

Urban Lakes and Wetlands: Opportunities and Challenges in Indian Cities

Case Study of Delhi

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Organisation of Presentation

- **Introduction**
 - Lake v/s urban lake
 - Impact of urbanisation on lakes
 - Status of lakes in Delhi
- **Materials and Method**
 - National wetland inventory of India (MoEF)
 - Blueprint for water augmentation in Delhi (INTACH)
 - Survey of lakes of Delhi (primary research)
 - Restoration of Hauz Khas
- **Result & Conclusion**
 - Opportunities
 - Challenges



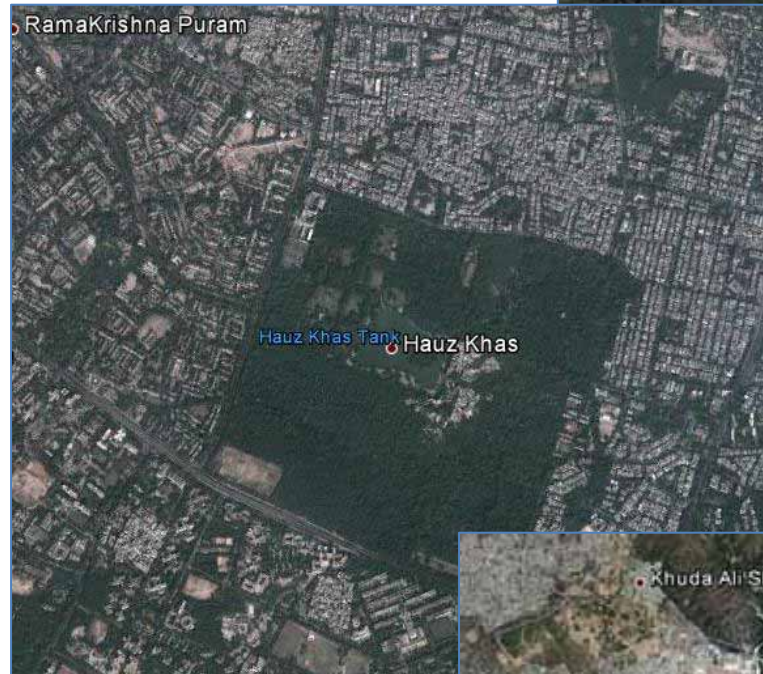
INTRODUCTION



Lake v/s Urban Lake

Is the difference
only
perceptual?

- Intensively built environment
- Altered hydrology, lost watershed
- Runoff, polluted
- *Lake is a reflection of its watershed*



Impact of Urbanisation on Lakes

Hydrology

- Decreased surface storage of stormwater results in increased surface runoff
- Increased stormwater discharge relative to baseflow discharge
- Increased erosion
- Changes occur in water quality
 - increased turbidity
 - increased nutrients, metals, organic pollutants,
 - decreased O₂
- Decreased groundwater recharge
- Increased floodwater frequency and magnitude
- Increase in range of flow rates



Impact of Urbanisation on Lakes

Geomorphology

- Decreased sinuosity of wetland/ upland edge reduces amount of ecotones habitat
- **Decreased sinuosity** of stream and river channels results in **increased velocity** of stream water discharge to receiving wetlands
- Alterations in shape of slopes(e.g., convexity) affects water gathering or water disseminating properties



Impact of Urbanisation on Lakes

Vegetation

- Large number of **exotic species** present
- Restricted pool of pollinators and fruit dispersers
- Small remnant patches of habitat not connected to other natural vegetation - **Fragmentation**
- Human enhanced dispersal of some species
- Trampling along wetland edges and periodically unflodded areas

Fauna

- Species with **small home ranges**, high reproductive rates, high dispersal rates favoured
- 'edge' species favoured over forest-interior species
- Absence of upland habitat adjacent to wetlands
- Absence of wetland/upland ecotones
- Human presence disruptive of normal behaviour



Urban Lake Issues in Indian Cities

- Hydrology; loss of watershed due to urbanisation
- Diversion of natural runoff through stormwater drain
- Pollution- solid waste and sewage
- Water balance
- Lowing of water table
- Lack of groundwater recharge



MATERIALS AND METHOD



Delhi: Lakes and Wetlands

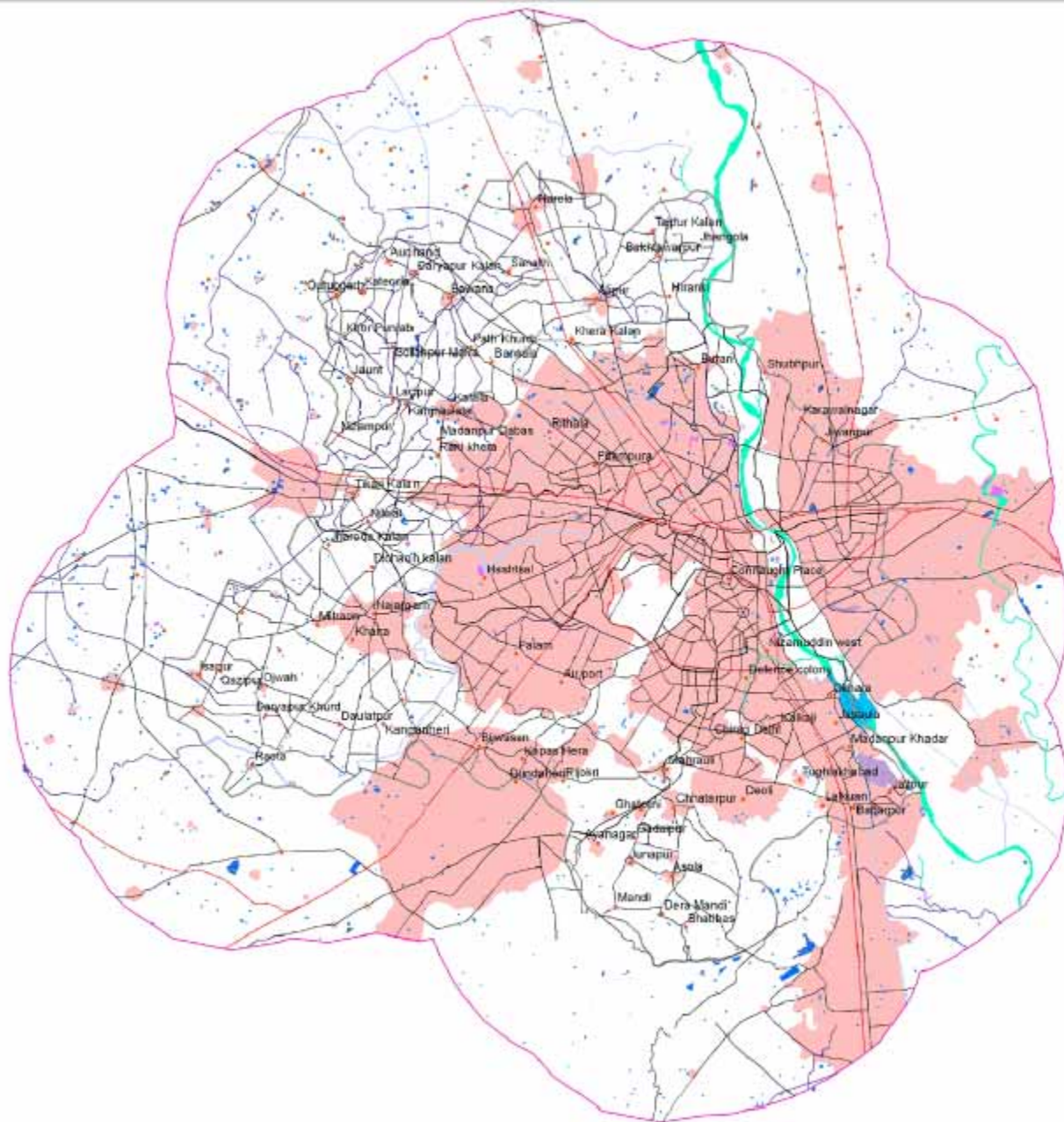
- National Inventory
- INTACH's Blueprint for Water Augmentation in Delhi
- Survey of lakes



National Inventory

Sr. No.	Wetland Category	Number of Wetlands	Total Wetland Area	% of wetland area	Open Water	
					Post-monsoon Area	Pre-Monsoon Area
	Inland Wetlands - Natural					
1	Lakes/Ponds	11	106	4.15	100	60
2	Ox-bow lakes/ Cut-off meanders	-	-	-	-	-
3	High altitude wetlands	-	-	-	-	-
4	Riverine wetlands	5	15	0.59	13	14
5	Waterlogged	10	86	3.36	54	65
6	River/Stream	26	1116	43.66	826	845
	Inland Wetlands -Man-made					
7	Reservoirs/Barrages	8	230	9.00	124	153
8	Tanks/Ponds	352	466	18.23	441	418
9	Waterlogged	29	471	18.43	85	145
10	Salt pans	-	-	-	-	-



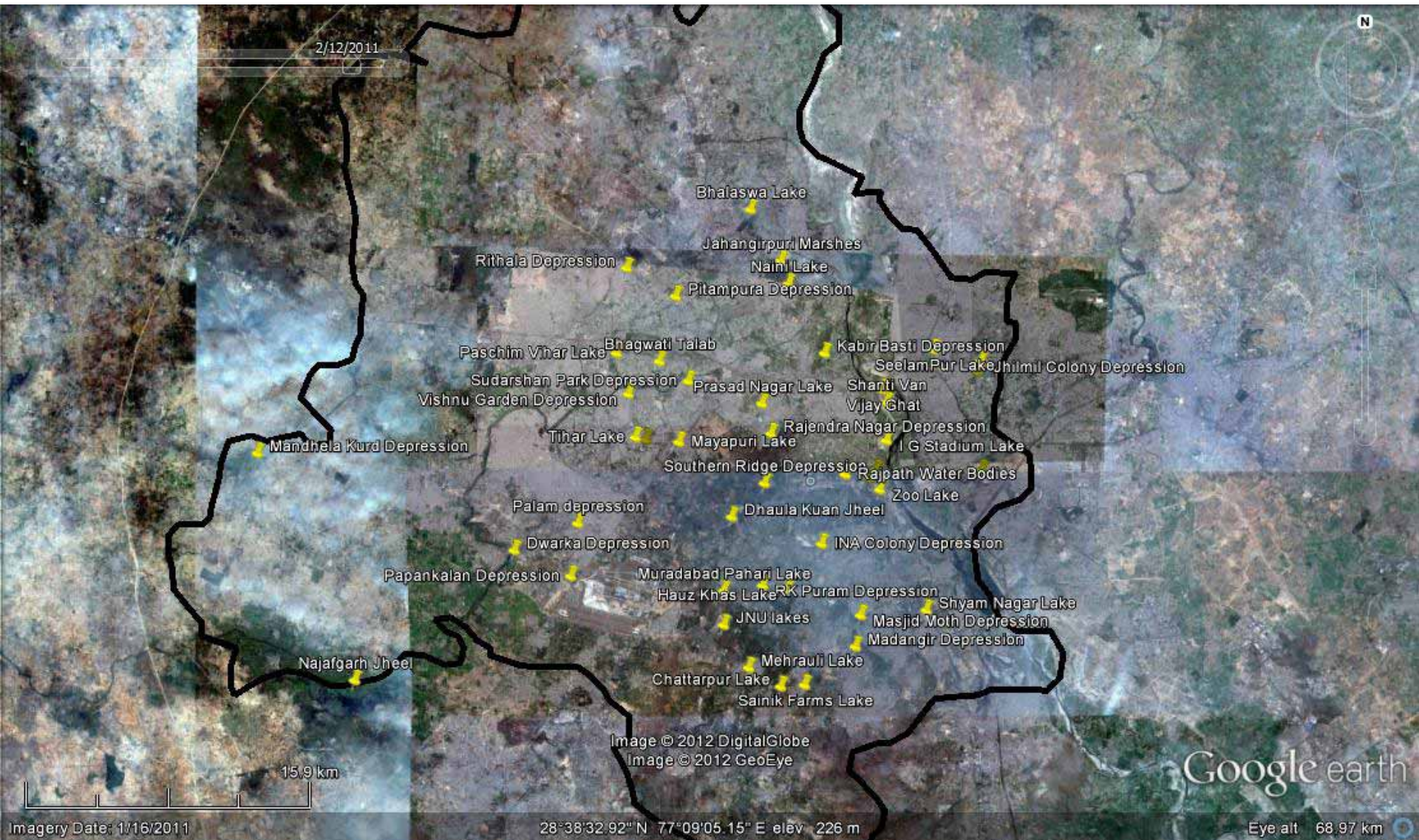


Blueprint for Water Augmentation in Delhi

- 44 Lakes
- 355 Village ponds
- Surface area and catchment of each lake
- Water storage and recharge capacity
- 22 lakes remain



Survey of lakes and water bodies in Delhi (INTACH)



Restoration of Hauz Khas

- Base information
- Approach
- Benefits
- Challenges



An Early View of The Hauz Khas



Fig. 2. Hauz Khas Madrasa. Seen from the northwest. The tomb of Firuz Shah is near the center. The south side of the madrasa extends to the right and the east side to the left with the mosque on the far left. (Photo: Jennifer Lort)





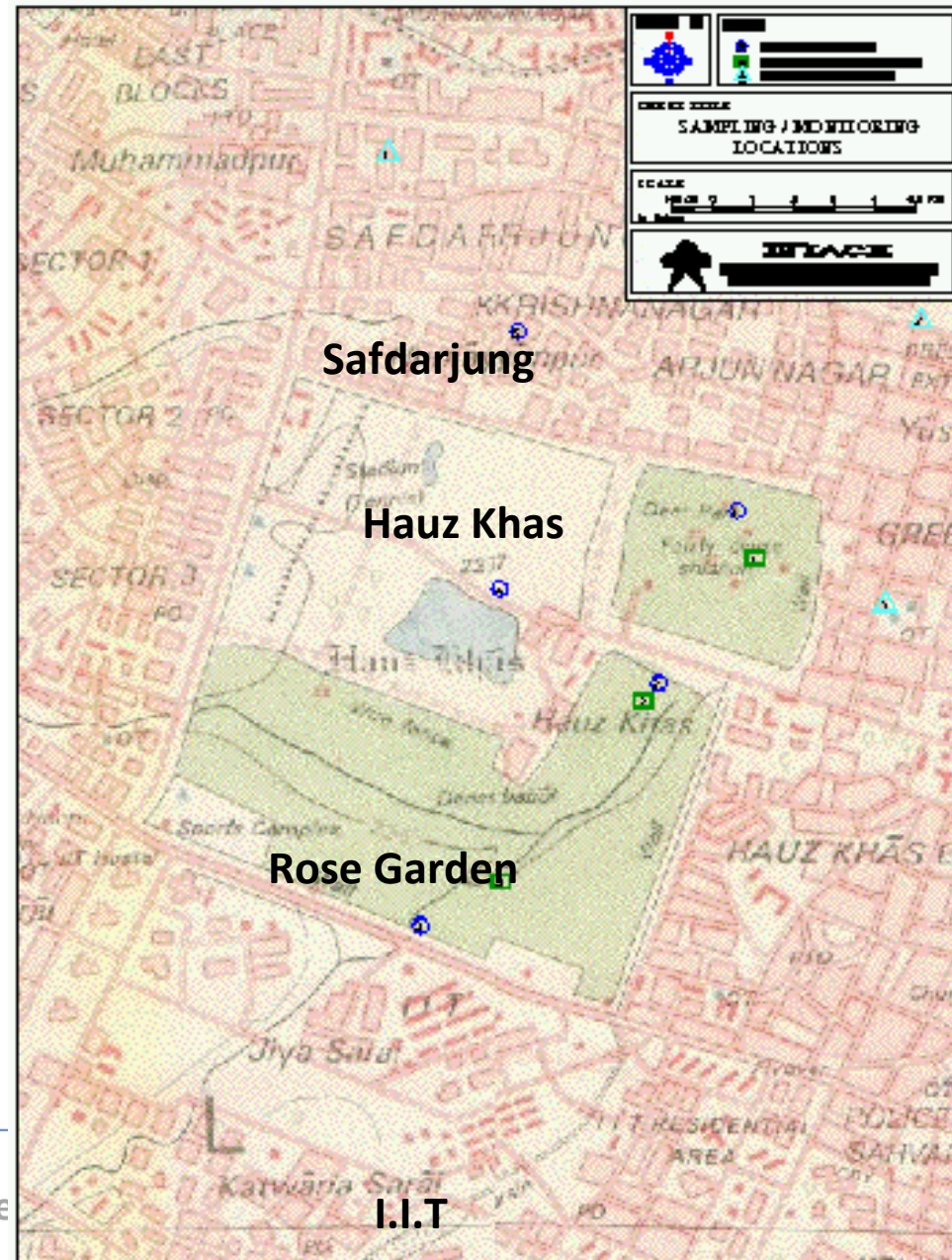
Aerial Photograph 2003

PAN + LISS3 - 0.6 Mtr. Resolution



Water Harvesting- Hauz Khas

- Ancient Reservoir Made By Allaudin Khilji In 1298 A.D.
- Overlooked By Tughlaq Monuments
- Reservoir Dry On Account Of Fall in Water Table and Diversions of Inflows Since 1959.
- Reservoir Area : 58515 Sq. Mtrs.
- Depth Range : 2 – 3.5 Mtrs
- Storage Capacity : 128733 Cu.M.
- Lithology : Silt With Gravel
- Depth to Bedrock : 70 MBGL.
- Water Table Depth: 20.0 MBGL.
- Permeability Coefficient : 3.54×10^{-7} cm/sec



Pre Project Condition

(May, 2003)



Bed Of The Hauz



**Vegetation Growth In The Bed
Of Hauz**





Ground Water

Improvement in Major Parameters

PRE-PROJECT

(March 2003)

- pH : 7.6
- Chloride : 70 mg/l
- BOD : 3 mg/l
- COD : 10 mg/l
- Nitrate : 20 mg/l
- Ammonia : 0.04mg/l

MID-PROJECT

(April 2004)

- pH : 7.1
- Chloride : 84 mg/l
- BOD : 1 mg/l
- COD : 4 mg/l
- Nitrate : 1.14 mg/l
- Phosphate : 1.44 mg/l
- Residual Chlorine -ND



Water Parameters

SANJAY VAN (November, 2004)

- pH : 7.5
- TDS : 464 mg/l
- TSS : 28 mg/l
- Nitrate : 6.67 mg/l
- Fluoride : 0.73 mg/l
- Phosphate : 4.63 mg/l
- BOD : Less Than 1 mg/l
- COD : 4 mg/l
- DO : 6.3mg/l

HAUZ RESERVOIR (November, 2004)

- pH : 8.5
- TDS : 778 mg/l
- TSS : 101 mg/l
- Nitrate : 5.43 mg/l
- Fluoride : 0.32 mg/l
- Phosphate : 4.71 mg/l
- BOD : 8 mg/l
- COD : 77.22 mg/l
- DO : 6.6mg/l





Day I



Day V



Day XV



Day XXV

Week	pH		Turbidity (FNU)		Conductivity (µmhos/cm)		BOD (mg/L)	
	Spot 1	Spot 2	Spot 1	Spot 2	Spot 1	Spot 2	Spot 1	Spot 2
First Week (13 – 19 July 2007)	9.57	9.25	102	174	800	797	50	70
Second Week (20 – 26 July 2007)	9.07	9.13	52	158	787	787	17	34
Third Week (27 July-02 August 2007)	8.82	9.02	50	131	761	748	15	28





RESULTS & CONCLUSION



Urban Lakes: Opportunities

- Creation of environmental asset
- Improvement in groundwater resource on which neighboring communities are dependent
 - 5 meters over a span of 3 yr
- The yield from surrounding tubewells has increased thereby reducing operational time and consequently reducing energy consumption
- 12 species of water birds including migratory birds
- Micro climatic amelioration
- Conservation of biodiversity
- Opportunity for urbanites to experience bird watching, ecosystem learning
- **Could be easily replicated in all Indian cities**



Urban Lakes: Challenges

- Sewage and soil waste management
- Dense urbanisation; not sensitive towards environmental concerns
- New approach hence, skepticism
- Multi stakeholder- difficult to get all players on same field
- Multiplicity of agencies
- Needs close monitoring and continuous treatment of inflow water & insitu treatment
- Lack of research in urban forestry, wetlands etc. proves limiting - confidence in implementing such projects is low
- Lack of awareness regarding ecological approaches



Thank You

