Water and Environment Support
in the ENI Southern Neighbourhood region

Explore the Potential of Natural Water Retention Measures (NWRM) at the catchment scale
Activity No. : N-W-JO-2

Assessment of the adopted NWRMs overall efficiency (technical and economical)

Stakeholders' Consultation Workshop

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Kempinski Hotel, Amman, Jordan

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NWRMs Applicability

- NWRM offer a variety of measures that are relevant EU wide. But:
  - Their design needs to be tailored for each eco-region.
  - Benefit depends on type, location, implementation design and combination with other measures.
- NWRM are far from being applied in all cases in which they would be an option/the best option. There is a need for a change of thinking to ensure NWRM are duly considered in planning processes.
- Enhanced knowledge is required for supporting the optimisation of NWRM and their combination with other measures, for quantifying their impacts at large scale, and for estimating all their benefits.

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NWRMs Applicability

- Research and demonstration in pilot activities is to be promoted to gather further evidence on the (real) effects of NWRM on flood mitigation at the catchment scale.
- There is no integrated framework to assess the net benefits and the cost-effectiveness of strategies for achieving multiple policy goals.
- Funding sources are available at the European and at other levels. But the utilisation of available financial resources for financing NWRM remains limited.
- Smart financial engineering is essential to the implementation of NWRM – searching for synergies between different funding instruments including innovative financing instruments.

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NWRMs Applicability

- Raising awareness on the potential role of NWRM remains essential – including with local communities and across sectors.
- NWRM can help achieving the objectives of different EU and national policies. However, their contributions to different objectives are rarely assessed because of the absence of multiple impact monitoring.
- The multifunctional and multi-sector character of NWRM requires enhanced collaboration between stakeholders representing different sectors.
- Enhanced coordination between planning processes across different policy areas (e.g. River Basin and Flood Risk Management, but also nature protection, rural development and land use/spatial planning) will provide more opportunities for NWRM and for their multiple benefits to be considered.

NWRMs Applicability

- Spatial planning is key for the successful implementation of NWRM.
- Urban planners should make the water cycle explicit in their territorial planning. The concept has now shifted from “design against nature” to “design with nature”.
- NWRM offer multiple benefits and opportunities for achieving WFD and FDs objectives and as such should be included in the RBMPs and FRMPs. NWRM often represent a "better environmental option".

NWRMs Applicability vs Dams

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- Policy and Decision makers are often (if not always) reluctant to use NWRMs instead of "traditional" practices namely "a dam construction". Dams as flood protection units are indeed efficient in term of routing flood peaks downstream by attenuating and translating flood peaks even in the case that water level is on the overflow level at the onset of a flood event.
- However, the construction of a (multipurpose) dam includes a lot of uncertainties (e.g. hydrological, geological, geotechnical, financial) that may disproportionally enhance the total cost of the project and the construction period, if not to abolish any plans.
- The "million dollar question" is if cumulatively the effects of many small-scale NWRMs may have a –more- significant effect on flood peaks attenuation and storage in the catchment with less economic costs.

Proposed actions

Task 4: Review of economic incentives and regulation regarding storm water management

A cost–benefit analysis will be performed for the selected NWRMs, comparing the economic and environmental **benefits** of the water retained in natural and/or artificial storages (economically by the associated usage (irrigation, water supply, etc.), flood defense and environmentally by the water quality of the recipients) with the **costs** of applying the NWRMs. According to the analysis and the sustainability of the concept in general, the economic incentives for further adopting NWRMs will be proposed and a regulation framework on the application of the NWRMs for the whole of the country will be prepared.

Results

- Cost – benefit analyses of NWRMs comparing the costs (cost of construction, pollution, etc.) with the benefits per m^3 retained in storage (including benefits from flood defense).
- Assessment of funding options according to the nature of retention (groundwater, surface water) and purpose of water use.
- Economic incentives for the application of NWRM
- Basic structure of regulation manual regarding application of NWRM in Jordan.

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Cost – Benefit Analyses – Azraq Area

COSTS

- Land Expropriation (if private).
- Excavation / Fill material.
- Gabion fill material transported and placed in situ.

BENEFITS

- Reduction of flood risk (damage reduction compensation in economic values).
- Increase of water availability (surface and groundwater) available for consumption in irrigation.

Cost – Benefit Analyses – Azraq Area

Type	Parameter	Amount	Price after Inflation (JO)	Total (JO)
Retention Pond	Stored Volume (m^3)	125,000.00	35.50	4,437,500.00
Check Dam	Volume of Gabions (m^3)	12,328.00	150	1,849,200.00
Total*				6,286,700.00*

Type	Checkdam	Retention Pond
Gabions (m^3)	12,328.00	180.00
Filling (m^3)	-	6,216.00
Excavation (m^3)	7,448.00	-

Cost – Benefit Analyses – Aljoun Area

Type	Parameter	Amount	Price after Inflation 2024 (JO)	Total (JO)
Swale	Area (m^2)	735.00	28.50	20,947.50
Soakaway	Stored Volume (m^3)	14.00	142.50	1,995.00
Pipes	Length (m)	45.18	150.00	6,777.00
Total				29,720.00

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Cost – Benefit Analyses – Aljoun Area

1. Benefit of replenishing groundwater

The rainwater that would once be lost due to runoff can be saved. When the water is infiltrated some of it will recharge the groundwater reservoir. This water will eventually be usable. The equation:

$$B_1 = p_b * V_b * \beta \qquad (1)$$

where p_b refers to the groundwater price (JO/m^3), V_b refers to the infiltration increased amount (m^3), and c refers to the groundwater recharge coefficient.

2. Benefit by lowering drainage facilities' operating expenses.

NWR facilities located in the community can reduce the cost of pipeline maintenance by reducing the quantity of runoff from precipitation that enters external drainage pipes and by alleviating strain on city pipelines. Consequently, a decrease in the volume of stormwater runoff from NWR facilities (Q, m^3), or a decrease in the quantity of external rainfall discharge, may be used to compute this benefit.

$$B_2 = s * Q \qquad (2)$$

where s refers to the operation cost per m^3 stormwater (JO/m^3).

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Cost – Benefit Analyses – Aljoun Area

3. Benefit from the flood protection expense exemption.

Before construction starts there is usually a fee for flood protection. Considering the discount rate as a payment the benefit is given by the following formula:

$$B_4 = m * A * \frac{j(1+j)^n}{(1+j)^n - 1} \qquad (4)$$

where m refers to the flood prevention charge-imposed amount (JO/m^2), A refers to the actual area of stormwater reduction and utilization facilities implemented, j refers to the discount rate (%), and n refers to the service period of NWR facilities (years).

Finally for the benefit-cost analysis the following formula can be used (benefit-cost) ratio:

$$BCR = \frac{B_t}{C_t} \qquad (5)$$

where B_t refers to the revenue earned in year t (JO), and C_t refers to the cost incurred in year t (JO).

The decision criteria, if BCR is greater than 1, the project investment was accepted.

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Thank you for your attention