International Water Management Institute

CGIAR

Nature-Based Solutions Session

SHE GROWS network
International Water Management Institute (IWMI)
The National Agriculture Research Center (NARC) research

Presented by
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Innovative water solutions for sustainable development

Food · Climate · Growth

Welcome & Objectives

Agenda

10:50 - 11:00 Members Gathering

11:00 - 11:10 Welcoming from EYJ, check-in and briefing BY IWMI.

11:10 - 12:45 NBS Session starting!

12:45 - 12:55 Q & A

12:55 - 13:00 Closing!

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International Water Management Institute (IWMI)

IWMI's global headquarters are located in Colombo, Sri Lanka. IWMI operates a network of 15 regional and country offices in Africa, Asia, and Europe.

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What Are Nature-Based Solutions?

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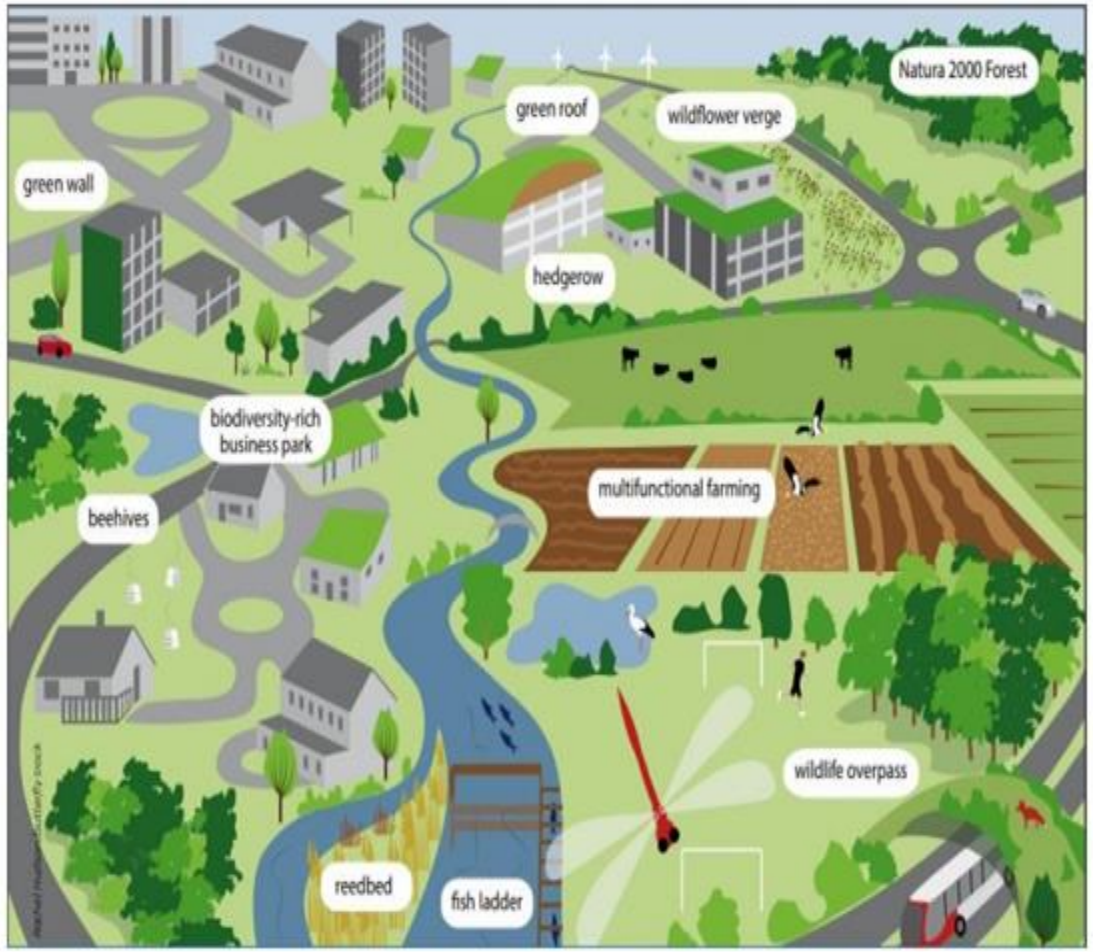
Official Definitions

- **IUCN (International Union for Conservation of Nature):** “Actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.”
- **European Commission EU:** Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits, and help build resilience.
- **UNEP (United Nations Environment Programme):** “NbS involve working with nature to address societal challenges, providing benefits for both human well-being and biodiversity.”

What Are Nature-Based Solutions?



Simple Introduction

Nature-Based Solutions (NbS) use natural systems—like trees, soil, and water—to solve everyday problems like floods, heat, and pollution.

Applications of NbS

- Protections from floods
- Protection side rivers and streams
- Protection soil erosion
- Treatment for different types of wastewater
- Increase city resilience to climate hazards (flash rains, heat waves, etc.)
- Rainwater harvesting
- Smart irrigation
- What else?

- Clean the air and water
- Provide food and green spaces
- Save money and improve health

Applications of NbS

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Applications of NbS

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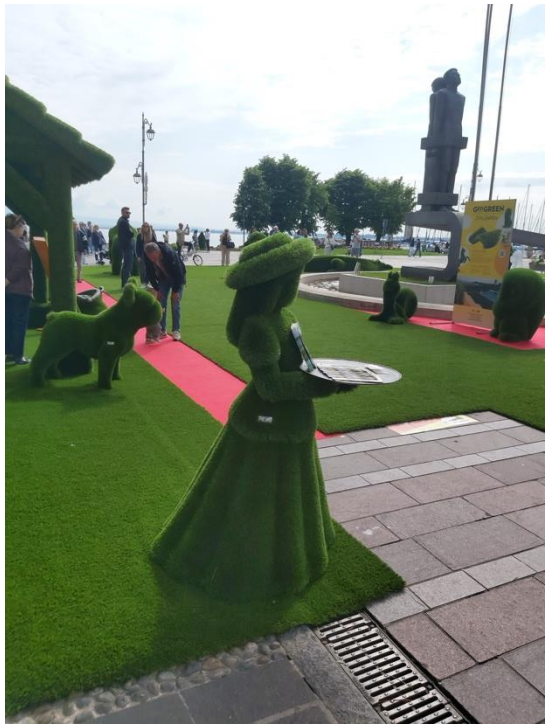
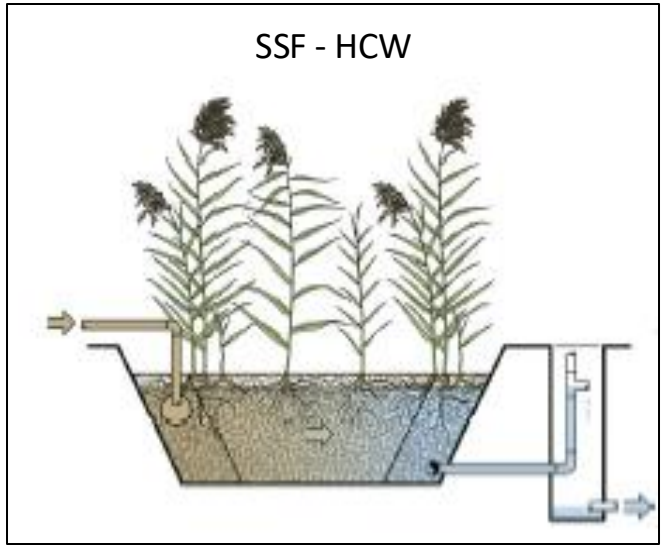
Applications of NbS

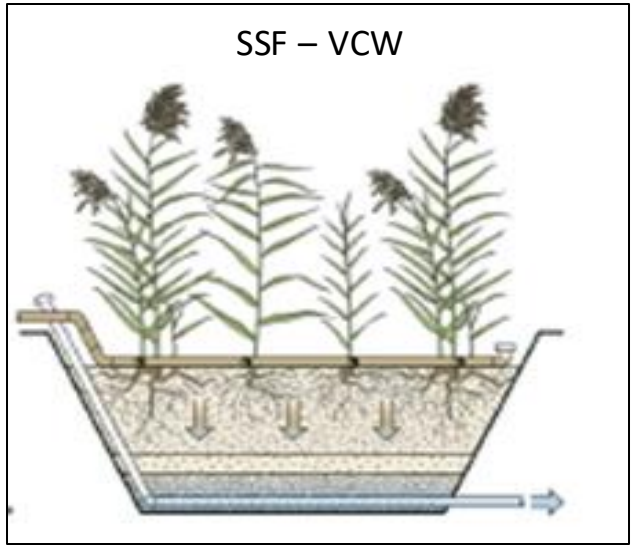
Applications of NbS



Constructed Wetlands (CWs)

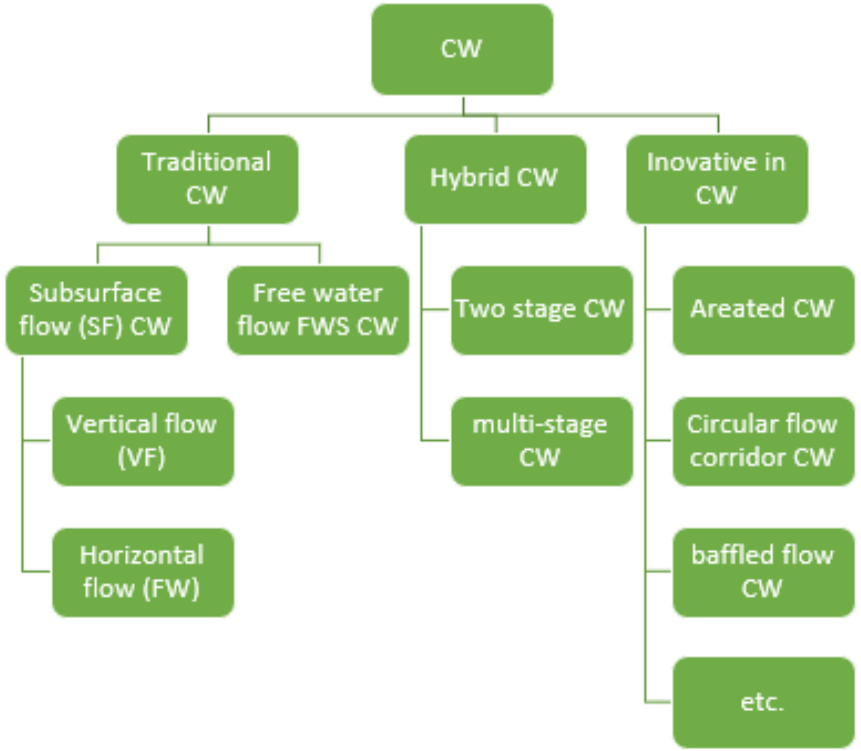
The applications of NbS in treating wastewater is treatment wetlands or constructed wetlands (CW). CWs are natural treatment technologies that efficiently treat many different types of wastewater or polluted water (domestic wastewater, agricultural wastewater, coal drainage wastewater, petroleum refinery wastewater, compost and landfill leachates, fish-pond discharges, textile mills, seafood processing,). CWs are engineered systems designed to optimize and copy processes found in natural environments and are therefore considered sustainable, environmentally friendly options for wastewater treatment.





Constructed Wetlands (CWs)

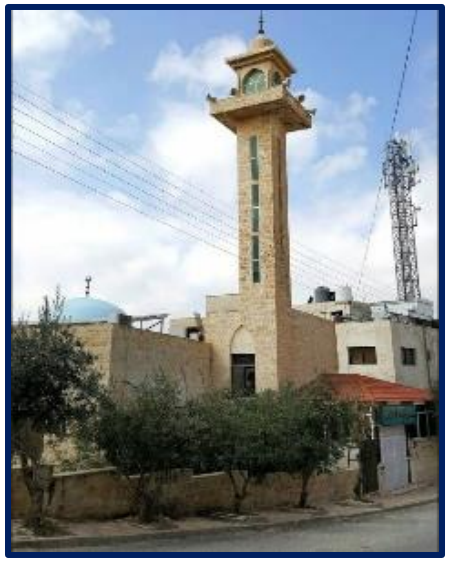
CWs have low operation and maintenance (O&M) requirements and are robust in that performance is less vulnerable to input variations. CWs can effectively treat raw, primary, secondary, or tertiary treated sewage and many types of agricultural and industrial wastewater (Nivala et al., 2017).



Main removing mechanisms for pollutant and pathogen in CWs.	
Parameter	Main removal mechanisms
Suspended solids (SS)	Sedimentation, filtration
Organic matter (OM)	Sedimentation and filtration for the removal of particulate organic matter, biological degradation (aerobic and/or anaerobic) for the removal of dissolved organic matter
Nitrogen (N)	Ammonification and subsequent nitrification and denitrification, plant uptake and export through biomass harvesting
Phosphorus (P)	Adsorption-precipitation reactions driven by filter media properties, plant uptake and export through biomass harvesting
Pathogens	Sedimentation, filtration, natural die-off, predation (carried out by protozoa and metazoa)
Heavy metals	Sedimentation, filtration, adsorption, precipitation, and biological degradation through plants and microbiological metabolism

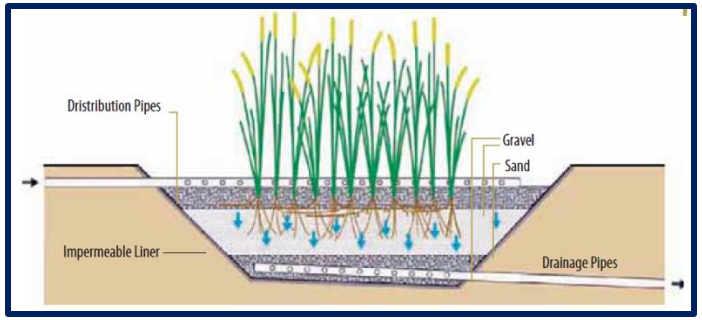
NbS in Jordan

NbS in Jordan: Constructed wetland for greywater treatment



Greywater

Gardening



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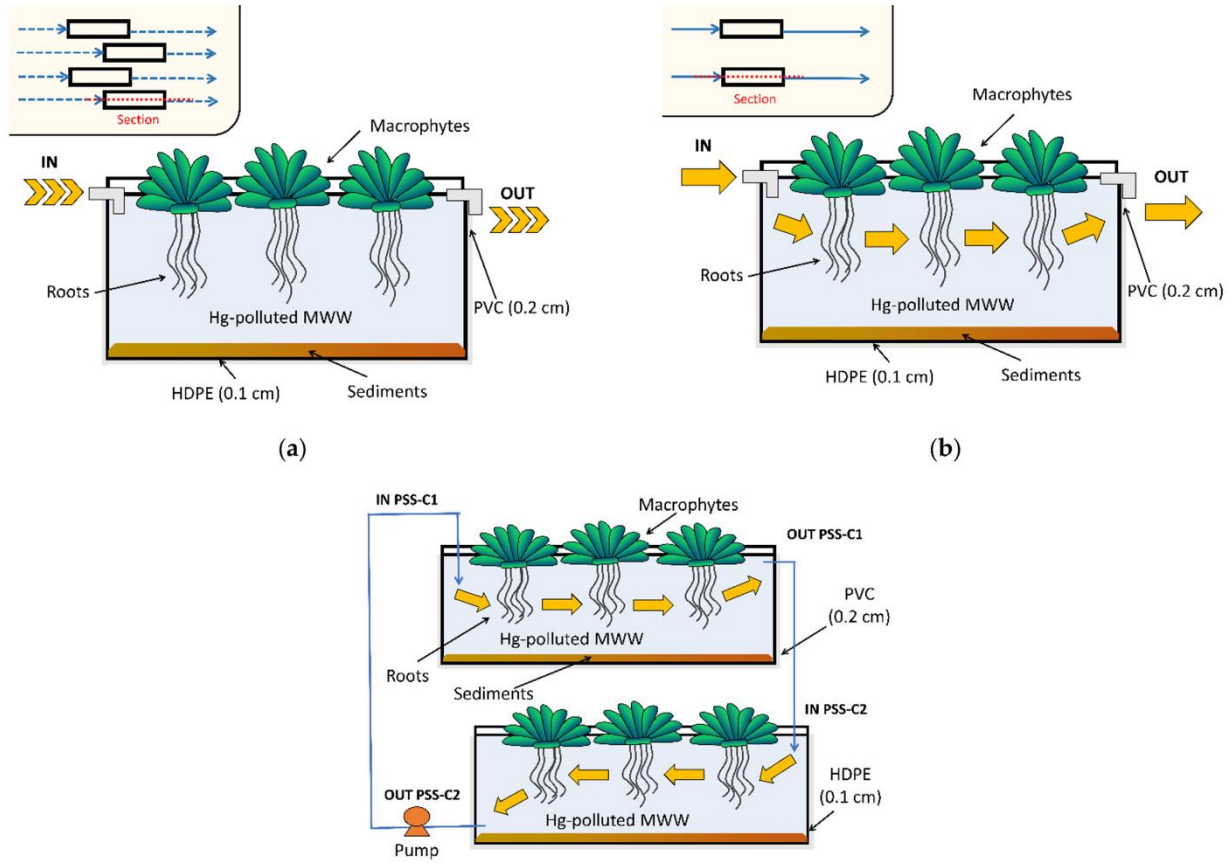
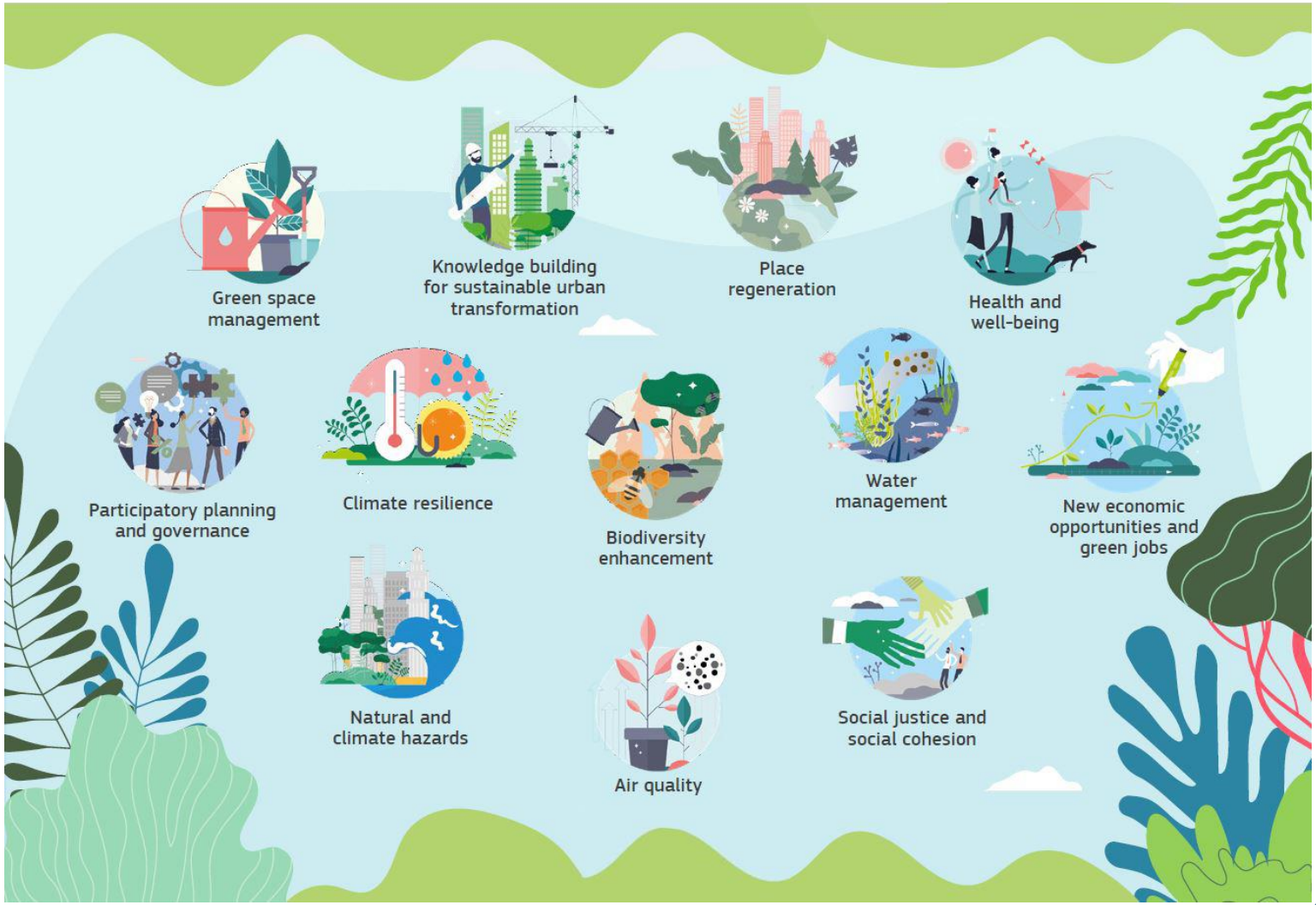
Mercury Removal from Mining Wastewater by Phytoaccumulation in Autochthonous Aquatic Plant Species

by Franco Hernan Gomez [1,2,3], Maria Cristina Collivignarelli [4,5], Ahmed Mohammad Nafea Masoud [1,2], Marco Carnevale Miino [4,*], Kelly Cristina Torres [6], Jesus Antonio Quintero [6], Sabrina Sorlini [1,2] and Mentore Vaccari [1,2,*]



Benefits and Co-benefits



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NbS: Why They Work — and What to Watch For

Why NbS Are Promising

- Low cost
- Locally available materials
- Simple to operate and maintain
- Multi-benefit
- Supports people & nature
- Job creation
- Area of innovation

Challenges of NbS

- Land requirements
- Community acceptance
- Slower results
- Maintenance culture
- Policy and governance gaps

NbS in the Community

- Tree planting in streets or schoolyards
- Rain gardens (e.g. Al Zohour project in Amman)
- Green sunshades, green bus stations, etc.
- Cleaning and protecting local Wadis
- Protection of watershed and soil health
- Green belts (dust solutions)
- Creating shared gardens or shared solutions
- Starting awareness groups with neighbors

NbS at Home-level

NbS	Purpose	Benefits
Rainwater Harvesting with Storage Barrels	Collect and store rainwater from rooftops for later use	• Increases water availability • Reduces urban runoff and flooding • Supports garden or cleaning water needs
Greywater Reuse for Irrigation	Reuse water from sinks, showers, and laundry for garden irrigation	• Reduces freshwater use • Supports home gardens • Reduces pressure on municipal water systems
Vertical Gardens on Building Walls	Maximize greenery in small spaces and improve building insulation	• Reduces heat transfer into buildings • Improves aesthetics and air quality • Supports pollinators (if using flowering plants)
Rooftop and Balcony Gardens	Reduce indoor temperatures, grow food, and improve air quality	• Enhances insulation and thermal comfort • Provides fresh vegetables and herbs • Absorbs rainwater runoff • Offers space for leisure and mental well-being
Shading with Climbing Plants (e.g., Vines, Creepers)	Provide natural shade for windows, balconies, and outdoor spaces	• Cools air and surfaces • Enhances privacy • Creates a micro-habitat for small birds and insects
Indoor Plants for Humidity and Cooling	Use transpiration to naturally cool rooms and enhance indoor air	• Improves indoor climate • Enhances psychological well-being

Criteria for Selecting NbS at Home-level

Criteria	Description
Feasibility	Is it technically and financially practical for your household to implement?
Water efficiency	Does it reduce water use or enhance water availability?
Space requirement	Can it be installed on a rooftop, balcony, wall, or small garden?
Maintenance needs	Can the household manage the upkeep with minimal training or cost?
Co-benefits	Does it improve comfort, air quality, food access, or health?
Cultural appropriateness	Does it align with local customs, beliefs, or aesthetics?

NbS in Agriculture

- In your personal experience, what negative effects of climate change have you noticed in agriculture?.
- How much do you think agriculture contributes to climate change?
- Can you give examples where agriculture benefits from nature?

NbS in Agriculture

According to FAO: Agriculture Nature-Based Solutions (Ag-NBS) are an effective, long-term, cost-efficient approach to tackling sustainable land and water resources management and climate change. These practices can help improve water availability and quality as well as restore ecosystems and soils worldwide, while offering substantial health co-benefits and achieving global food security

- NbS is working with nature rather than against it.
- NbS leverage ecosystem services to enhance agricultural resilience
- NbS drive sustainability by saving resources and minimizing environmental harm
- NbS approaches systematically considers the synergies and tradeoffs between agricultural productivity and environmental sustainability.

Goals of NbS in Agriculture

Biodiversity: By promoting a variety of plant species to enhance resilience and productivity.

Nutrient Cycling: Relying on natural processes to recycle nutrients and reduce soil degradation.

Water Retention: Retaining water flows and conserving water.

Healthy Soils: Enhanced water infiltration and retention, reduced runoff and erosion.

Climate Adaptability: Enhanced adaptive capacity for improved resilience to climate change impacts.

Cost-effectiveness: Cost-effective food production systems leveraging natural processes.

Healthy Ecosystems: Restoring watersheds to improve water quality and quantity.

Balanced systems: Holistic approach considering the interconnections between different elements such as water, soil, plants and animals etc.

Case Study of NbS in Agriculture

Pilot to promote sustainable farming practices and enhance agricultural resilience in Qaa Baalbek, Lebanon

The RNBWS pilot under Al Murunah addresses water scarcity and agricultural sustainability through a climate-smart demonstration farm with the following features:

- Resilient crop choices: Plantation of native trees that are drought and heat-tolerant and have low water requirements.
- Biodiversity: The 2-hectare farm is divided into blocks each for Pistachio, Walnut, Capers and Grapevines. Further, the intercropping of vegetables is planned within young trees for early financial returns and sustainability.
- Wind breaks: Native trees planted at the boundary of demonstration plot to act as wind breaks that provide habitat for birds and reduce irrigation requirements.
- Solar-powered irrigation: Dependance on 100% clean energy to minimize carbon footprint.
- Efficient irrigation management: Implementation of drip irrigation system for maximum water use efficiency.
- Organic manuring: The virgin soil is applied organic manures for better management.

Case Study of NbS in Agriculture

Pilot to promote sustainable farming practices and enhance agricultural resilience in Qaa Baalbek, Lebanon

- Rainwater harvesting: Irrigation source for the demonstration farm is Qaa lake that harvests and store rainwater.
- Resilient community: Empowering women-led CBO to manage demonstration farm effectively through capacity-building programs on irrigation system operation and maintenance.

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Case Study of NbS in Agriculture

Pilot NBS Intervention for Sustainable Irrigation and Salinity Management in Nile River Delta

The Egypt Pilot promotes sustainable agriculture, and has following features:

- Solar-powered irrigation: Dependence on renewable solar energy for pumping and distribution reduces reliance on fossil fuels and supports low-carbon farming practices.
- Diverse cropping patterns: Provision of canal water to each small field, improves flexibility for farmers in selecting different crops according to market and climate.
- Enhanced Irrigation Efficiency: Pipe network for irrigation reduce conveyance and seepage losses, hence improve water-use efficiency at the field level.
- Salt Management and Soil Health: Implementation of leaching practices to prevent salt accumulation in the root zone and continuous salinity monitoring through helps to mitigate rising salt concentrations and ensures sustainable crop productivity.

Case Study of NbS in Agriculture

Farmer led ultra-low pressure and low-cost drip irrigation system in Arid regions of Balochistan, Pakistan

Water Efficiency:

- Water directly to the root zone, minimizing evaporation and runoff.
- Precise delivery tailored to crop requirements.
- Water resource sustainability and scarcity mitigation in arid and semi-arid regions.
- Farmer friendly operations and maintenance.

Energy Efficiency:

- Reduced pumping costs needed for groundwater extraction and pressurization.
- Potential for renewable integration reducing dependence on fossil fuels.
- Reduced chemical fertilizer and weedicide requirements.
- Decreased tillage needs.

Case Study of NbS in Agriculture

Farmer led ultra-low pressure and low-cost drip irrigation system in Arid regions of Balochistan, Pakistan

Food Security:

- Improved plant growth and enhanced crop yields.
- Diverse cropping options supporting high-value and water-sensitive crops.
- Reduced risks of crop failure and enhanced resilience by ensuring consistent and deficit water supply.

Environmental Impact:

- Minimized soil degradation by avoiding over-irrigation and excessive tillage.
- Precise nutrient delivery and reduced fertilizer pollution.
- Reduction in methane emissions.

Case Study of NbS in Agriculture

Farmer led ultra-low pressure and low-cost drip irrigation system in Arid regions of Balochistan, Pakistan

Crop	Duration	Estimated Evapotranspiration	Irrigation Water Used	Water Use Efficiency	Conventional WUE	Absolute Gain
Wheat	174 days	364 mm	431 mm	84.45%	55 %	⬆ 29.45%

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Thank You - Q&A

Innovative water solutions for sustainable development

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