

# Case Studies of bioengineering using NbS for strengthening resilience in WASH

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FOR WATER  
AND SANITATION  
**CRDF** CEPT  
UNIVERSITY

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# NbS, Bioengineering & Climate Resilience

## CORE TECHNIQUES & APPLICATIONS



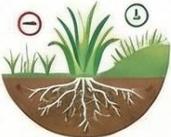
### Using Nature to Heal Nature

NbS employ natural processes to remove pollutants and improve overall ecosystem health.

### Key Bioengineering Techniques



Bioremediation



Phytoremediation



Phytostabilization



### Essential for Water Security

NbS improve water retention, purification, and the resilience of WASH services.

## THE DUAL DIVIDENDS OF NbS

### Direct Climate Resilience Benefits



Flood Control



Drought Resilience



Water Quality Regulation

### Indirect Co-Benefits



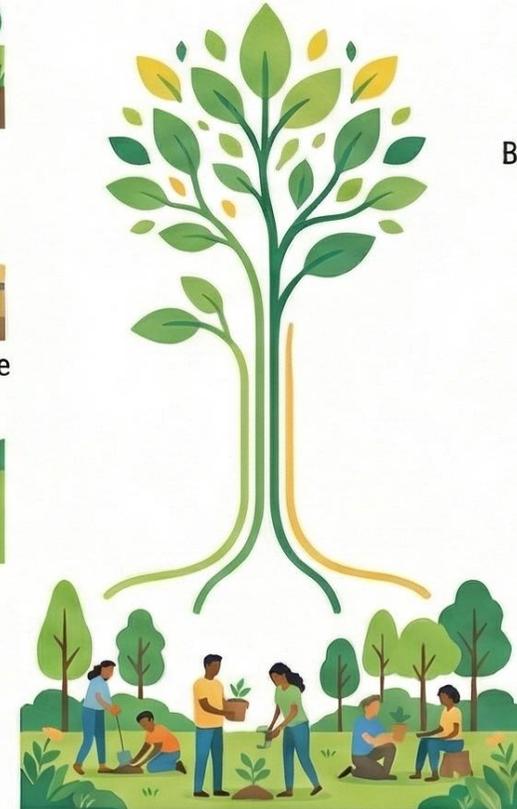
Biodiversity Conservation



Livelihood Generation



Carbon Sequestration



### Strengthening Social Cohesion

Fosters community stewardship of ecosystems, bringing people together.

# Areas of Intervention: Contained & Flowing Water Bodies



Adverse climate resistant

Adverse soil resistant

Drought resistant

Polluted water resistant

Local availability

Easy multiplication

Nutrient intake capacity

Heavy metals uptake capacity

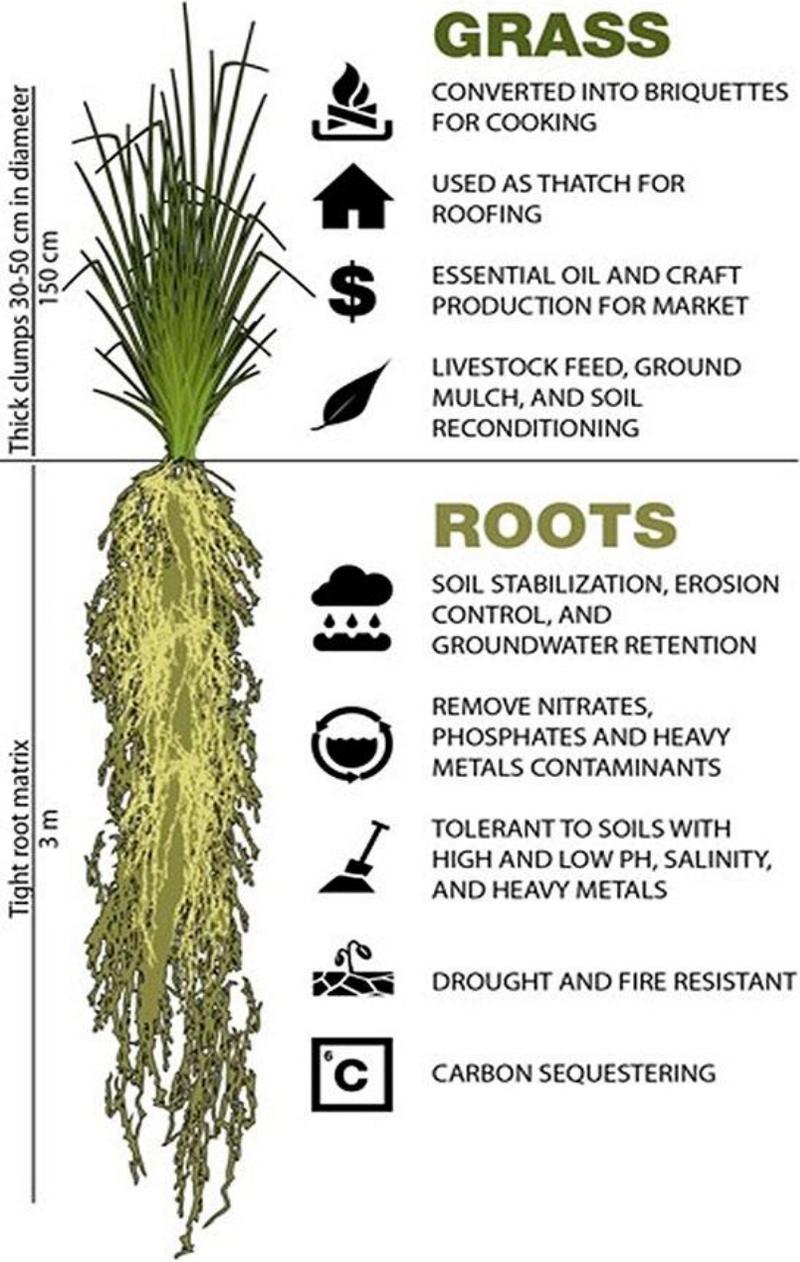
Non-invasive

Animal resistant

Submergence resistant

# VETIVER

*Chrysopogon zizanioides*



## GRASS



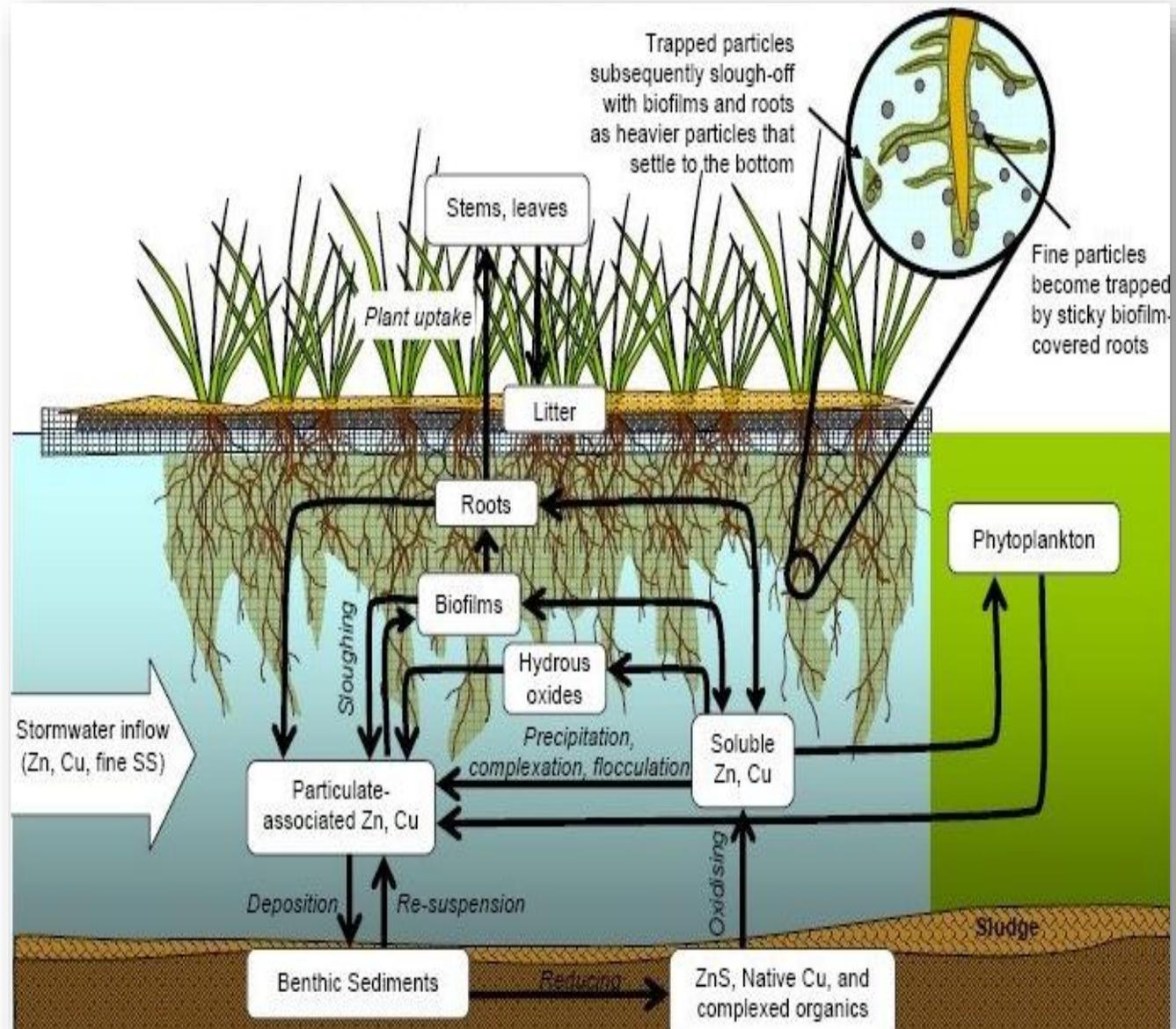
- CONVERTED INTO BRIQUETTES FOR COOKING
- USED AS THATCH FOR ROOFING
- ESSENTIAL OIL AND CRAFT PRODUCTION FOR MARKET
- LIVESTOCK FEED, GROUND MULCH, AND SOIL RECONDITIONING

## ROOTS



- SOIL STABILIZATION, EROSION CONTROL, AND GROUNDWATER RETENTION
- REMOVE NITRATES, PHOSPHATES AND HEAVY METALS CONTAMINANTS
- TOLERANT TO SOILS WITH HIGH AND LOW PH, SALINITY, AND HEAVY METALS
- DROUGHT AND FIRE RESISTANT
- CARBON SEQUESTERING

# The Hydroponic Vetiver System (HVS)



# HVS materials



# Case Study 1: Water body eco-restoration: Morepukur, Rishra



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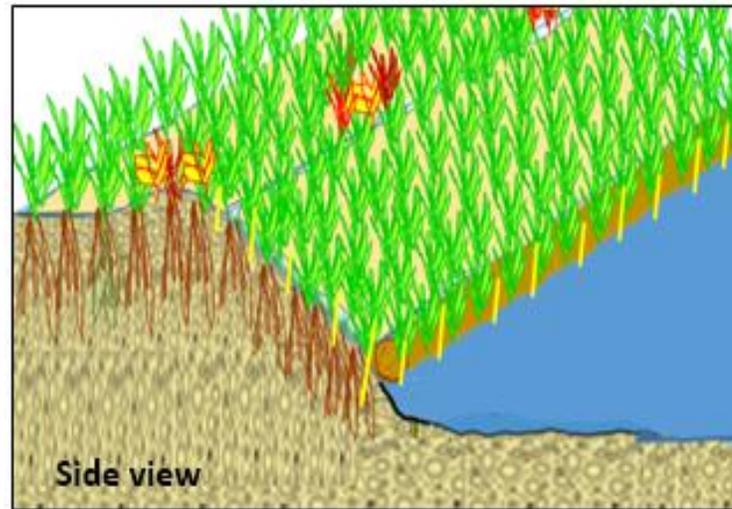
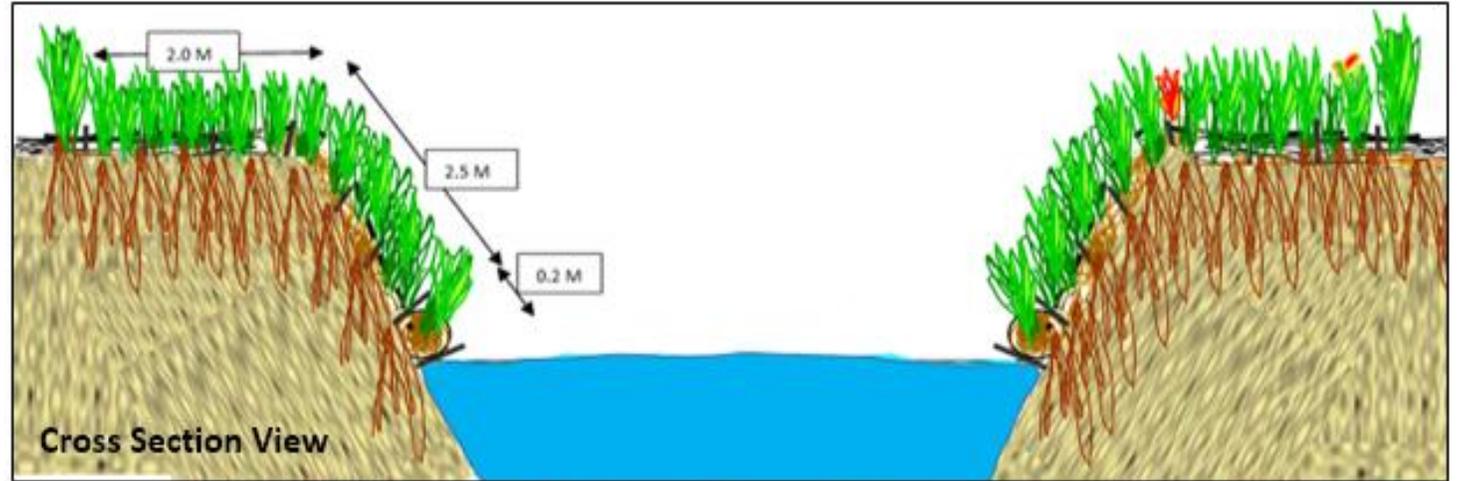


**BEFORE**

**AFTER**



# Case Study 2: Embankment Eco-restoration: Belegghata Canal



# Case Study 2: Embankment Eco-restoration: Belegghata Canal



# Case Study 2: Embankment Eco-restoration: Belegghata Canal



# Case Study 3: Embankment Stabilization: Bankura



# Case Study 3: Embankment Stabilization: Bankura



# Case Study 3: Embankment Stabilization: Bankura



Stabilisation of 20,000 sq.m



# Case Study 4: Flyash Dumpsite Stabilization, Bokaro, Jharkhand

Area : 5,500 sq.m (55 m x 100 m)



# Case Study 4: Flyash Dumpsite Stabilization, Bokaro, Jharkhand



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# Highway slope stabilization



# Livelihoods Generation

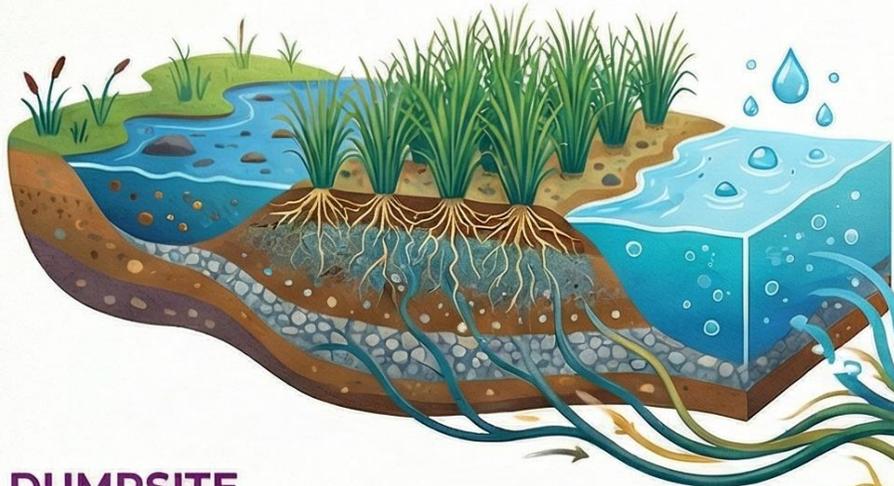


# Livelihoods Generation



# NbS Applications using VETIVER

## WASTEWATER MANAGEMENT



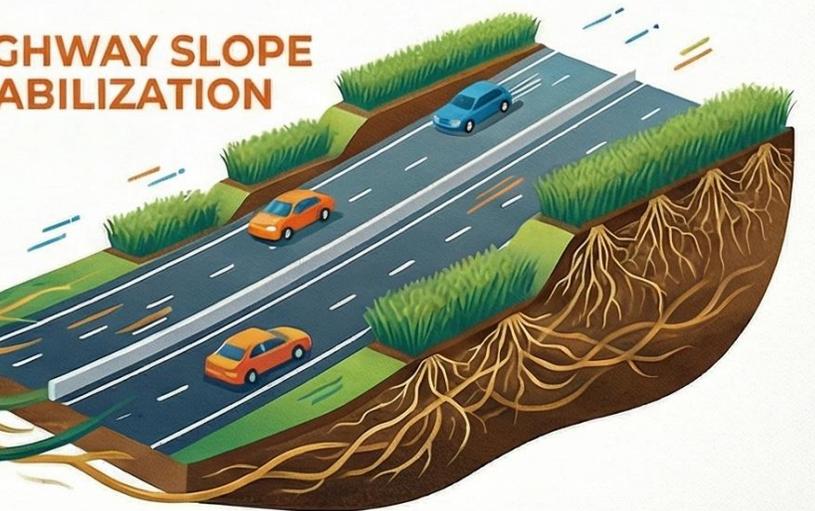
## EMBANKMENT PROTECTION



## DUMPSITE STABILIZATION



## HIGHWAY SLOPE STABILIZATION



# Thank You

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