year	< 0.2 m/year	0 m/year	0.3 m/year	**6**	**6**	**5**
EB6	Dumpsites rehabilitated	# of sites	7/13 rehabilitated (54%) Multiple informal dumps in riparian and hillside areas.	7/13 (Stagnant)	13/13 (100%)	10	13	**3**	**4**	**4**
EB7	Active weather monitoring stations	# stations	3 Stations (with data gaps or non-operational).	0 - 1 functional	> 5 fully operational	5	10	**1**	**1**	**3**
EB8	Area under fire prevention measures	% wooded area	Low Coverage (< 10%)	< 10%	> 50%	40%	100%	**1**	**1**	**3**

Indicator	**Current situation and BAU scenario in the Damour area**	**Recommendations - alternative scenario**
EB1. Coastal Vulnerability Index (CVI)	The Damour coast currently faces moderate vulnerability (4.56). Rapid urbanization and the loss of natural buffers are exacerbating coastal risks. The BAU scenario predicts increased erosion and higher vulnerability to climate-induced sea-level rise.	The alternative scenario requires enforcing **strict coastal setbacks, controlling sand extraction,** and **implementing nature-based coastal protection** to enhance resilience and lower the CVI below 4.0.
EB2. Riparian, Coastal, and Forest Ecosystem Coverage under Protection	Currently, about 41.3% of the area has wooded cover. However, focusing solely on "forest" protection is highly misleading. Riparian and coastal habitats, as well as Groundwater-Dependent Ecosystems (GDEs), are far more critical in this area and are under severe pressure from haphazard urban sprawl. The BAU scenario points to continued habitat fragmentation.	Conservation efforts must be expanded to explicitly **include riparian buffer zones and coastal wetlands**. The alternative scenario requires **legally enforcing the protection** of these critical habitats (e.g., enforcing **MoE Decision 129/1**) to halt the degradation of the river ecosystem.
EB3. Species Conservation Status	There are currently 4-10 threatened species, but citing this number in isolation is misleading without directly linking it to their habitat degradation. The loss of aquatic and terrestrial species is a direct symptom of drying rivers and pollution. The BAU trend shows a worsening conservation status.	To achieve the target, interventions must focus on **holistic habitat restoration**—particularly restoring **environmental flows** and **halting pollution**—which will naturally allow species populations to recover and be removed from the threatened list.
EB4. Environmental flow compliance	The river flow is critically failing. During the dry season (August 2023), flow at the sea mouth plummeted to 0.005 m3/s, meaning 97% of the flow is extracted or lost before reaching the sea, leaving only a trickle. In a	It is an absolute priority to define and enforce a **mandatory environmental flow (0.1 to 0.5 m³/s)**. The alternative scenario requires **strict caps on upstream abstraction** (especially

	BAU scenario, the lower basin will completely dry up, destroying aquatic life and submarine springs.	during August-October) and **removing illegal water traps** and diversions to restore connectivity to the estuary.
EB5. Riverbank erosion	Riverbank erosion is significant (≈ 0.5 m/year), driven by extreme rainfall events and aggravated by human activities such as drifting tracks and illegal construction on the banks. The BAU trend (BoE 6) predicts severe land loss and increased sedimentation in the river.	The alternative scenario requires the implementation of **Nature-based Solutions (NbS)** for riverbank stabilization, alongside **strict penalization** and removal of land-use violations (e.g., concrete restaurants encroaching on the river).
EB6. Dumpsites rehabilitated	While 7 out of 13 identified dumpsites have been rehabilitated, multiple informal dumps remain active in riparian and hillside areas. In a BAU scenario, these sites will continue to leach heavy metals and pollutants into the Damour Priority Coastal Aquifer and the river.	The alternative scenario requires the **immediate closure and rehabilitation of all remaining informal dumpsites**, coupled with the **establishment of robust, basin-wide municipal solid waste management strategies.**
EB7. Active weather monitoring stations	The area suffers from a severe lack of hydrometeorological data. The 3 existing stations are either non-operational or suffer from massive data gaps. The BAU scenario (BoE 1) leaves decision-makers "blind" to climate risks, recharge rates, and actual water balances.	Upgrading and expanding the **climate and groundwater monitoring network** is a fundamental prerequisite for the IMP. The alternative scenario requires at least **5 fully operational stations integrated into a unified data-sharing platform.**
EB8. Area under fire prevention measures	Fire prevention coverage is dangerously low (< 10%). The upper catchments, which are vital for aquifer recharge and soil stability, are highly vulnerable. The BAU scenario leaves the forested areas at immense risk of destruction.	The alternative scenario requires the deployment of **early-warning systems and community-based fire prevention management plans** to cover at least 40% of the wooded areas, especially within the Shouf Biosphere Reserve buffer zones.



Observed Pattern:

- Some indicators (e.g. ecosystem condition, biodiversity proxies) remain within BoE 3–4, suggesting partial functionality.
- Other indicators (e.g. pollution levels, riverbank degradation, lack of environmental flow regulation) approach BoE 5–6, indicating increasing pressure.

Interpretation:

The amoeba diagram reflects:

- an uneven and transitional structure
- with certain components still within acceptable ranges
- while others are deteriorating

This confirms that environmental degradation is:

- ongoing but not yet irreversible

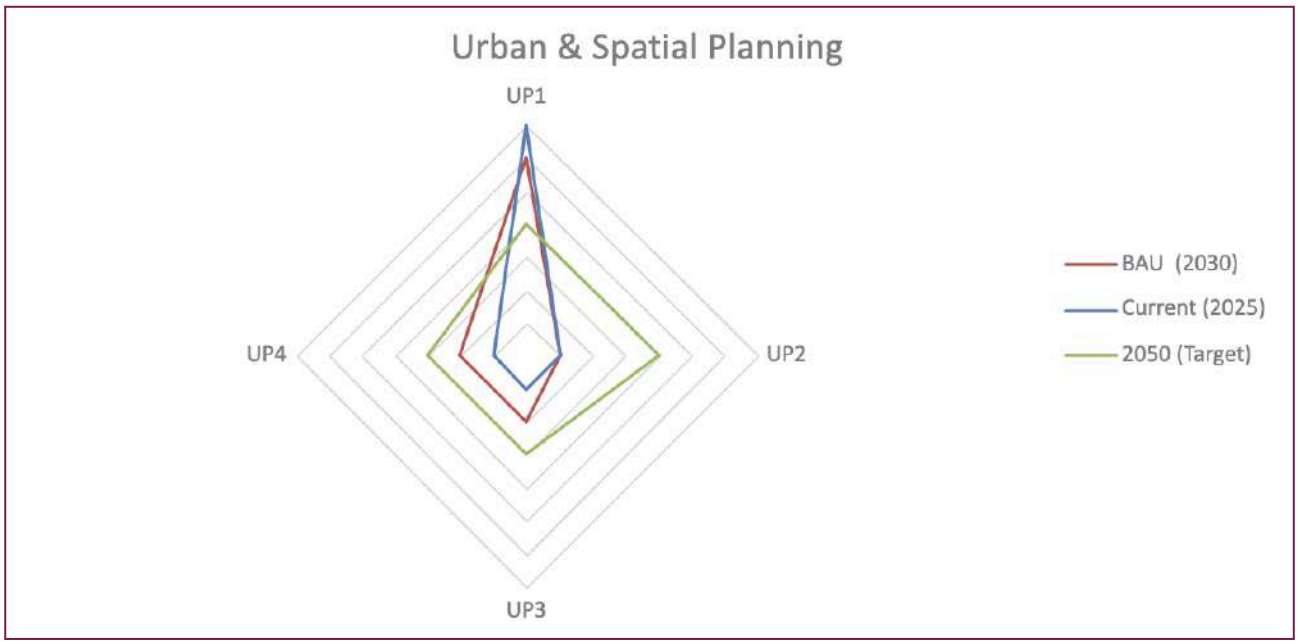
This supports the interpretation that the environmental sector requires p**reventive and stabilizing interventions, rather than full restoration**. The **absence of environmental flow monitoring is particularly critical and should be addressed as a priority.** These trends are reflected in the environmental indicator set (Annex 3.3), especially indicators related to environmental flow compliance, riverbank condition, and ecosystem protection status.

2.2.4 Urban Planning and Governance: Structural Incoherence and Unregulated Expansion

The BoE scoring for urban planning and governance presents a highly heterogeneous pattern, reflecting severe inconsistencies between theoretical planning frameworks and actual implementation capacity on the ground.

Group Urban Planning and Governance										
#	**Indicator**	**Unit**	**Baseline**	**BAU Value**	**Alternative Value**	**Sustainable Minimum**	**Sustainable Maximum**	**Current (2025)**	**BAU (2030)**	**2050 (Target)**
UP1	Urban expansion in riparian zones	% or ha/year	High Pressure - 200,7 ha lost (2014-2024) ≈ -20,1 ha/year - Artificial areas cover 24% (121 km²) of the total territory (500 km²)	> 25 ha/year lost	< 5 ha/year lost	0 ha/year lost	10 ha/year lost	**6**	**7**	**4**
UP2	Citizen participation in monitoring and stewardship	qualitative or Composite Score	Low or ad hoc participation. Score ≈1/5	Score 1/5 (Stagnant)	Score > 4/5	Score 3/5	Score 5/5	**1**	**1**	**4**
UP3	Alignment of municipal master plans with basin water management objectives	qualitative	Fragmented / Outdated. Zoning often conflicts with river buffer zones; enforcement is weak, leading to "haphazard" development	Low / No Alignment	Full Alignment	Moderate Alignment	Full Alignment	**2**	**1**	**3**
UP4	Enforcement actions on land-use violations	#/year	Low / Reactive. Violations (e.g., riverbank restaurants, drifting tracks) are visible but rarely penalized.	Low / Reactive	Proactive & Systematic	Consistent Penalization	Zero Violations	**2**	**1**	**3**
Indicator			**Current situation and BAU scenario in the Damour area**				**Recommendations - alternative scenario**			

UP1. Urban expansion in riparian zones	Currently, artificial areas cover 24% of the total territory, creating massive impermeable surfaces that reduce infiltration and increase surface runoff. The area has lost over 200 hectares of riparian zones in the last decade (≈ -20.1 ha/year) due to haphazard urban sprawl. The BAU scenario predicts extreme unsustainability by excess (BoE 7), exacerbating flood risks and the depletion of the coastal aquifer.	The alternative scenario requires **enforcing strict zoning regulations** to prevent any further encroachment of built-up areas. It is crucial to enforce existing legal frameworks, such as **MoE Decision 129/1**, to protect and rehabilitate riparian habitats and restrict urban expansion within river buffer zones.
UP2. Citizen participation in monitoring and stewardship	Citizen participation in environmental stewardship is currently exceptionally low or ad hoc (BoE 1). The BAU trend shows a persistent lack of community engagement, which threatens the long-term sustainability of any management initiative and leads to stakeholder apathy	To reach the alternative target, local community committees with diverse expertise must be established to enhance accountability and oversight. **Promoting citizen science and establishing local observatories** will foster local ownership and ensure continuous, transparent monitoring.
UP3. Alignment of municipal master plans with basin water management objectives	Municipal master plans are largely fragmented and outdated, with zoning often directly conflicting with river buffer zones and natural habitats. In a BAU scenario (BoE 1), this structural incoherence will allow haphazard development to continue degrading the basin.	The alternative scenario demands the formal adoption of the **Damour Area Charter to translate the shared vision into a binding regulatory framework.** This will ensure strict alignment between local municipal master plans and basin-wide integrated water and coastal management objectives.
UP4. Enforcement actions on land-use violations	Enforcement actions are currently critically low and reactive, largely due to institutional fragmentation. Visible violations—such as concrete riverbank restaurants, drifting tracks, and illegal wells—are rarely penalized. The BAU scenario assumes a total lack of regulatory control (BoE 1).	The alternative scenario requires the establishment of a **formal cross-sectoral coordination committee** to oversee IMP implementation and empower municipalities to enforce regulations. This includes proactive inspections and the strict penalization and removal of illegal constructions encroaching on the river



Observed Pattern

- Indicators related to urban expansion and artificialization (e.g., UP1) tend to fall within BoE 6–7, indicating severe unsustainability by excess. The Damour area is experiencing rapid land artificialization.

- Conversely, indicators related to enforcement, coordination, and institutional effectiveness (UP3, UP4) fall within BoE 1–2, indicating an almost total absence of regulatory control (unsustainability by default).

Interpretation

The amoeba diagram is therefore highly irregular:

- moderate to low performance in formal planning and citizen participation;
- critical weakness in enforcement and cross-sectoral coordination;
- excessive pressure from unregulated urban expansion and artificialization.

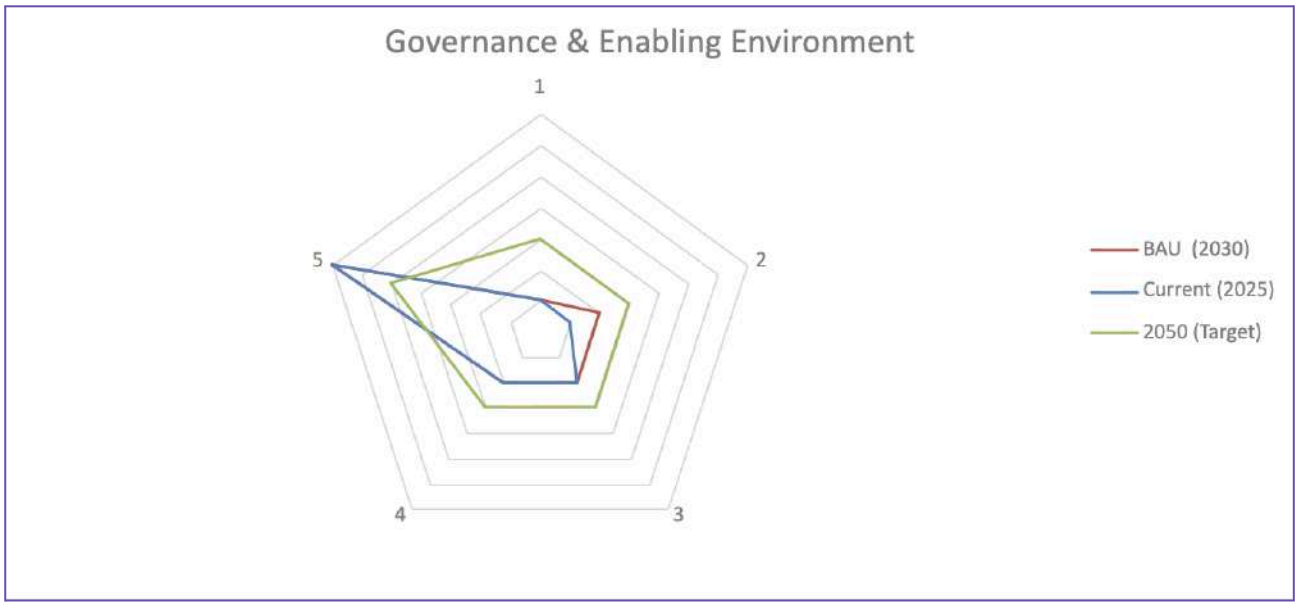
This confirms the presence of a massive **"implementation gap"**—a governance failure rather than just a policy gap. As highlighted by the Damour Diagnostic Analysis, haphazard urban sprawl is directly encroaching on riparian zones (with over 200 hectares lost in the last decade) and critical coastal aquifer recharge areas. Artificial areas now cover 24% of the total territory, increasing surface runoff and severely reducing the infiltration capacity needed to replenish the Damour Priority Coastal Aquifer. Furthermore, municipal master plans are outdated and zoning often directly conflicts with river buffer zones. Land-use violations—such as concrete riverbank restaurants, illegal wells, and drifting tracks—remain highly visible but are rarely penalized. Therefore, establishing a unified Basin Charter and a cross-sectoral enforcement committee is an absolute prerequisite to halting the artificialization of the Damour area's natural and agricultural landscapes.

2.2.5 Governance: Structural Incoherence

The BoE scoring for governance presents a highly heterogeneous pattern, reflecting inconsistencies between planning frameworks and implementation capacity.

Group Cross-Cutting Coordination for the Damour Area Governance										
#	**Indicator**	**Unit**	**Baseline**	**BAU Value**	**Alternative Value**	**Sustainable Minimum**	**Sustainable Maximum**	**Current (2025)**	**BAU (2030)**	**2050 (Target)**
GO1	River Basin Charter / IMP	Status	Draft/Pending	Pending / Stalled	Legally Adopted & Implemented	Formally Adopted	Fully Enforced	**1**	**1**	**3**
GO2	Damour area water management model	Status	No / Concept	No Model / Uncalibrated	Fully Operational DSS	Basic Water Balance	Advanced DSS & Numerical Model	**2**	**1**	**3**
GO3	Water quality and quantity awareness / monitoring campaigns	#/year	Sporadic and project-based campaigns.	Sporadic (<1/year)	Continuous (>4/year)	2/year	Continuous Monitoring	**2**	**2**	**3**
GO4	Basin-wide mapping completeness	% coverage	Partial and fragmented mapping.	< 50% Coverage	> 90% Coverage	70% Coverage	100% Coverage	**2**	**2**	**3**
GO5	Recreational Use Intensity	# visitors or # establishments	High Pressure / Unregulated.	Severe Overcrowding	Regulated Capacity	Controlled Setbacks	Ecological Carrying Capacity	**7**	**7**	**5**
Indicator			**Current situation and BAU scenario in the Damour area**				**Recommendations - alternative scenario**			
GO1. River Basin Charter / IMP			The Integrated Management Plan (IMP) and the River Basin Charter are currently only in the draft/pending stage. In a Business-As-Usual (BAU) scenario, this lack of a formalized agreement leads to a severe "implementation gap" (BoE 1), where governance remains highly fragmented and theoretical plans fail to translate into binding actions on the ground.				The alternative scenario requires the formal adoption and legal implementation of the Damour Area Charter. This charter must serve as a **binding commitment for municipalities and national institutions,** supported by the creation of a **permanent Cross-Sectoral**			

		Coordination Committee under the General Directorate of Hydraulic and Electrical Resources (GDHER) - MoEW to oversee enforcement.
GO2. Damour area water management model	Currently, there is no fully operational water management or accounting model for the area. Decision-makers operate blindly due to a lack of abstraction data and poor monitoring. BAU predicts continued reliance on outdated estimates and guesswork (BoE 1), exacerbating aquifer depletion and seawater intrusion.	The alternative scenario demands the **development, calibration, and periodic updating of a basin-scale numerical model and Decision Support System (DSS)**. This tool is essential to accurately simulate groundwater recharge, set sustainable abstraction quotas, and model climate change scenarios.
GO3. Water quality and quantity awareness / monitoring campaigns	Awareness and monitoring campaigns are currently sporadic and heavily reliant on short-term external projects. In a BAU scenario (BoE 2), stakeholder apathy persists, limiting local compliance and community stewardship over shared water resources and ecosystems.	The target scenario relies on **organizing recurrent, institutionalized campaigns focused on pollution, scarcity, and conservation**. Promoting **citizen science** and **establishing community-based observatories** will integrate the local population into continuous and transparent monitoring efforts.
GO4. Basin-wide mapping completeness	Spatial data regarding riparian buffer zones, land-use, and aquifer recharge areas is highly partial and fragmented. The BAU trend (BoE 2) points to continued haphazard development, as authorities are unable to protect ecological boundaries they have not clearly delineated.	The alternative scenario requires **completing a comprehensive multi-thematic mapping of the basin** (including Groundwater-Dependent Ecosystems, hydrogeology, and risk zones). This data must be **kept up-to-date and integrated into a unified digital geospatial platform (**like MapX) to **inform local municipal master plans.**
GO5. Recreational Use Intensity	Recreational use along the river and coastal zones (e.g., riverbank restaurants, resorts) is operating under high pressure and is largely unregulated. The BAU scenario points to extreme unsustainability by excess (BoE 7), causing severe localized pollution, habitat destruction, and riverbank erosion.	The alternative scenario requires the implementation of **sustainable tourism guidelines** and the strict enforcement of environmental protection laws (such as MoE Decision 129/1). A **permit system** must be established to cap visitor capacity within ecological limits and ensure mandatory wastewater treatment for all recreational facilities.



Observed Pattern

- Indicators related to policy frameworks and planning tools tend to fall within BoE 3–4, indicating the existence of formal structures.
- Indicators related to enforcement, coordination, and institutional effectiveness fall within BoE 1–2, indicating weak implementation.

Interpretation

The amoeba diagram is therefore highly irregular:

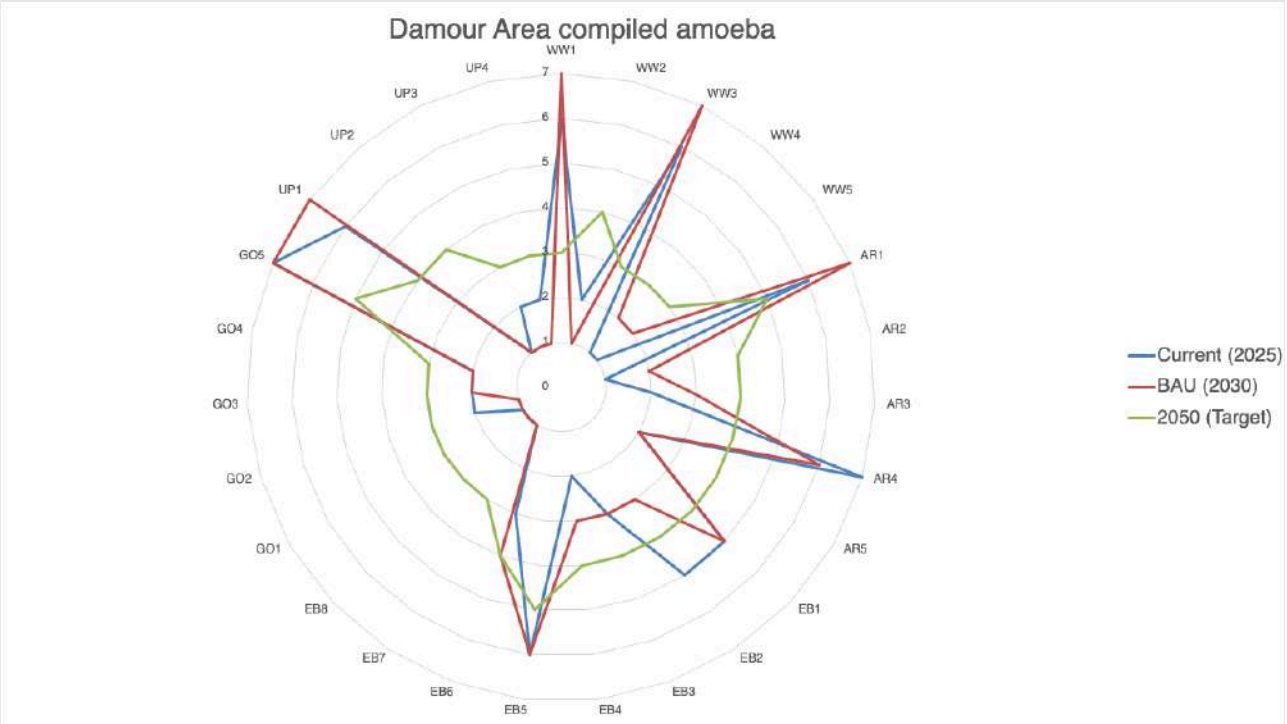
- moderate performance in formal planning
- critical weakness in enforcement and coordination

This confirms the presence of a governance gap, rather than a policy gap.

The identification of governance as the central system constraint is directly supported by the BoE results. Strengthening enforcement and coordination mechanisms is therefore a prerequisite for effective sectoral interventions. The governance-related weaknesses identified in this section are further captured through the indicators presented in Annex 3.4 and Annex 3.5, particularly those addressing enforcement, coordination mechanisms, and alignment of planning frameworks.

2.2.6 Cross-Sectoral Analysis: System-Level Patterns

Figure 1. Compiled Amoeba diagrams for Damour Area



When BoE results are considered across all sectors, several consistent patterns emerge.

- **Polarization at the Extremes (Dual Unsustainability)**

  A striking feature of the chart is the clustering of values at both ends of the BoE scale:

  - Low values (1–2) appear frequently, indicating **system failure**, weak capacity, or **absence** of functioning structures in several indicators.
  - High values (6–7) are also common, reflecting **overexploitation, stress, or unsustainable pressure** on resources and systems.

This polarization confirms a pattern of dual unsustainability: the system is not simply underperforming—it is **simultaneously underdeveloped in some areas and overstretched in others**. This creates instability and **reduces overall system resilience.**

- **Lack of Convergence Toward Sustainability Range**

  Relatively few indicators fall consistently within the BoE 3–5 range, which represents the sustainable operating space.

  This indicates that:

  - The system is not gradually approaching sustainability
  - but rather operating outside acceptable thresholds

- **Strong Sectoral Imbalances and Fragmentation**

  The irregular, **"spiky" shape** of the amoeba highlights significant disparities between indicators within the same sector:

  - Some dimensions show high performance while adjacent ones lag severely.
  - This lack of internal consistency indicates that progress is uneven and uncoordinated.

  In practical terms:

  - **Gains in one area are not reinforced by complementary improvements elsewhere.**
  - The system behaves in a fragmented manner, **limiting the effectiveness of isolated interventions.**

- **Governance as a Systemic Bottleneck**

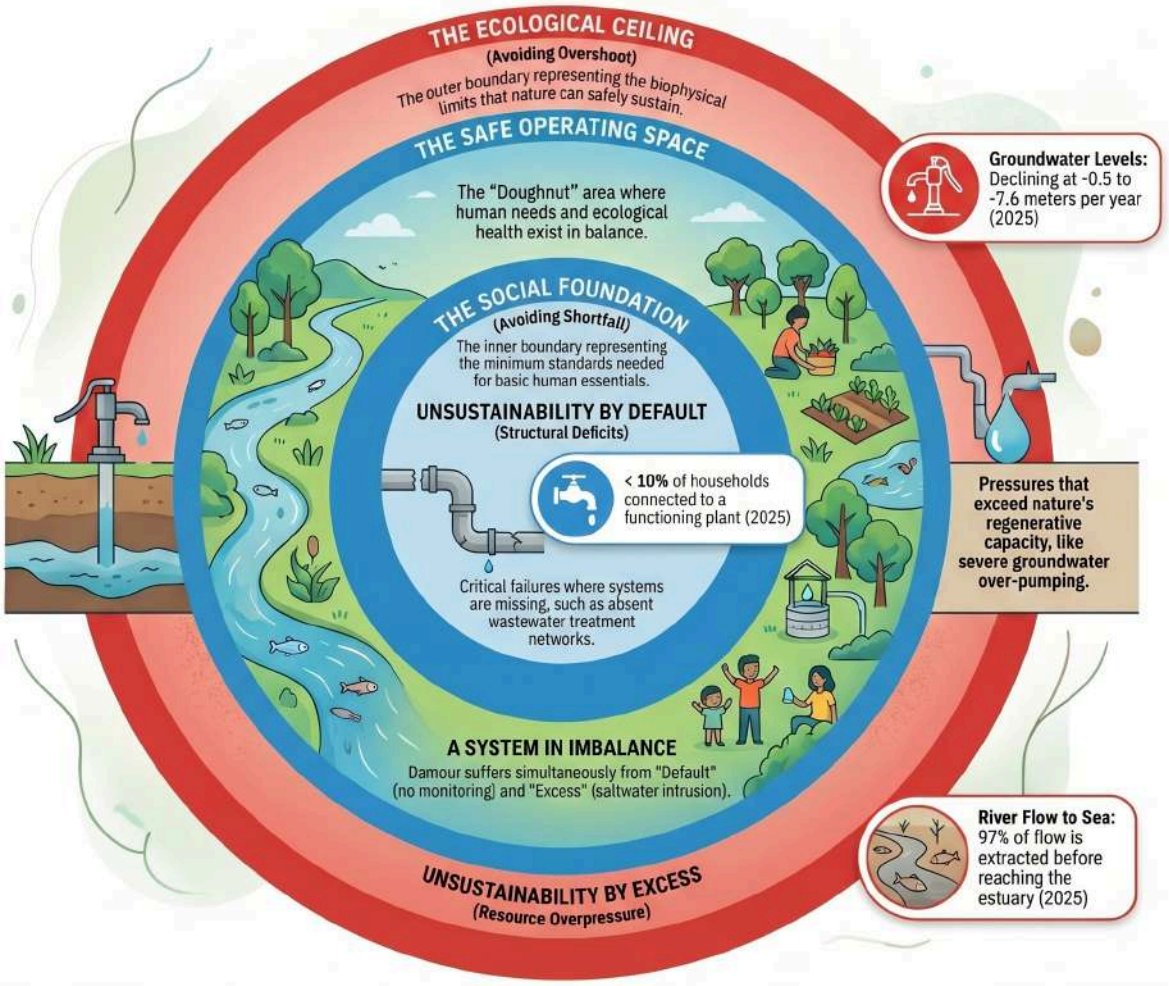
  Across all sectors, governance-related indicators consistently show lower BoE values, reinforcing their role as a system-wide constraint.

  - This points to **institutional weakness, limited coordination, or insufficient regulatory capacity.**
  - Even where technical or sectoral improvements exist, weak governance acts as a **cross-cutting constraint,** preventing systemic alignment and scaling.

  This pattern suggests that governance is not just another sector—it is a foundational enabler, and its weakness undermines progress across all other domains.

The distribution of indicators across the Band of Equilibrium, as presented in Annexes 3.1 to 3.5, confirms the concentration of values at both extremes of the scale and the limited presence of indicators within the sustainable range.

Figure 2. Damour Area Sustainability Model[1]



2.2.7 Narrative Scenarios: Envisioning the Damour Area in 2050

- **The Cost of Inaction (Business-as-Usual Scenario)**: Imagine standing near the Damour estuary in the late summer of 2050 under the Business-as-Usual scenario. The riverbed is nearly completely dry, its natural flow reduced to a polluted trickle largely composed of raw, untreated sewage from failing, power-starved infrastructure. The once-thriving green riparian buffers have been swallowed by haphazard concrete sprawl, illegal drifting tracks, and informal dumpsites that leach toxins into the soil. Underground, the invisible crisis is equally dire: decades of unmetered, unregulated pumping have exhausted the coastal aquifer, pulling the sea inland until the groundwater is simply too salty for families to drink or farmers to use. With no unified governance or active Water User Associations, farmers are left isolated, struggling to keep high-water-demand crops alive using contaminated river water, creating severe public health risks. It is a landscape defined by a tragedy of the commons—where fragmented governance, unchecked extraction, and stakeholder apathy have completely eroded the ecosystem's capacity to sustain both nature and local livelihoods.
- **A Rebalanced System (Sustainable Alternative Scenario)**: Now, envision an alternative 2050, shaped by the firm implementation of the IMP. The river flows vibrantly all year round to the estuary, safeguarded by a strictly enforced environmental flow that sustains aquatic life and submarine springs. The riverbanks are restored, vibrant green corridors stabilized by Nature-based Solutions, free from concrete encroachments and monitored proudly by

[1] Please note that this model has been created using an AI.

engaged local citizen observatories. Upstream, solar-powered wastewater treatment plants operate efficiently, ensuring that no raw sewage enters the environment while providing farmers with a safe, alternative source of irrigation. Supported by active cooperatives, these farmers have transitioned to smart drip irrigation and climate-resilient crops, drastically reducing water waste. In this future, the Damour area is no longer a collection of competing municipalities, but a resilient, interconnected basin where coordinated governance, strict well licensing, and active community stewardship have successfully brought human development back into a safe operating space, in harmony with the environment's natural limits.

Figure 3. The Damour River estuary in 2050: on the left, unchecked urban sprawl and ecological collapse; on the right, restoration, resilience, and a thriving balance between nature and people[2].

2.3 Implications for Implementation Strategy

Across thematic groups, several key messages emerged.

In the **water** sector, discussions consistently pointed to a system under stress, where over-abstraction, insufficient monitoring, and underperforming wastewater infrastructure combine to push conditions beyond acceptable limits. Drawing on recent UNESCO hydrogeological assessments, participants highlighted the critical threats of **irreversible seawater intrusion and coastal aquifer depletion.** Furthermore, establishing an accurate baseline is hindered by significant data gaps, including missing or inaccurate meteorological data (where available, it is full of gaps and inaccuracies). Governance fragmentation severely exacerbates these issues; for instance, the jurisdiction of water authorities often follows governorate boundaries that do not perfectly align with the hydrological system. However, it was noted that public water and wastewater projects are planned and implemented at the level of the Beirut Mount Lebanon Water Establishment (EBML), which oversees the whole area. Participants agreed that priority should be given to **improving monitoring systems, advancing the conjunctive management of surface water and groundwater, and ensuring the operation and maintenance of existing infrastructure,** rather than focusing solely on new investments.

Regarding **agriculture** and irrigation, stakeholders clarified important nuances surrounding water demand. High agricultural water use in the Damour Area does not necessarily equate to high agricultural production; rather, it is largely driven by **inefficient traditional irrigation methods** and **the widespread cultivation of high-water-demand crops**. Consequently, the indicators reflect no direct link to farmer productivity itself, but more the water efficiency of agricultural methods used. Proposed management interventions must therefore focus on the r**estriction of high-irrigation-demand crops**, the transition

[2] Please note that these pictures have been created using an AI.

to **water-saving technologies** and the use of **nature-based solutions**, ensuring that the agricultural activity itself is preserved and optimized.

Governance issues emerged as a central theme throughout the workshop. Stakeholders underscored that fixing the **policy gap alone is not sufficient;** the **implementation gap is equally critical.** Participants emphasized that improving governance—through stronger enforcement, better alignment of municipal plans, Public-Public cooperation, and enhanced coordination—was essential to achieving sustainable outcomes. The lack of operational systems in the area often leads the general population to resort to unmoderated or inefficient practices that further reduce the availability of resources. Public–public partnerships (such as cross-sectoral and inter-municipal coordination committees) between municipalities and national institutions were seen as particularly important, alongside greater involvement of civil society in monitoring and awareness efforts, notably through Citizen Science initiatives to foster local ownership.

Regarding **urban planning and development**, stakeholders emphasized the critical threat of **haphazard urban sprawl and rapid land artificialization**. With artificial areas now covering 24% of the territory and directly encroaching on riparian zones (over 200 hectares lost in the last decade) and vital coastal aquifer recharge areas, the lack of enforced zoning is exacerbating both water scarcity and flooding risks. **Municipal master plans are frequently outdated, fragmented, or conflict directly with basin-level water management objectives**. Consequently, an effective implementation strategy must prioritize the **strict enforcement of land-use regulations, the alignment of municipal zoning with the basin's ecological boundaries,** and **the proactive penalization of land-use violations** (such as illegal riverbank constructions and drifting tracks) to halt further environmental degradation

Environmental considerations further reinforced this perspective. The system is currently experiencing a transitional degradation towards **unsustainability**. While some ecosystem indicators currently score a 3-4 on the BoE, this indicates only a partial or fragile functionality that remains highly vulnerable to pressures, as a score of 3 represents the absolute minimum acceptable threshold. Participants stressed that **citing the presence of 4-10 threatened species is misleading if not directly linked to the degradation of their specific habitat status**. Furthermore, conservation efforts must expand beyond mere forest protection to prioritize the area's most critical habitats. As emphasized by UNESCO's recent findings, **safeguarding Groundwater-Dependent Ecosystems (GDEs), such as riparian zones and submarine groundwater discharges (SGD),** is vital.

In particular, participants highlighted the critical need for the **conjunctive management of surface water and groundwater to safeguard the Damour Priority Coastal Aquifer and its dependent ecosystems (GDEs) against severe over-extraction and seawater intrusion.** Addressing existing governance shortfalls, it was noted that fixing policy gaps alone is insufficient; a holistic approach must also tackle infrastructural and operational deficits. The lack of operational systems in the Damour Area often forces the local population to resort to unmoderated or inefficient practices, further reducing the availability of vital resources. Furthermore, evidence-based decision-making requires addressing the severe scarcity of meteorological data, which, where available, remains full of gaps and inaccuracies. Participants stressed that public water and wastewater projects must be coordinated more effectively. While the Establishment of the Beirut and Mount Lebanon Water Establishment (EBML) oversees the entire area, overlapping mandates across governorate boundaries and institutional fragmentation continue to hinder integrated management. Participants highlighted the importance of managing natural resources in a way that ensures their continued accessibility and renewal, rather than focusing solely on short-term gains. The degradation of riverbanks, the reduction of environmental flows, and the accumulation of pollution were seen as direct consequences of both technical and governance failures. **Restoring ecological connectivity** will require integrating **Nature-based Solutions (NbS)** and **Ecosystem-based Adaptation (EbA)**—key pillars of the Plan Bleu's strategy. Finally, to **bridge the implementation gap and attract future funding**, participants concluded that these proposed alternative measures must be systematically filtered through **Multi-Criteria Analysis (MCA)** and **Cost-Benefit Analysis (CBA)** to ensure they are both **ecologically restorative and financially viable.**

Building on these discussions, participants identified a set of priority actions that reflect both immediate needs and longer-term objectives. In line with the Plan Bleu activities, this reflects an **important paradigm shift from purely scientific monitoring to "observation for investment"**. These include in the context of the Damour area, **strengthening water monitoring systems** (particularly for tracking the freshwater-saltwater interface and early signs of seawater intrusion, as highlighted by UNESCO and the Coastal Aquifer Management Plan (CAMP)), **regulating groundwater abstraction** through strict well licensing and metering, **rehabilitating wastewater infrastructure, improving solid waste management, protecting riverbanks and Groundwater-Dependent Ecosystems (GDEs), promoting sustainable agricultural practices,** and **developing alternative water sources** such as hill lakes and Managed Aquifer Recharge (MAR) systems to mitigate groundwater depletion and seawater intrusion. Equally important were actions aimed at **improving governance**, including **enhancing coordination, transparency, and citizen engagement**. As proposed by the UNESCO CAMP, a **permanent Cross-Sectoral Coordination Committee** should be established under the General Directorate of Hydraulic and Electrical Resources (GDHER–MoEW). This committee will coordinate IMP implementation, monitoring, and enforcement across sectors, because

addressing policy gaps without an institutional enforcement mechanism is insufficient. Finally, to successfully bridge the aforementioned "implementation gap," participants concluded that these proposed priority measures must be structured into bankable project pipelines ready to attract blended finance and private capital using Cost-Benefit Analysis (CBA) and Multi-Criteria Analysis (MCA) as financial reality checks. This will ensure that the final Integrated Management Plan does not remain on the shelf, but becomes a legally binding and financially viable tool for climate resilience.

2.4 Final Statement on Validation

The alignment between narrative analysis and BoE results leads to several practical conclusions:

- interventions must address **both structural deficiencies and excess pressures**
- sectoral actions must be coordinated through **governance mechanisms**
- monitoring systems must be developed to move indicators from Tier 2–3 toward Tier 1
- prioritization should focus on sectors with the highest concentration of extreme BoE values

The BoE scoring and Amoeba diagrams developed during Workshop 3 provide strong validation of the analytical findings presented in this report. The consistency between stakeholder-derived scores, visual patterns (amoebas), and narrative interpretation demonstrates that the Climagine process has successfully translated complex system dynamics into a coherent and evidence-based framework for decision-making.ce.

2.5 Gender Inclusiveness at the Third Climagine Workshop

Building on the MedProgramme Gender Mainstreaming Strategy previously applied in earlier stages, the third Damour Climagine workshop continued to foster an inclusive environment, bringing together 49 participants and speakers from a wide range of sectors, including government ministries (Energy and Water, Agriculture, Public Works and Transport, Environment, Industry), local authorities (Damour Municipality and other municipalities), academic and research institutions (University of Balamand, CNRS, LARI, etc.), United Nations agencies (UNESCO, UNICEF, UN/ESCWA, GWP-Med, PAP/RAC, Plan Bleu), consulting firms, NGOs, and civil society. Among the participants, both women and men held technical, decision-making, and facilitation roles, with women serving as directors, researchers, engineers, project coordinators, hydrologists, and sector experts, including key figures such as Dr. Manal Nader (Director, Marine and Coastal Resources Program, University of Balamand), Tracy Zarour (Hydrologist, UN/ESCWA), and Dr. Youssra Ghoussein (Researcher, CNRS)

Gender Statistics for the Damour Climagine Workshop

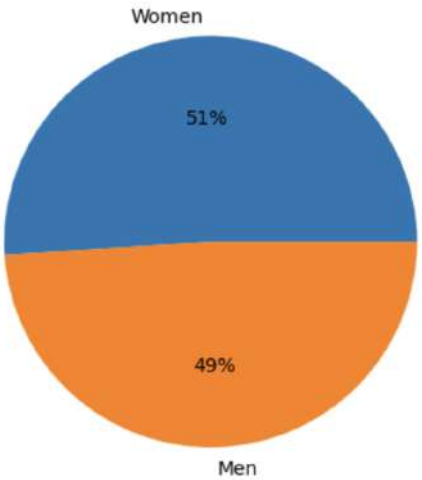
Total number of participants with identified gender: 49

- Women : 25
- Men : 24

Percentage of women: 51%

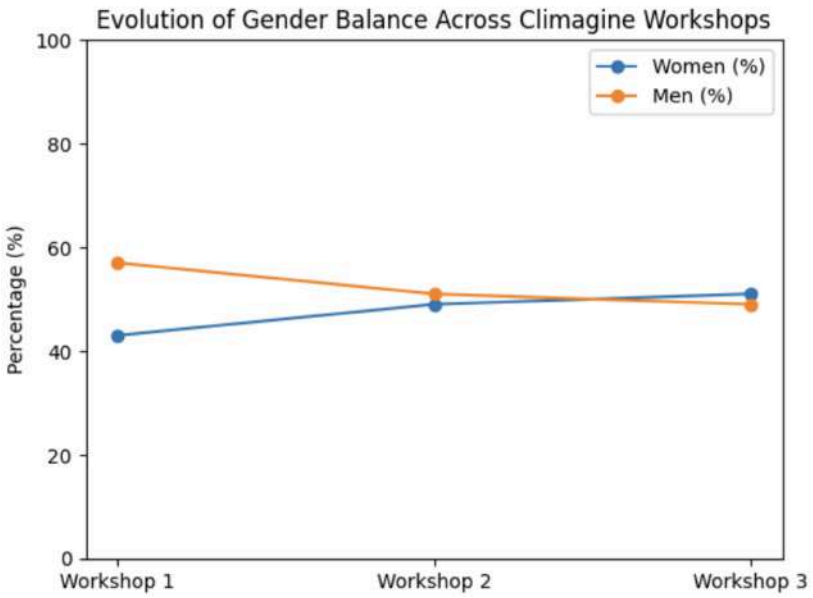
Percentage of men: 49%

Figure 4. Gender Distribution of Participants for the Third IMP Damour Climagine Workshop



This represents positive evolution in gender balance across the Climagine series: the first workshop (July 2025) had 47 participants (43% women, 57% men), the second (51 participants, 49% women, 51% men), and now the third achieving near parity at 51% women.

Figure 5. Evolution in Gender Balance across the Climagine Series



Gender was also addressed as a **cross-cutting theme** throughout the workshop, both in plenary discussions and within the thematic group work. Discussions nevertheless highlighted persistent challenges, particularly the **lack of sex-disaggregated data** and the **limited integration of gender indicators** in the water, agriculture, environment, and governance sectors. This lack of gender-specific data, combined with limited awareness of the gender-differentiated impacts of environmental management and climate change, underscores the need for targeted efforts in future data collection, capacity building, and awareness-raising activities under the programme.

3. Conclusion and Next Steps

3.1 Main Outcomes

3.1.1 Framing the Damour System: From Diagnosis to Operational Insight

The Climagine process applied to the Damour Integrated Management Plan (IMP) provides a comprehensive and structured understanding of the Damour Area as a coupled environmental, hydrological, and governance system. The three workshops did not function as isolated exercises, but rather as **successive layers of analysis, each refining and operationalizing the findings of the previous stage.**

Workshop 1 established the baseline diagnosis, identifying a system under pressure from multiple and interacting drivers: water scarcity, groundwater depletion, infrastructure inefficiencies, environmental degradation, and governance fragmentation. Workshop 2 translated these pressures into a structured set of indicators, making explicit the key variables through which system performance can be assessed. Workshop 3, through the application of the Band of Equilibrium and the development of Amoeba diagrams, enabled a transition from descriptive understanding to analytical and decision-oriented interpretation.

Taken together, these stages reveal that the **Damour system is not characterized by a single dominant failure, but rather by a layered and interdependent set of dysfunctions, in which technical, environmental, and institutional factors reinforce one another.**

3.1.2 The Nature of Unsustainability: Dual Dynamics of Deficit and Excess

A central insight emerging from the Climagine workshop 3 analysis is the coexistence of two distinct but interconnected forms of unsustainability within the Damour system:

- On one hand, several indicators fall within the range of **unsustainability by default, reflecting the absence, failure, or non-functionality of essential systems**. This is particularly evident in the **wastewater** sector, where the widespread reliance on cesspits and the lack of operational treatment infrastructure indicate a structural deficiency in basic service provision. Similarly, the absence of monitoring systems for water flows, groundwater abstraction, and environmental conditions reflects an institutional inability to observe and manage system dynamics.
- On the other hand, a number of indicators fall within the range of **unsustainability by excess, reflecting pressures that exceed the carrying capacity of the system. Groundwater** abstraction is the most critical example, with evidence of significant depletion and deepening of wells. **Agricultural water use**, combined with inefficient irrigation practices, further contributes to this dynamic. In environmental terms, pollution loads and ecosystem degradation represent additional forms of excess pressure.

What distinguishes the Damour case is not simply the presence of these two forms of unsustainability, but their **simultaneous occurrence within the same system.** This duality creates a particularly complex management challenge: **interventions must address both the absence of systems** (requiring investment and institutional development) and the **overuse of resources** (requiring regulation and enforcement).

3.1.3 Interpreting the Amoeba Diagrams: A System of Imbalance Rather Than Uniform Decline

The Amoeba diagrams developed in Climagine workshop 3 provide a multi-dimensional representation of system performance across sectors. However, their analytical value lies in the **patterns they reveal** rather than the individual scores themselves.

Across all sectors, the amoebas exhibit distorted and irregular shapes, rather than a uniform contraction or expansion. This indicates that the **Damour system is not uniformly degraded; instead, it is highly unbalanced, with some components functioning at moderate levels while others are critically deficient or under excessive pressure.**

In the water supply and wastewater sector, the amoeba is characterized by a pronounced inward collapse across most indicators, combined with outward extensions in indicators related to losses and abstraction. This pattern reflects a system that is both **inefficient and overexploited**, confirming that **infrastructure alone is not sufficient without effective operation and control.**

In the agricultural sector, the amoeba shows moderate performance in production-related indicators, but significant **weaknesses in efficiency and governance**. This suggests that agriculture remains **viable in the short term** but is operating in a manner that is **not sustainable over time**, particularly in relation to **water use.**

The environmental amoeba presents a mixed picture, with some indicators remaining within or near sustainable ranges, while others indicate significant degradation. This reflects the fact that environmental systems have **not yet reached a point of irreversible collapse,** but are subject to increasing pressures that, if unaddressed, will lead to further deterioration.

In the urban planning sector, the amoeba is highly distorted, reflecting a profound **disconnect between physical development and regulatory control.** It shows extreme outward extensions in indicators related to urban expansion and land artificialization, driven by haphazard sprawl into riparian and recharge zones. Conversely, it exhibits a severe inward collapse in indicators measuring enforcement, citizen participation, and the alignment of municipal master plans. This pattern clearly illustrates that **explosive urbanization is occurring in a near-total vacuum of spatial planning and institutional oversight.**

The governance amoeba is perhaps the most revealing, displaying high variability and inconsistency across indicators. This reflects a system in which **legal and planning frameworks may exist, but are not effectively implemented or enforced.** The gap between formal structures and actual practice is a defining feature of the Damour system.

Taken together, these amoebas indicate that the **central issue is not simply low performance, but lack of coherence and integration across system components. The system does not fail uniformly; it fails through fragmentation.**

3.1.4 Governance as the Central Constraint

One of the most consistent findings across all workshops is the **central role of governance as the primary constraint on system performance.** This is not due to a lack of knowledge or absence of policy frameworks. On the contrary, stakeholders demonstrated a clear understanding of the issues and potential solutions.

The challenge lies in the **translation of knowledge into coordinated action.**

Governance weaknesses manifest in several ways:

- fragmentation of institutional responsibilities across sectors and administrative levels
- lack of enforcement of existing regulations, particularly in relation to zoning and water use
- absence of basin-level coordination mechanisms
- limited data sharing and integration across institutions

This results in a system where i**nterventions are implemented in isolation, without consideration of their cumulative impacts or interactions.** For example, upstream water diversions may address local needs but generate downstream conflicts, while wastewater management failures in one area contribute to environmental degradation elsewhere.

The **distinction between the Damour River Basin and the Damour Area further highlights this governance challenge.** Hydrological processes operate at the basin scale, while decision-making and service delivery are largely confined to municipal boundaries. This mismatch leads to a situation in which problems are generated at one scale but addressed at another, reducing the effectiveness of interventions.

3.1.5 Scenario Analysis: The Cost of Inaction

The scenario analysis conducted in this workshop provides a forward-looking perspective on system trajectories. Under a Business-as-Usual (BAU) scenario, the continuation of current practices leads to a **gradual but steady deterioration of system conditions.** Groundwater depletion is expected to intensify, infrastructure inefficiencies to persist, and environmental degradation to accumulate. The Amoeba diagrams under this scenario show further movement of indicators toward unsustainable ranges, particularly in relation to water resources. Importantly, the BAU scenario does not necessarily imply immediate collapse. Rather, it reflects a p**rocess of progressive degradation, in which system resilience is gradually eroded.** This type of trajectory is particularly challenging, as it may not trigger urgent responses until critical thresholds are reached.

In contrast, the sustainable scenario, as defined implicitly through the Band of Equilibrium, represents a state in which indicators are maintained within acceptable ranges. Achieving this state does not require perfection, but rather a **rebalancing of the system, reducing excess pressures while addressing structural deficiencies.** The gap between the BAU trajectory and the sustainable range provides a clear indication of the **scale and urgency of required interventions.**

3.1.6 Strategic Priorities and Leverage Points

The combined analysis of indicators, BoE values, and Amoeba diagrams alloClimagine workshop for the identification of key leverage points within the system.

The **water supply and wastewater** sector emerges as the **highest priority,** due to its central role in both human well-being and environmental health. Improvements in this sector have the potential to generate cascading benefits across agriculture, ecosystems, and urban development. **Governance** reform is identified as a **cross-cutting priority.** Without mechanisms for coordination, enforcement, and data integration, sectoral interventions are unlikely to achieve their intended outcomes. The establishment of basin-level governance structures, such as a Basin Committee or Charter, is therefore an important step. The **agricultural** sector represents a major source of **pressure on water resources.** Enhancing irrigation efficiency and promoting more sustainable practices can significantly reduce demand, but requires both technical support and institutional organization, such as water user associations. The **environmental** sector, while not yet at a point of irreversible collapse, requires **proactive measures** to prevent further degradation. This includes the definition and enforcement of environmental flows, protection of riverbanks, and monitoring of ecosystem indicators. Finally, cross-cutting measures, such as the development of data platforms, promotion of citizen engagement, and inclusion of diverse stakeholder groups, are essential for building a resilient and adaptive system.

3.2 Data Gaps and the Need for a Monitoring Framework

A recurring theme throughout the Climagine process is the lack of reliable and comprehensive data. This includes:

- absence of systematic monitoring of river flows and groundwater levels
- limited information on water abstraction and usage
- lack of integrated data systems across institutions

These gaps constrain the ability to accurately assess system performance and to track the impact of interventions. However, rather than undermining the process, these **limitations have been explicitly incorporated into the methodology through the use of proxy indicators and qualitative assessments.** In this sense, the indicator system serves not only as a **tool for monitoring, but also as a diagnostic of institutional capacity.** The development of a comprehensive monitoring framework is therefore a priority, not as a standalone activity, but as an integral component of the IMP.

3.3 From Analysis to Implementation

The Climagine process has successfully provided a structured and shared understanding of the Damour system, as well as a set of tools for ongoing assessment and decision-making. However, the transition from analysis to implementation requires careful consideration.

Key challenges include:

- aligning interventions with institutional capacities
- sequencing actions to address both immediate and long-term needs
- ensuring coordination across sectors and administrative levels
- maintaining stakeholder engagement beyond the workshop process

The indicator framework and associated tools (BoE, Amoeba diagrams) provide a basis for adaptive management, allowing for continuous refinement of strategies as new data becomes available and conditions evolve.

3.4 Concluding Perspective

The Damour case illustrates that sustainability challenges are not solely a function of resource scarcity or technical limitations. Rather, they emerge from the interaction of environmental pressures, infrastructure systems, and governance structures.

The Climagine methodology has demonstrated its capacity to:

- structure complex system dynamics
- translate qualitative insights into operational indicators
- support scenario-based analysis

- facilitate dialogue among diverse stakeholders

At the same time, the process highlights the importance of moving beyond analysis toward implementation, with a focus on governance, monitoring, and coordination. Ultimately, the effectiveness of the **IMP will depend not only on the quality of its analytical foundation, but on the ability of institutions and stakeholders to translate this foundation into sustained and coordinated action.**

3.5 Operationalizing the IMP: Strategic Recommendations and Next Steps

To ensure the successful operationalization of the Damour Area Integrated Management Plan (IMP) and to bridge the "implementation gap" identified during the Climagine workshops, the following strategic recommendations and post-development steps must be integrated:

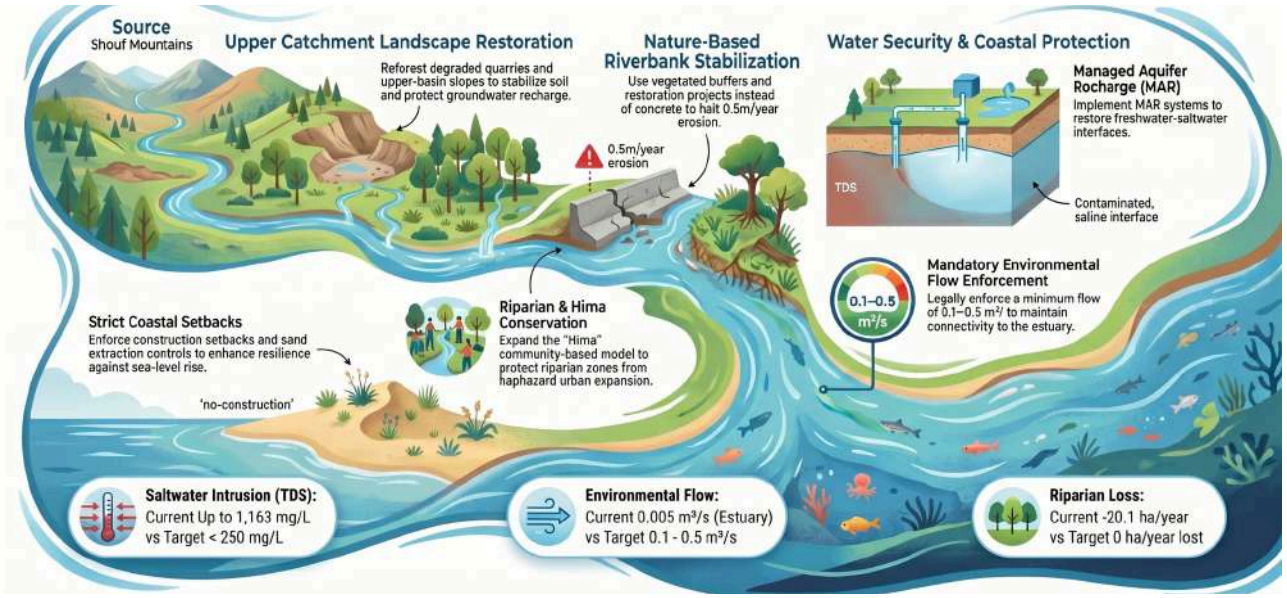
1. Governance and Institutional Coordination:

- Establish and operationalize a formal **Cross-Sectoral Coordination Committee (under GDHER-MoEW)** agreed upon in the workshop to immediately enforce IMP regulations and harmonize actions across municipalities
- Draft and formally sign a **Damour River Basin Charter** to serve as the **political and institutional commitment mechanism for the IMP.** While the IMP provides the technical and strategic roadmap, the Charter will **bind local municipalities and stakeholders to a shared governance agreement,** ensuring strict alignment between local municipal master plans and the basin-wide water management objectives.

2. Technical Interventions and Nature-based Solutions (NbS):

- Implement **Nature-based Solutions (NbS)** and **Ecosystem-based Adaptation (EbA)** to restore river connectivity, stabilize riverbanks, and explicitly protect Groundwater-Dependent Ecosystems (GDEs).
- Formally designate the **Damour Coastal Aquifer as a "Strategic Aquifer System"** and enforce strict groundwater protection zones. Regulate groundwater abstraction through comprehensive well licensing and mandatory metering for public and major private wells.
- Upgrade and **secure the operation and maintenance (O&M) of decentralized wastewater treatment plants (WWTPs)** and solid waste sorting facilities to halt the severe pollution of surface and coastal waters.

Figure 6. Six priority Nature-based Solutions (NbS) and Ecosystem-based Adaptation (EbA) strategies designed to restore the Damour River Basin's environmental integrity.



3. Monitoring, Evaluation, and Citizen Science:

- Create a **unified geospatial monitoring intelligence unit within GDHER**, integrating data into platforms like Plan Bleu's MapX Observatory. This unit should systematically track the freshwater-saltwater interface, climate risk indicators, and land-use changes.

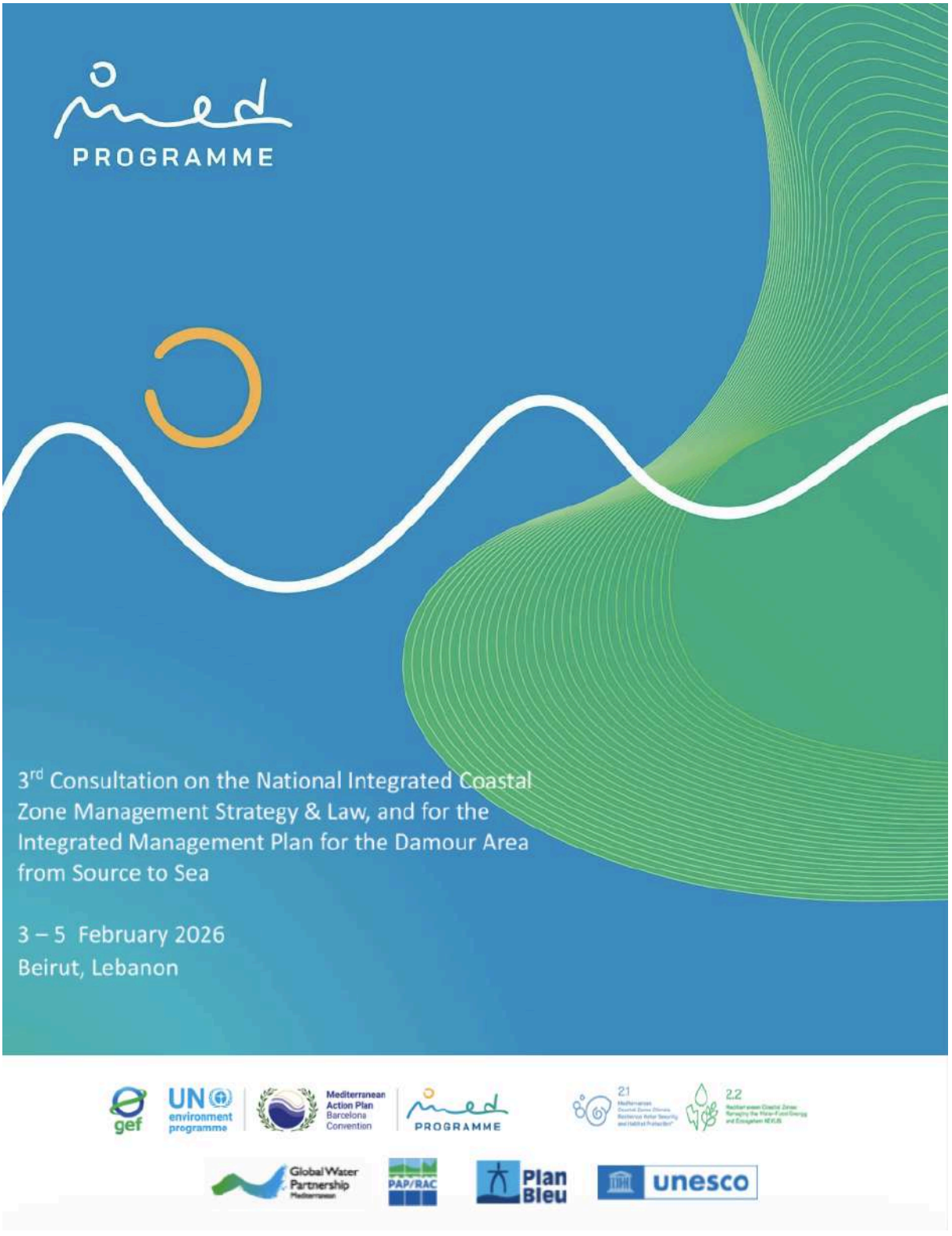
- Promote **citizen science** and establish **local community-based observatories** to foster local stewardship, ensuring continuous, transparent data collection and public awareness.
- Refine and continuously update the Bands of Equilibrium (BoE) and Amoeba diagrams to **visually communicate the cost of inaction (Business-As-Usual) versus the benefits of sustainable planning to policymakers and the public**.

4. Financial Strategy and Bankability:

- Execute rigorous **Cost-Benefit Analyses (CBA)** and **Multi-Criteria Analyses (MCA)** to ensure that proposed coastal adaptation and water management measures are financially viable and realistic
- Structure the IMP's priority actions into "bankable" project pipelines to attract blended finance, international donor support, and private capital, shifting from theoretical planning to c**oncrete green and blue economy investments**.

4. Annexes

5.1 Event agenda



Venue: Crowne Plaza Beirut By IHG, Hamra Main Street, Beirut 7512 Lebanon

Day 1 - 3 February 2026

I. Cross-sectoral coordination and spatial integration for enhanced natural resources management in Lebanon within the framework of MedProgramme (ICZM Strategy and Law)

Time	Session Description	Partner
08:30-09:00	**Registration and Welcome Coffee**	
09:00-11:00	**Session 1: Draft ICZM Strategy and Law** • Welcome words by Ms. Daria Povh Škugor, PAP/RAC Director • Introductory Presentation on ICZM Strategy – Dr. Manal Nader, University of Balamand • Working Groups on the measures from the drafted ICZM Strategy	PAP/RAC
	Coffee break (continuous)	
11:00 - 13:00	• (cont.) Working Groups on the measures from the drafted ICZM Strategy • Introductory Presentation on the Law – Dr. Josiane Yazbeck, Environmental Legal Expert • Working Groups on the draft Law	
13:00-14:00	*Lunch break*	
14:00-15:30	**Session 2: Building a shared vision for the Lebanese coastal area through the Climagine participatory approach** • Introduction to the Climagine participatory methodology for integrating stakeholders' views on the Lebanese coast • Thematic groups assess past and present coastal conditions using sustainability indicators ranked by RACER criteria • Groups define minimum and maximum indicator values to establish a "safe operating space" for ecosystem and socio-economic balance by 2050 • Groups use of the Band of Equilibrium (BoE) to visualize current sustainability states and limits	Plan Bleu PAP/RAC

15:30-16:00	*Coffee Break*	
16:00-17:30	• Workshop participants examine two future scenarios for Lebanon's coast: - Business-as-Usual with ongoing unsustainable impacts, and - a Sustainable Pathway focused on long-term policies • Each thematic group uses amoeba diagrams to graphically represent the current status and desired future targets of Sustainability Indicators, highlighting gaps to address	

Day 2 - 4 February 2026

II- Cross-sectoral coordination and spatial integration for enhanced natural resources management in Lebanon within the framework of MedProgramme (ICZM Strategy and Law) - continued

Time	Session Description	Partner
09:00-10:30	**Session 3: Prioritisation introduction** *Dr. Jean Hugé, Dr. Ante Ivcevic* • Coasts as complex social-ecological systems • Coastal stakeholders and multiple rationalities • From prioritisation principles to criteria • Prioritisation in practice: which tools to use when, for what and with whom?	PAP/RAC
10:30-11:00	*Coffee break*	
11:00-12:30	**Session 4: Prioritisation in practice** • Prioritisation in practice: nominal group technique (NGT)-based exercise for the measures of the ICZM Strategy • Short reflection, strengths and weaknesses of the approach	PAP/RAC
12:30-14:00	*Lunch break*	
14:00-16:00	**Session 4 (cont.): Prioritisation in practice** • Prioritisation in practice: nominal group technique (NGT)-based exercise for the measures of the ICZM Strategy • Wrap up of NGT	PAP/RAC

Day 3 – 5 February 2026

I. The development of an Integrated Management Plan for the Damour Area from source to sea (Damour IMP)

Time	Session Description	Partner
09:00-11:30	**Session 5: The Damour Area Integrated Management Plan from source to sea** *GWP-Med and MORES s.a.r.l* ● Updated Situational Analysis and Deliberation on the Damour Area Integrated Management Plan ● Discussion of Problems ● Action Plan Focus Groups	GWP-Med
11:00-11:30	*Coffee Break (continuous)*	
11:30-13:00	*GWP-Med and CNRS* ● The Water-Energy-Food-Ecosystems Nexus Assessment for the Damour Area: findings and way forward	
13:00-14:00	*Lunch break*	
14:00-15:30	**Session 6: Climagine - Building a shared vision for the Damour Area - 2050 indicator targets** ● Introduction to the Climagine foresight approach for participatory planning ● Thematic groups addressing water, agriculture, biodiversity, and governance ● Each group establishes minimum and maximum indicator values that define a "safe operating space" to maintain ecosystem and socio-economic balance through 2030 and 2050 ● Each group uses the Band of Equilibrium (BoE) to visualize current states and limits of sustainability	Plan Bleu PAP/RAC
15:30-16:00	*Coffee Break*	
16:00-17:30	● Each group explores two main scenarios: ● i. Business-as-usual: continuation of current unsustainable trends. ● ii. Sustainable pathway: proactive strategies to achieve sectoral and overall sustainability	

	• Each group presents past and present Sustainability Indicators states using BoE diagrams • Each group introduces Amoeba diagrams for illustrating proposed future indicator values in 2050	
17:30-18:00	**Closing remarks** • *Éloïse Leguérinel, Ante Ivcevic, Barbara Tomassini*	Plan Bleu, PAP/RAC, GWP-Med

5.2 List of Participants

Title	First Name	Last Name	Organisation	Position
Dr.	Abbas	Fayad	National Advisor/Consultant	Private Sector.
Mr.	Ali M.	Zeidan	Khatib & Alami	Senior Manager/ Water Resources and Stormwater....
Ms.	Amina	Basbous	CAS	Department of National Accounts and coordination.
Mr.	Ante	Ivcevic	PAP/RAC	International Organization.
Mr.	Antoine	Waked	National ICZM Strategy...	Climate Change expert.
Mr.	Bachir	Aoun	Municipality of Damour	Lawyer.
Ms.	Barbara	Tomassini	GWP-Med	International Cooperation / Private Sector.
Ms.	Christina	Kontaxi	GWP-Med	International Organization.
Ms.	Daria	Povh Skugor	PAP/RAC	International Organization.
Ms.	Éloïse	Leguérinel	Plan Bleu / RAC	Project Manager / International Organization.
Ms.	Fatima	Hmede	LARI	Academic / Research.
Mr.	Georges	Gharios	UNESCO	National Programme Officer for Natural Sciences.
Mr.	Habib	Maalouf	Ministry of Environment	Minister's Advisor.
Ms.	Hanan	Hassan	Shouf Biosphere Reserve	Public Sector (Water).
Mrs.	Hiam	Abou Abdallah	Damour Municipality	Vice President.
Mr.	Hussam	Hawwa	Difaf	National Expert and Consultant.
Ms.	Iffat	Idriss	Lebanese Coastal Forum / Cedards for care	Civil Society / NGO.
Mr.	Jean	Huge	Consultant	International Organization.
Ms.	Josée	El Haddad	Consultant/Univ Balamand	International Organization.
Mr.	Joseph	Bechara	Lebanon Reforestation Initiative	Wildfire and Forest Management expert.
Dr.	Josiane	Yazbeck	National ICZM Strategy...	Consultant/ Legal expert.
Mr.	Jules	Hatem	MORES	Private Sector / Consulting.
Mr.	Kareem	Salameh	Hariri Foundation	Program coordinator.
Ms.	Karen	Nawwar	National ICZM Strategy...	Social expert.
Ms.	Leya	Zgheib	MoE / UNDP	Project Coordinator.
Mr.	Mahmoud	Termos	MoI	Department of Technical Affairs & Industrial Services / Industrial Zone Beam.
Mr.	Malek	Ghandour	Lebanese Environment Forum	President.
Dr.	Manal	Nader	University of Balamand	Director, Marine and Coastal Resources Program.
Colonel	Mazen	Saker	Lebanese General Security	Maritime expert.
Ms.	Mia	Farah	Media Sector	Journalist/Media specialist.
Dr.	Milad	Fakhry	CNRS - National Center for Marine Sciences	Academic / Research.
Mr.	Nabil	Rizk	UNICEF	WASH specialist - Communication and engagement.
Mr.	Nadim	Kanaan	Municipality of Damour	Municipal Council.
Ms.	Nadine	Saade	CAS	National coordinator of the environment sector.
Ms.	Najwa	Chaaya	Municipality of Damour	Lawyer.

Ms.	Nancy	Awad	Council for Development and Reconstruction	Public Sector (Planning).
Mr.	Nizam	Bou Khzam	البيت البناني للبيئة-كفرحيم	Eco-tourism.
Mr.	Nizar	Zahreddine	Kfarfakoud Municipality	Member.
Mr.	Paul	Abi Rached	Terre Liban	President.
Mr.	Raed	Nasr	Kfarfakoud municipality	Head.
Mr.	Raed	Al Rayess	Aley Municipality, Go Green Recycling	Council member, founder and CEO.
Ms.	Raghida	Haddad	SPNL	Civil Society / NGO.
Mr.	Raji	Maasri	MORES	Private Sector / Consulting.
Ms.	Rawan	Al Jamal	University of Balamand	Research Assistant, Marine and Coastal Resources Program.
Ms.	Salam	Nassar	MORES	Private Sector.
Ms.	Samah	Termos	Remote Sensing Center	Surveying Engineer Research Assistance.
Ms.	Soumaya	Ayadi	ACE	Civil Society / NGO.
Mr.	Tony	Naufal	MORES	Junior Geologist.
Ms.	Tracy	Zarour	UN/ESCWA	Hydrologist.
Dr.	Youssra	Ghoussein	CNRS	Researcher.

5.3 Final INDICATOR Matrices

The indicator matrices presented in Annex 3 provide the detailed structure underlying the analysis developed in this report. Each indicator corresponds to the thematic discussions and BoE assessments carried out during Workshop 3. While the present report focuses on the interpretation of system dynamics, the annexed matrices constitute the operational backbone of the Climagine methodology, supporting future monitoring, evaluation, and decision-making.

ANNEX 3.1 Final Indicator Metrics: Water & Wastewater Management

Final Indicator	Logic / Relevance	DPSIR Link	Unit	Current Baseline / Proxy	Data Readiness	Main Sources	Priority Interventions	Expert Convergence Note
Groundwater abstraction versus groundwater level trend	Tracks sustainability of groundwater use by linking abstraction pressure to observed changes in groundwater levels, rather than treating abstraction or level decline separately.	Pressure / State / Impact	Ratio abstraction-to-recharge and/or groundwater level change (m/year)	High pressure; declining trends observed; local evidence of deepening wells	Tier 2	MoEW, public wells, municipalities, utilities, expert monitoring	Metering, water accounting, aquifer modelling, conjunctive use, aquifer recharge pilots	This should replace any weaker standalone abstraction-only indicator. Late expert input correctly insists on interpreting levels against pumping, recharge and salinity risk.
Metered wells (public and major private)	Measures the extent to which groundwater abstraction is actually controlled and reportable.	Response / Pressure proxy	% or number of wells equipped with functional meters and reporting	Low / partial; private metering negligible	Tier 2	MoEW, municipalities, water establishment	Metering programme, enforcement, data platform	Expert input usefully clarifies that "metered" must mean functioning + reported, not just installed.
Households connected to a functioning wastewater treatment service	Tracks real sanitation coverage, distinguishing network connection from effective treatment.	Pressure / State / Impact	% of households	Very low effective coverage in many areas	Tier 2	Municipalities, EBML / utilities, WWTP operators	Network completion, pumping station repair, O&M stabilization	This is better than "connected to WWTPs" alone. The wording should explicitly say "functioning treatment service."
Wastewater effectively treated	Captures actual treatment performance relative to design or operational capacity, highlighting whether plants work in practice rather than only existing on paper.	Pressure / State / Impact	m^3/day treated and/or % of design capacity effectively treated	Low efficiency; major operational constraints	Tier 2	WWTP operators, utilities, municipalities, MoEW/CDR where relevant	O&M, troubleshooting, rehabilitation, compliance monitoring	Late expert input strengthens this indicator significantly; it should be kept.
Water quality monitoring campaigns (surface and groundwater)	Establishes whether a minimum, structured monitoring effort exists to detect pollution trends and guide management.	State / Response	# campaigns/year and/or % planned sites sampled	Monitoring fragmented and weak	Tier 2–3	MoEW, utilities, municipalities, shared platform, citizen science support	Monitoring programme, shared data platform, defined parameters and sites	This is a better operational indicator than vague "water quality monitored."
Salinization / seawater intrusion risk in coastal aquifer zones	Tracks groundwater quality deterioration in the lower basin and coastal interface.	State / Impact	Chlorides mg/L, TDS mg/L, or classified salinity risk	Existing evidence of salinity stress in coastal aquifer	Tier 1–2	MoEW, labs, aquifer studies	Coastal abstraction control, recharge protection, aquifer recharge, ecological flow support	Keep as a separate complementary indicator if room allows; otherwise integrate analytically under the groundwater abstraction / level trend indicator.

ANNEX 3.2 Final Indicator Metrics: Agriculture

Final Indicator	Logic / Relevance	DPSIR Link	Unit	Current Baseline / Proxy	Data Readiness	Main Sources	Priority Interventions	Convergence Note
Efficient irrigation coverage	Measures the extent to which agricultural land uses water-efficient systems rather than wasteful traditional methods.	Response	% of irrigated agricultural land	Low efficiency; drip irrigation still limited	Tier 1–2	MoA, LARI, remote sensing, field surveys	Drip irrigation incentives, modernization, training	Keep as core productivity-efficiency indicator.
Farmers applying Good Agricultural Practices (GAP) / organic or reduced-chemical practices	Tracks transition toward less polluting and more water-conscious farming systems.	Response	% of farmers / % of farms	Low adoption	Tier 2	MoA, cooperatives, NGOs, certification schemes	GAP extension, training, biopesticides, organic pilots	Merge GAP / organic / biopesticide logic into one strong indicator, rather than scattering them.
Irrigated land using polluted water	Captures the use of unsafe water for irrigation and related ecosystem and health risks.	Pressure / Impact	% of irrigated land	Significant in lower basin according to workshop discussion	Tier 2	Field surveys, MoE, MoA, local observation	Safe reuse standards, source control, monitoring, wastewater treatment	This indicator is politically sensitive but should remain.
Active Water User Associations (WUAs) or equivalent collective irrigation structures	Measures whether water governance in agriculture is organized collectively rather than remaining fully individualistic.	Response	# active WUAs / associations	Few or inactive	Tier 2–3	MoA, municipalities, local unions	WUA formalization, irrigation governance, maintenance roles	Keep; it links agriculture to governance.
Crop–irrigation typology mapping	Provides a planning basis for water allocation by identifying crop type, irrigation method, and likely water pressure zones.	State / Response	Updated map / yes-no / % area mapped	Partial or absent	Tier 3	MoA, remote sensing, consultants, municipalities	Remote sensing, crop-water planning, allocation tools	Keep as a strategic indicator because it enables future planning.
Agricultural water demand	Estimates total water requirement for dominant crop systems and supports basin-wide water accounting.	Pressure	MCM/year	Existing estimates available but partial	Tier 2	MoA, modelling, field surveys	Water accounting, crop shifts, irrigation efficiency	I would retain this from Climagine workshop 2 because it anchors the agriculture theme in actual basin water use.

ANNEX 3.3 Final Indicator Metrics: Environment & Biodiversity

Final Indicator	Logic / Relevance	DPSIR Link	Unit	Current Baseline / Proxy	Data Readiness	Main Sources	Priority Interventions	Convergence Note
Protected / high-biodiversity area under effective conservation or management	Tracks whether ecologically important areas are not only designated but functionally protected or managed.	State / Response	% of basin / % key habitats under management	Existing protected cover but uneven management	Tier 2	MoA, MoE, CNRS, reserves, NGOs	Protected area enforcement, Hima models, local stewardship	Better to frame around "effective conservation" rather than legal designation only.
Environmental flow compliance	Measures whether minimum ecological flow reaches the lower river and estuary.	State / Impact	m^3/s and/or compliance status	Critical failure in dry season	Tier 2	MoEW, hydrological data, modelling	Flow rules, abstraction caps, environmental allocation	This is one of the most strategic Damour indicators and should remain central.
Dumpsites identified and rehabilitated	Tracks progress in reducing riparian and hillside dumping pressure.	Pressure / Response	# sites identified / # rehabilitated / % rehabilitated	Illegal dumping remains active in several localities	Tier 1–2	Municipalities, MoE, waste master plans	Closure, rehabilitation, municipal SWM strengthening	Keep simple and operational.
Riverbank protection / restoration progress	Measures stabilization or restoration of degraded river corridors and encroached areas.	State / Response	m/year erosion trend and/or ha / km restored	Riverbank degradation evident	Tier 2	Municipalities, CNRS, army maps, NGOs	Nature-based riverbank restoration, encroachment control	This should remain visible because it links environment, urban pressure and floodplain management.
Fire prevention coverage in priority watershed zones	Reflects preparedness against wildfire risk affecting upper-basin vegetation and catchment function.	Response	% of priority area covered by fire prevention measures	Low coverage	Tier 2–3	Civil Defense, municipalities, MoA, MoE	Fire plans, community units, early warning	Keep, but frame as watershed-risk management not forestry only.
Operational climate / weather monitoring stations	Tracks the existence of a minimum hydro-climatic observation network supporting basin risk assessment.	Response	# operational stations	Very limited and partly non-functional	Tier 1–2	CNRS, LARI, reserves, MoPWT	Station upgrading, maintenance, data-sharing	Keep as an enabling indicator.

ANNEX 3.4 Final Indicator Metrics: Urban Planning & Governance

Final Indicator	Logic / Relevance	DPSIR Link	Unit	Current Baseline / Proxy	Data Readiness	Main Sources	Priority Interventions	Convergence Note
Urban expansion in riparian and sensitive areas	Tracks land conversion and encroachment in zones critical for water, floodplain function, and ecological continuity.	Pressure / State	ha/year or % area affected	High pressure and ongoing sprawl	Tier 1–2	CNRS land cover, municipal plans, remote sensing	Zoning enforcement, river buffers, land-use control	Keep as the main urban pressure indicator.
Enforcement actions on land-use violations	Measures whether regulations are actually applied rather than merely existing.	Response	# actions/year	Low / reactive	Tier 2	Municipal records, MoE, MoEW, ISF	Enforcement support, municipal water / environmental police, legal follow-up	This remains essential even if politically uncomfortable.
Alignment of municipal plans with basin water-management objectives	Assesses whether local planning instruments are consistent with basin protection priorities.	Response	Qualitative score / yes-no / review status	Fragmented and outdated in many areas	Tier 3	Municipalities, DGUP, MoEW	Plan review, basin charter integration	Keep as a strategic planning indicator.
Citizen participation in monitoring and stewardship	Captures whether residents engage in reporting, stewardship, and oversight, especially for shared resources.	Response	qualitative score / composite index	Low or ad hoc	Tier 3	Municipalities, NGOs, community groups	Citizen observatories, reporting tools, women and youth inclusion	Keep because it emerged strongly from workshop discussion.
Local data and stakeholder reporting platform	Measures whether a functional shared platform exists for reporting, dialogue, and coordination.	Response	yes-no / operational status	Emerging or project-based only	Tier 3	Basin institutions, municipalities, NGOs, MoEW	Data platform, grievance/reporting tools, transparency	This is more useful than abstract "coordination exists".
Protected river buffer / setback compliance	Tracks whether designated river protection zones are respected in practice.	Pressure / Response	% compliant river corridor / % non-compliant area	Weakly controlled	Tier 2–3	Remote sensing, municipal permits, field checks	Buffer zone regulation, setback enforcement	This is more operational than broader green-blue infrastructure indicators at this stage.

ANNEX 3.5 Final Indicator Metrics: Cross-cutting Indicators

Final Indicator	Logic / Relevance	DPSIR Link	Unit	Current Baseline / Proxy	Data Readiness	Main Sources	Priority Interventions	Convergence Note
Damour Area Charter / IMP progress	Tracks progress toward an agreed governance framework and shared rules for basin management.	Response	yes-no / % progress	Under preparation	Tier 3	MoEW, partners, municipalities	Charter drafting, adoption, implementation	Must remain central.
Damour water balance / management model	Measures whether a functional basin-scale water accounting and allocation model exists.	Response	yes-no / operational status	No full operational model yet	Tier 3	CNRS, consultants, MoEW, utilities	Water balance modelling, calibration, abstraction integration	This is one of the strongest enabling indicators.
Water quality and quantity awareness / monitoring campaigns	Captures communication and participatory monitoring efforts at basin scale.	Response	# campaigns/year	Sporadic and project-based	Tier 2–3	NGOs, municipalities, MoEW	Awareness campaigns, citizen science, education	Keep but distinguish from formal technical monitoring.
Basin-wide mapping completeness	Measures whether spatial information exists on land use, riparian buffers, infrastructure, and risk zones.	Response	% thematic coverage complete	Partial and fragmented	Tier 3	CNRS, MoE, municipalities, consultants	Multi-thematic mapping, updates	Necessary enabling indicator.
Public awareness of the Damour Area / Basin as a shared management unit	Reflects whether the Damour Area is understood socially and institutionally as a common planning space.	Response	qualitative score	Low	Tier 3	Municipalities, civil society, surveys	Basin-branded communication and education	Useful because the workshops showed weak shared basin identity.
Public–public cooperation mechanisms operationalized	Captures whether cooperation between municipalities, water establishment, and national authorities moves from workshop dialogue to functioning arrangements.	Response	yes-no / # formal cooperation actions	Emerging but not institutionalized	Tier 3	MoEW, municipalities, utilities	Coordination committee, shared reporting, pilot agreements	This is not from the early matrix, but I recommend adding it because it came through strongly in the workshop notes and expert logic.

5.4 Explanatory sheet outlining the methodology and the scoring criteria distributed during the workshop

IMP Damour Workshop 3 – Expert Guidelines

Purpose of Workshop 3

Workshop 3 is the final expert convergence step of the Climagine process for the IMP Damour. The objective is to agree on acceptable limits, targets, and system balance using the Band of Equilibrium (BoE) and Amoeba diagrams.

1. Review the Current Value (derived from WS2).
2. Define the Safe Operating Space (Min & Max acceptable values).
3. Assign a BoE Score (1-7) to the Current Situation.
4. Assign a BoE Score for the 2030 "Business as Usual" (BAU) scenario if no laws are passed.

Rules for Experts

1. Ranges, not Digits: Focus on thresholds (min/max), not precise figures.
2. Expert Judgment: Use your professional judgment where data is incomplete.
3. Justification: Do not introduce new indicators unless strongly justified.
4. Sustainability First: Prioritize long-term coastal sustainability over short-term feasibility.

Band of Equilibrium – Indicator Sheet

Theme:
Indicator:
Unit:
Tier (1/2/3):
DPSIR Role:
Current State:
Minimum Acceptable Level (Red Line):
Target Level (2030 / 2050):
Confidence (High/Medium/Low):
Data Source / Responsible Institution:
Notes / Assumptions:

1. Validate Baseline: Look at the "Baseline (2025)" column. Does this match your field experience?
2. Define Safe Range: What are the minimum and maximum acceptable numbers for Lebanon in 2030? (e.g., Minimum 10% MPAs).
3. Score the Present: Using the 1-7 scale, give a score to the "Baseline".
   - *Example: 8% wastewater treatment is a SCORE 1 (Critical Deficit).*
4. Score the Future (BaU): If we do nothing, what will the score be in 2030? (Better, same, or worse?)

Colour	Number	Ranking of the SI on the Band of Equilibrium
	1	Unsustainable by default
	2	Low sustainability by default
	3	Lower sustainability threshold
	4	Sustainable
	5	Upper sustainability threshold
	6	Unsustainable by excess
	7	Very unsustainable by excess

Amoeba Diagram Guidance

The Amoeba diagram visualizes system balance across multiple dimensions.
Scores are informed by the BoE discussion.

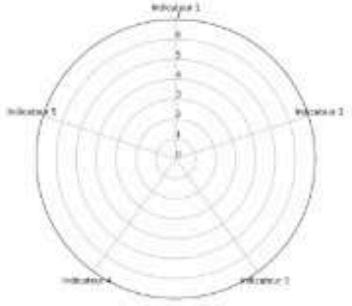
• Step 1: On the radar chart, place a BLUE DOT for the Current Score of each indicator. Connect them. -> This is the "Sick Patient".
1. Plot the Current State (Blue): On your radar chart, mark the Current Score (0-7)

• Step 2: Place a RED DOT for the Future (BaU) Score. Connect them. -> This is the "Prognosis without treatment".
2. Plot the Sustainable 2050 Scenario (Green): Mark the Target Score (usually 4 or 5) where you want to be.

• Step 3: The GREEN CIRCLE (Score 3-5) is the Band of Equilibrium. Your Strategy must bring the dots into this circle!
3. Analyze the Gap:
◦ The distance between the Blue line and the Green line represents the "Implementation Gap" for the new ICZM Law.

Key Reminder: The objective is not precision, but agreement on what is acceptable (Score 3), what is not (Score 0-1), and where the coast should go (Score 5).
◦ Where does the shape collapse inward (Score 1-2)? This is a deficit (e.g., Lack of laws, lack of water).
◦ Where does the shape explode outward (Score 6-7)? This is an excess (e.g., Pollution, Urban Sprawl).

Imagine a radar chart (Spider chart) with 7 concentric rings.
• Center (1): Critical Failure.
• **Ring (3-5): THE GREEN ZONE (GOAL).**
• Edge (7): Critical Excess.



DEFINITIONS / REMINDERS

Band of Equilibrium (BoE)

The **Band of Equilibrium** defines the *acceptable operating space* for an indicator.

- **Minimum acceptable level (red line):**
  Below this level, risks to the coastal system become unacceptable and corrective action is required.
- **Target level (green line):**
  Desired condition under a sustainable IMP vision (2030–2050).

BoE values are **ranges**, not exact numbers.

Indicator Tiers

- **Tier 1:** Robust enough to define BoE today
- **Tier 2:** Relevant but provisional (data or methods need improvement)
- **Tier 3:** Strategically important but not yet quantifiable

Tiering reflects **feasibility**, not importance.

DPSIR Reminder

Indicators may reflect:

- **Pressure** – human stresses on the coast
- **State** – condition of systems
- **Impact** – consequences for nature or society
- **Response** – policies and actions

Amoeba Diagram

A **visual synthesis tool** showing IMP system balance across key themes.

- Compares **current situation** vs **sustainable IMP trajectory**
- Supports prioritization and communication
- Not a ranking or performance score

Key Reminder

The objective is **not precision**,
but agreement on **what is acceptable, what is not, and where the coast should go**.

STRATEGY CARD: From Diagram to Law

- **Sector:** _____

- **The "Red" Alert:** Which indicator is the furthest from the Green Zone?
  - *Indicator:* _____
  - *Current Score:* ___ (Target: 4)
  - *Indicator:* _____
  - *Current Score:* ___ (Target: 4)
  - *Indicator:* _____
  - *Current Score:* ___ (Target: 4)
  - *Indicator:* _____
  - *Current Score:* ___ (Target: 4)
  - *Indicator:* _____
  - *Current Score:* ___ (Target: 4)

- **The Fix (Action Plan):** What specific clause must be in the IMP Damour to pull this indicator back into the Band of Equilibrium?

  - *Legal/Policy Action:*

_____

  - *Infrastructure Action:*

_____