iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** VII **Month of publication:** July 2025

DOI: https://doi.org/10.22214/ijraset.2025.73131

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue VII July 2025- Available at www.ijraset.com

Nature-Based Solutions and Green Infrastructure in Watershed Management

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Abstract: Nature- Grounded results (NBS) and Green Structure (GI) are decreasingly honored as effective and sustainable approaches in watershed operation. These strategies influence natural processes and ecosystem services to address hydrological challenges, alleviate flooding, ameliorate water quality, and enhance biodiversity. This report explores the integration of NBS and GI in watershed operation, pressing styles, accoutrements, results, conversations, and crucial conclusions. The comprehensive analysis includes numbers, tables, and references to applicable literature to support the findings.

I. INTRODUCTION

Watershed operation plays a critical part in sustaining water coffers, controlling corrosion, and maintaining ecological balance. Traditional finagled approaches frequently overlook ecological integrity and long- term sustainability. Nature- Grounded results and Green Structure give volition or reciprocal strategies by exercising natural rudiments and processes. exemplifications include reforestation, swamp restoration, passable pavements, and bioswales. The global shift towards NBS and GI is driven by their capability to deliver multiple co- benefits similar as climate change mitigation, enhanced adaptability, and cost- effectiveness. This report discusses the principles, operations, and effectiveness of NBS and GI within the environment of watershed operation.

II. METHODS AND MATERIAL

A. *Study Area*

A representative milepost with mixed land use husbandry, civic, timber) was named for this study

B. *Data Collection*

1) Hydrological data: rainfall, runoff, infiltration rates.
2) Land use/land cover (LULC) maps.
3) Soil types and topography.

C. *Nature-Based Solutions Applied*

1) Reforestation and afforestation
2) Wetland restoration
3) Stream buffer zones
4) Green roofs and permeable pavements
5) Rain gardens and bioswales

D. *Analytical Methods*

1) Hydrological modelling using SWAT (Soil and Water Assessment Tool)
2) GIS-based spatial analysis
3) Cost-benefit analysis

III. RESULTS AND DISCUSSION

A. *Hydrological Impact*

Hydrological Impact perpetration of NBS and GI led to a significant reduction in peak runoff and total runoff volume by 20- 35. The increase in infiltration and groundwater recharge was observed

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B. Water Quality Improvement

NBS practices reduced sedimentation and nutrient lading(nitrogen and phosphorus) into water bodies. Average reduction of 30 in nutrient situations was recorded.

C. Biodiversity and Ecosystem Services

The establishment of green structure enhanced niche connectivity and supported advanced biodiversity indicators.

D. Economic and Social Benefits

Analysis revealed that original investments in NBS and GI are neutralize by long- term savings through reduced flood tide damage, bettered water quality, and recreational benefits.

TABLE I

SOLUTION	HYDROLOGICAL BENEFIT	WATER QUALITY IMPROVEMENT	COST-EFFECTIVENESS
Wetland Restoration	High	High	Moderate
Green Roofs	Moderate	Low	High
Bioswales	Moderate	Moderate	High
Reforestation	High	High	Low

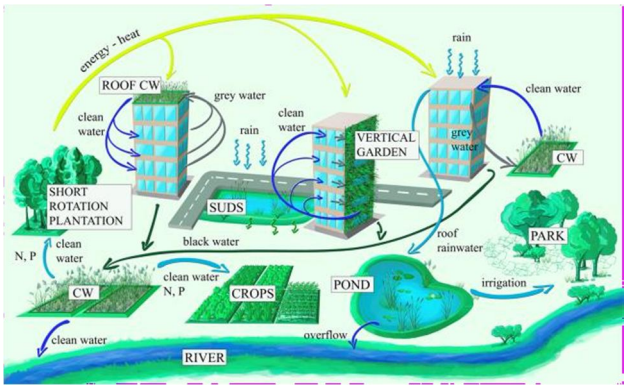
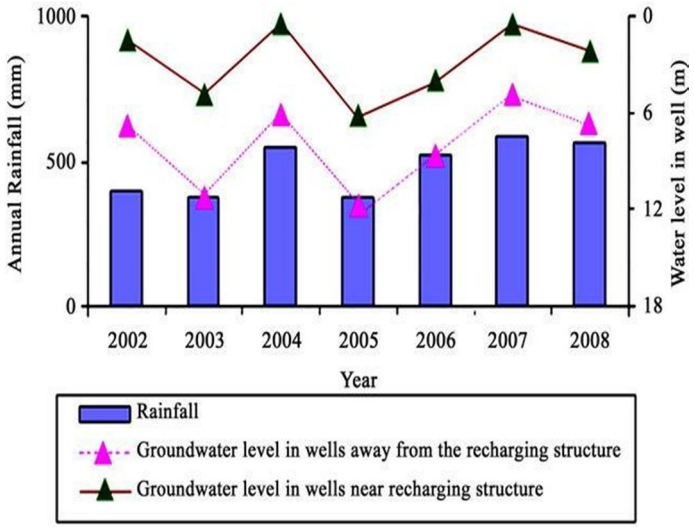


Figure 1: Nature-Based Solutions and Green Infrastructure in Watershed Management



A. Links and Bookmarks

- United Nations Environment Programme on NBS
- European Commission on Green Infrastructure
- SWAT Model Official Site
- Altieri, M.A. 1989. Agroecology – A new research and development paradigm for world agriculture. Agriculture, Ecosystems and Environment 27: 37– 36.
- Barot, S. et al. 2015. Evolving away from the linear model of research: A response to Courchamp et al. Trends in Ecology and Evolution 30: 368– 370.
- Barot,S. J. C. Lata, G. Lacroix. 2012. Meeting the relational challenge of ecological engineering within ecological sciences. Ecological Engineering 45: 13– 23.
- Benedict, M. A., E.T. McMahon. 2006. Green infrastructure: Linking landscapes and communities. Washington, D.C.: Island.

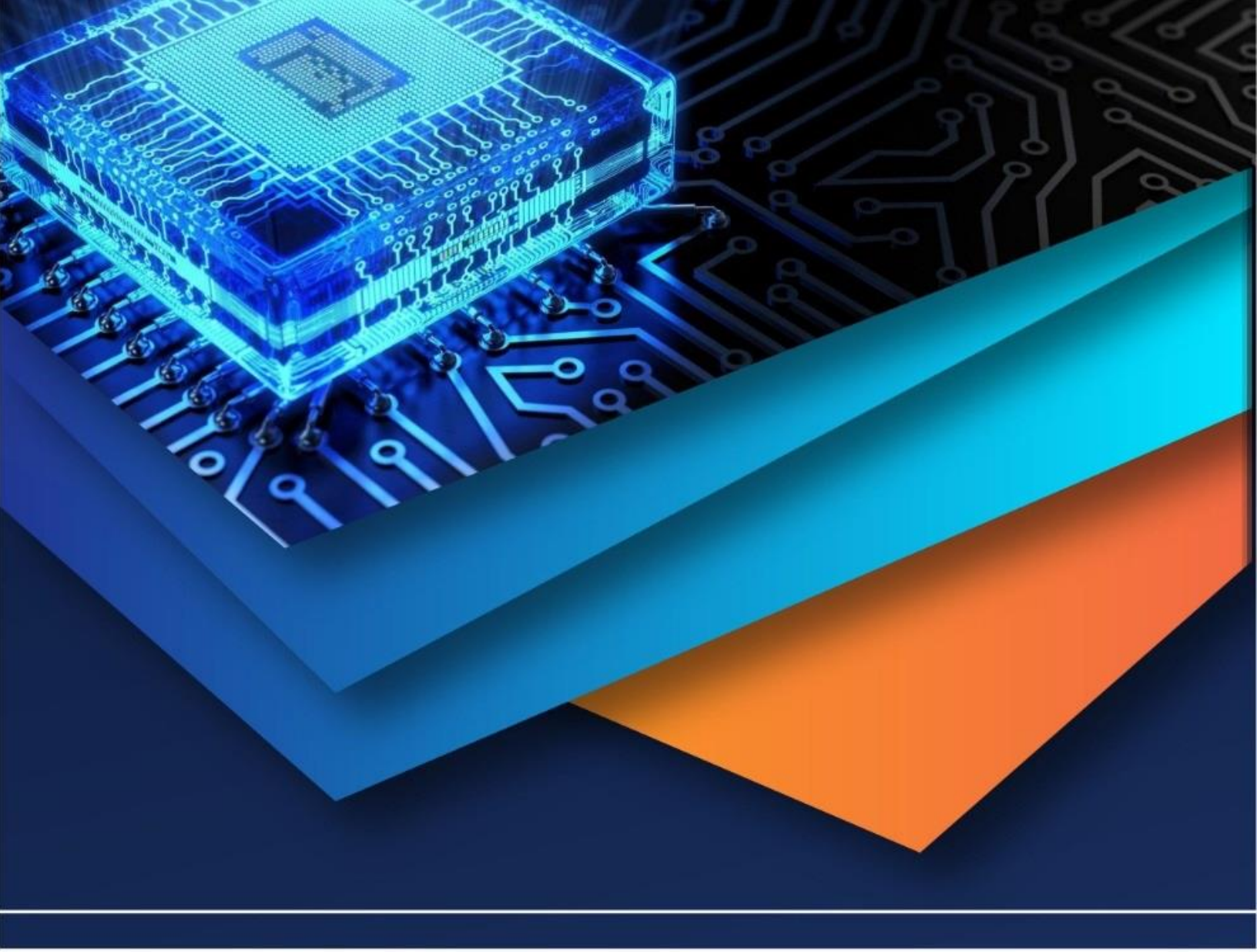
IV. CONCLUSION

Nature-Based Solutions and Green Infrastructure provide innovative, multifunctional approaches to watershed management that align with ecological principles. Their application results in enhanced water management, biodiversity conservation, and climate resilience. Although initial investments may be higher than conventional methods, the long-term environmental, economic, and social benefits justify their adoption. Future research should focus on scaling up these solutions, policy integration, and community participation.

REFERENCES

[1] European Commission. (2013). Green Infrastructure (GI)— Enhancing Europe's Natural Capital.
[2] United Nations Environment Programme. (2021). Nature- Based Solutions for Climate Change.
[3] Arnold, J.G., et al. (1998). SWAT: Soil and Water Assessment Tool. USDA Agricultural Research Service.
[4] Cohen-Shacham, E., Walters, G., Janzen, C., & Maginnis, S. (2016). Nature-based Solutions to Address Global Societal Challenges. IUCN.
[5] Gill, S.E., Handley, J.F., Ennos, A.R., & Pauleit, S. (2007). Adapting Cities for Climate Change: The Role of the Green Infrastructure. Built Environment.

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