MAINSTREAMING BIODIVERSITY CONSERVATION IN VILLAGE DEVELOPMENT PLANNING: INSIGHTS FROM PARTICIPATORY CONSULTATIONS WITH GRAM PANCHAYATS IN THE GANGA RIVER BASIN

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Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga: Community-based aquatic species conservation and outreach in Ganga River basin

Mainstreaming Biodiversity Conservation in Village Development Planning: Insights from Participatory Consultations with Gram Panchayats in the Ganga River Basin

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Red-crowned roofed turtle (*Batagur Kachuga*) © Saurav Gawan

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Summary

Ganga River system supports a diverse assemblage of freshwater biodiversity, including several threatened and endemic species, while sustaining the livelihoods of millions of people, particularly the rural riverside communities. Despite its ecological and socioeconomic significance, the basin's freshwater ecosystems are under severe and escalating stress from a growth-oriented, unsustainable development paradigm. Mainstreaming biodiversity conservation in village development planning, particularly at the grassroots level through Gram Panchayats, is a critical pathway for reconciling environmental sustainability with socioeconomic development, and for operationalising international commitments such as Target 14 of the Kunming-Montreal Global Biodiversity Framework.

This study aimed to identify the drivers of freshwater biodiversity decline in the Ganga River basin as perceived by Gram Panchayats, and the possible solutions to these drivers, in order to explore pathways for mainstreaming biodiversity conservation in village development planning through participatory approaches. A three-day basin-level stakeholder consultation workshop entitled 'Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning' was held at the Wildlife Institute of India, Dehradun, from 31st July to 2nd August 2024, under the NMCG-funded Ganga Biodiversity Conservation Initiative: Phase II. A total of 58 individuals participated, including Gram Pradhans, ward members, Block Development Council (BDC) members, and representatives from select villages along the Ganga River and its tributaries, spanning six basin states, viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, and Himachal Pradesh, and 12 rivers of the Ganga River system. The workshop comprised an introductory and orientation session pertaining to the purpose of the workshop, technical sessions and field visits to apprise the participants with the tenets and real-life applications of sustainable rural development, and focus group discussions (FGDs) to facilitate knowledge exchange.

The FGDs employed a problem and solution tree approach, with 'declining aquatic biodiversity' as the core issue, to systematically identify the drivers of freshwater biodiversity decline and possible solutions as perceived by the participants at the village level. Three primary issues were identified, namely direct exploitation of riverine resources, pollution, and unsustainable and unregulated land use and land cover change, rooted in five overarching categories of underlying root causes, viz. institutional and governance failures, socio-economic inequities, limited knowledge and awareness, technological and infrastructure deficits, and climate change and natural hazard vulnerability.

The solutions identified by the participants were comprehensive, spanning regulatory enforcement, participatory governance, livelihood diversification, capacity building, eco-sensitive infrastructure, and the revival of traditional conservation practices. The findings were further analysed through the Driver-Pressure-State-Impact-Response (DPSIR) framework, which systematically mapped the causal linkages from underlying drivers to societal and ecological impacts, and the multi-pronged responses required to address them. The drivers and solutions identified through this participatory process may inform the preparation of village micro plans centred on mainstreaming biodiversity conservation in village development planning for select villages along the Ganga River and its tributaries. The grassroots-level insights generated through this exercise may further contribute to actionable, village-specific conservation and development interventions, as well as broader policy and regulatory frameworks for the Ganga basin.

Udhwa Lake, Sahibganj district, Jharkhand © Goura Chandra Das

1. Introduction

The Kunming-Montreal Global Biodiversity Framework (GBF), adopted during the 15th meeting of the Conference of the Parties (COP 15) in December 2022, lays down the pathway for achieving the Convention on Biological Diversity's (CBD) vision of 'a world living in harmony with nature by 2050'; in simple terms, it provides a roadmap for halting biodiversity loss and promoting coexistence. GBF's key elements include four overarching long-term goals for 2050 and 23 action-oriented global targets for 2030. Notably, Targets 14 to 23 outline the 'tools and solutions for implementation and mainstreaming', including 'full integration' of biodiversity and its values across 'all levels of Government and all sectors, in particular those with significant impacts on biodiversity' (Target 14).

Biodiversity mainstreaming, as defined by the Convention on Biological Diversity (CBD), refers to "integrating or including actions related to conservation and sustainable use of biodiversity at every stage of the policy, plan, programme and project cycle, regardless whether international organizations, businesses or governments lead the process". It is the systematic integration of biodiversity considerations into policies, strategies, and practices of public and private actors that impact or depend on biodiversity. By placing biodiversity at the centre of development planning, it aims to transform land- and resource-use paradigms by underscoring the role of biodiversity in achieving the broader development goals, and ensuring that conservation is not perceived as a constraint on economic growth, but rather its core element. It can redirect different aspects of public and private decision-making (Figure 1).

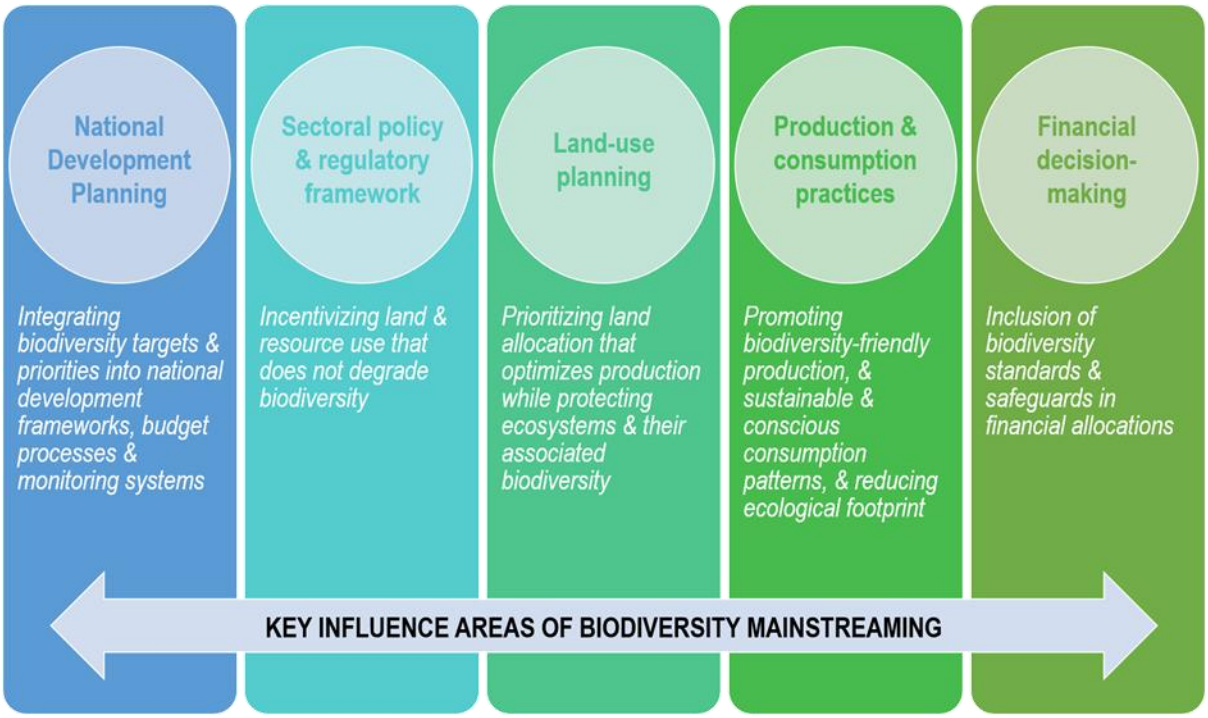


Figure 1. Key areas of decision-making influenced by biodiversity mainstreaming (Redford et al., 2015)

In the face of climate change and biodiversity loss, and given the site- and context-specific nature of their drivers, place-based adaptation that aligns with international commitments and national strategies is essential. This ensures that adaptation efforts are both locally relevant and globally consistent, leading

to more effective and sustainable outcomes. Local governments are uniquely positioned to lead place-based adaptation and sustainability transitions. Their proximity to both ecosystems and the communities dependent on them makes them effective agents in integrating biodiversity considerations into development planning and land-use decisions.

The Ganga River basin is a vital ecological, economic and cultural region in India. The rivers in the basin are home to diverse flora and fauna, including several endangered and endemic species, and contribute significantly to national, regional and local economies through agriculture, fisheries, tourism, etc. The rivers also flow through some of the most economically marginalized regions in the country, making conservation a livelihood imperative, not just an ecological one. The freshwater ecosystems and resources in the basin are under severe stress due to a growth-oriented unsustainable development paradigm, and its consequences in the form of pollution (water, soil and air), conventional agricultural practices rooted in enhancing yield through agrochemicals, over-exploitation of riverine resources (fish, riverbed material, short grasslands etc.), unregulated, unplanned and unsustainable tourism, climate change and its impacts, declining biodiversity, rampant unplanned urbanisation encroaching on riverbanks and wetlands, policy incoherence, etc.

Given the ecologically and socially diverse landscape of the Ganga River basin—and the limited economic diversity, particularly in the rural areas, which are highly dependent on freshwater resources—it is imperative to shift from the dominant growth-oriented development paradigm to a more holistic and sustainable one that emphasizes biodiversity conservation, social and gender inclusivity, self-reliance, and resilience. In this context, mainstreaming biodiversity conservation in development planning, particularly at the grassroots, emerges as a critical strategy to reconcile environmental sustainability with socioeconomic development. It fosters sustainable development while preserving the unique biodiversity of the Ganga River basin. By integrating biodiversity considerations into various grassroots developmental sectors, it aligns conservation goals with local economic and social needs. Mainstreaming biodiversity conservation in village development planning necessitates the identification of key drivers of freshwater biodiversity decline and context-specific solutions through participatory consultations with Gram Panchayats.

1.1 Aim

The study aims to identify the drivers of freshwater biodiversity decline in the Ganga River basin, as perceived by Gram Panchayats, and the possible solutions to these drivers, in order to explore pathways for mainstreaming biodiversity conservation in village development planning through participatory approaches.

1.1.1 Objectives

Under the overarching aforementioned aim, the objectives are as follows,

a) To identify the key drivers of freshwater biodiversity decline in the Ganga River basin as perceived by Gram Panchayats.
b) To document solutions and conservation strategies identified by Gram Panchayats for addressing freshwater biodiversity decline.
c) To explore pathways for mainstreaming biodiversity conservation in village development planning through participatory approaches.

2. Methodology

2.1 Key Stakeholder Identification

India has a multi-tiered governance structure, with the central government at the apex, followed by the state governments and local governments. In urban areas, local governance comprises Municipal Corporations (Nagar Nigam), Municipal Councils (Nagar Palika), and Nagar Panchayats, while in the rural areas, a three-tier Panchayati Raj system is in place, consisting of the Zilla Parishad (district level), Panchayat Samiti (block level), and Gram Panchayat (village level), which forms the base of the decentralised Indian governance structure (Government of India, 1950a; b). The Gram Panchayat, as the lowest and most direct tier of governance at the grassroots, is not only central to village development planning but also uniquely positioned to inform the drivers of local biodiversity decline. It was consequently identified as the key stakeholder for mainstreaming biodiversity conservation in village development planning.

2.2 Stakeholder Workshop

A three-day basin-level stakeholder consultation workshop entitled 'Sensitization of *Gram Pradhans* for mainstreaming biodiversity conservation in village level development planning' was held at the Wildlife Institute of India (WII), Dehradun, Uttarakhand, from 31st July 2024 to 2nd August 2024. This workshop was conducted under the National Mission for Clean Ganga (NMCG) funded 'Ganga Biodiversity Conservation Initiative: Phase-II', entitled 'Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga'. Members of the Gram Panchayat (village council), including Gram Pradhans (village heads), ward members, Block Development Council (BDC) members, and representatives of Gram Panchayats where elected members were unable to attend, from select stretches of the Ganga River and its tributaries, were invited to the workshop. Overall, 58 individuals participated, spanning six basin states, viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, and Himachal Pradesh, and 12 rivers of the Ganga River system, namely Bhagirathi, Alaknanda, Ganga, Yamuna, Ramganga, Kali, Chambal, Ghaghra, Rapti, Gomti, Kosi, and Gandak. The workshop comprised an introductory and orientation session, technical sessions, field visits and focus group discussions (FGDs) (Annexure-I).

The inaugural session introduced the participants to the Namami Gange programme, NMCG, WII, the NMCG-WII Ganga Biodiversity Conservation Initiative and its community-based conservation component, and the aim and objectives of the workshop, with emphasis on the importance of engaging stakeholders and institutions at the grassroots.

Six technical sessions were conducted to sensitise and educate the participants on the conservation significance of freshwater ecosystems and their biodiversity, and the role of Gram Panchayats and local institutions in biodiversity conservation and sustainable development. The sessions covered the achievements and scope of the NMCG-WII Ganga Biodiversity Conservation Initiative; an overview of the aquatic flora and fauna of the Ganga River basin and the ethics and protocols for wildlife monitoring and rescue; the role of Gram Panchayats and local institutions in plastic waste management and the Sustainable Development Goals (SDGs) at the grassroots level; the laws, policies, and regulations pertaining to sanitation and waste management; the due process and responsibilities of Gram Pradhans during rescue of species in distress; and the adoption of sustainable agriculture, particularly millet

farming, as a nature-based solution for the conservation of freshwater ecosystems and their associated biodiversity.

Three field visits were conducted to expose the participants to grassroots models of sustainable development, biodiversity conservation, and responsible waste management. The participants visited the Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun, where they gained insights into low-cost, community-led, sustainable solutions in agriculture, horticulture, and energy, and the role of Gram Panchayats in village-level development and water conservation; the Social Development for Communities (SDC) Foundation's plastic waste segregation and learning centre, Dehradun, where they were familiarised with responsible waste management and disposal practices; and the six museums housed at the Forest Research Institute (FRI), Dehradun, under the Indian Council of Forestry Research and Education (ICFRE), where they gained an understanding of the diversity of forest ecosystems, their products, and the challenges they face.

2.2.1 Focus Group Discussions

Multiple focus group discussions (FGDs) were conducted with the heads, members, and representatives of Gram Panchayats from select villages along the Ganga River and its tributaries, across six basin states, viz. Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, and Himachal Pradesh, to identify the drivers of freshwater biodiversity decline and possible solutions, as perceived by the participants at the village level. The FGDs employed a problem and solution tree approach, with 'declining aquatic biodiversity' as the core issue. The respondents were divided into 12 groups based on their districts, states, and river stretches (Table 1). Each FGD was moderated by at least three NMCG-WII project representatives working in the respective districts to ensure focused discussions, minimise interviewer bias, and enable proper documentation.

Table 1. Group-wise state, districts and rivers covered in the focus group discussions (Annexure I)

Group	State	Districts	Rivers	No. of participants
Group 1	Uttarakhand	Chamoli, Tehri Garhwal, Uttarkashi	Bhagirathi, Alaknanda, Ganga	9
Group 2	Uttar Pradesh	Bijnor, Muzaffarnagar, Bulandshahr, Sambhal	Ganga	8
Group 3	Uttar Pradesh	Farrukhabad, Kannauj, Shahjahanpur	Ganga, Ramganga, Kali	4
Group 4	Uttar Pradesh	Prayagraj, Kaushambi	Ganga, Yamuna	6
Group 5	Uttar Pradesh	Etawah	Yamuna, Chambal	1
Group 6	Uttar Pradesh	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	Ghaghra, Rapti	10
Group 7	Uttar Pradesh	Mirzapur, Jaunpur, Varanasi, Chandauli	Ganga, Gomti	11
Group 8	Bihar	Bhagalpur, Katihar	Ganga, Kosi	2
Group 9	Bihar	West Champaran, Vaishali	Ganga, Gandak	3
Group 10	Jharkhand	Sahibganj	Ganga	2
Group 11	West Bengal	Nadia	Hooghly	1
Group 12	Himachal Pradesh	Sirmaur	Yamuna	1

2.3 Problem Tree Analysis

Problem tree analysis (PTA) is a participatory methodology used to identify and visualise the causes and effects pertaining to one or more overarching problems within complex systems, and determine potential solutions to the identified problems. It aids in clarifying complex interdependencies within systems, consequently enabling informed decision-making and targeted interventions (Jiménez-Galina et al., 2023). PTA can assist in incorporating biodiversity considerations in village development plans by highlighting the ecological impacts of various development activities at both local and regional scales. It facilitates a structured and shared understanding of conservation needs and priorities by promoting dialogue among stakeholders, encouraging a thorough examination of underlying issues, allowing stakeholders to visualise interrelated social-environmental-economic issues, and pinpoint root causes and effects of the problem. By fostering systemic thinking in a participatory setting with stakeholders relevant to the issue and scale of the problem (Figure 2), PTA enables the identification of contextually relevant and sustainable solutions, and the development of effective conservation strategies. In the context of this study, PTA was applied to identify and map the drivers of aquatic biodiversity decline and possible solutions at the grassroots level in the rural Ganga River basin, which were subsequently visualised in the form of problem and solution trees.

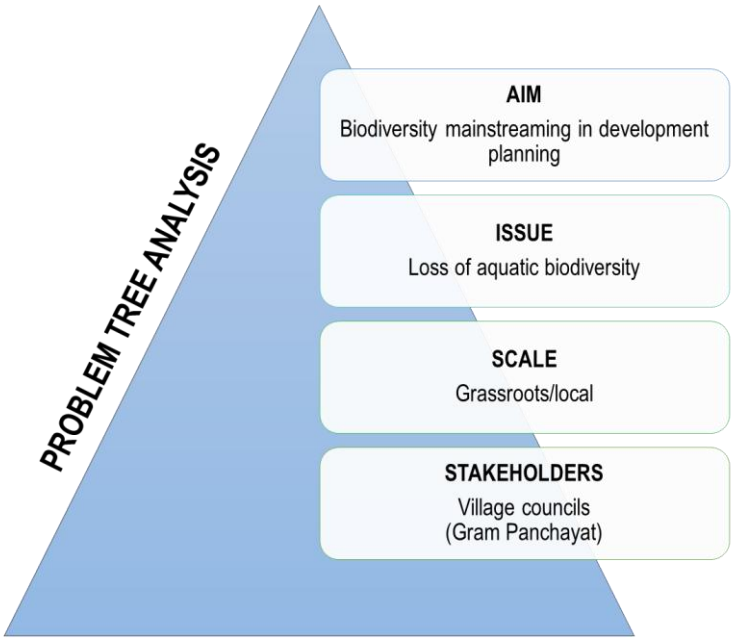


Figure 2. Aim, issue, scale, and stakeholders for the problem tree analysis

3. Results

The river- and district-wise FGDs revealed three primary issues, namely biodiversity loss, declining rural livelihoods, and pollution. One or more of these issues were identified by all the groups. The other issues cited were under the thematic issues of weak institutional support, poor compliance with government regulations, unplanned development, and climate change impacts and poor adaptation (Table 2; Appendices I and II).

Table 2. Group-wise primary issues identified by the participants in the focus group discussions

Group	Districts	Primary issues identified
UTTARAKHAND *(Rivers: Bhagirathi, Alaknanda, Ganga)*		
Group 1	Chamoli, Tehri Garhwal, Uttarkashi	Natural and human-caused disasters Lack of awareness Agriculture Human-wildlife conflict
UTTAR PRADESH *(Rivers: Ganga, Ramganga, Kali, Yamuna, Chambal, Ghaghra, Rapti, Gomti)*		
Group 2	Bijnor, Muzaffarnagar, Bulandshahr, Sambhal	Pollution (water, soil & solid waste) Lack of government support Lack of livelihood
Group 3	Farrukhabad, Kannauj, Shahjahanpur	Declining rural livelihood Declining biodiversity
Group 4	Prayagraj, Kaushambi	Declining aquatic biodiversity
Group 5	Etawah	Lack of livelihood
Group 6	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	Declining biodiversity
Group 7	Mirzapur, Jaunpur, Varanasi, Chandauli	Declining biodiversity Declining rural livelihood
BIHAR *(Rivers: Ganga, Kosi, Gandak)*		
Group 8	Bhagalpur, Katihar	Water Pollution Poaching of turtles and migratory and native birds Sand and soil mining Land and soil erosion (riverbank, forest, village, and agricultural land)
Group 9	West Champaran, Vaishali	Declining aquatic biodiversity Riverine pollution Waterlogging
JHARKHAND *(Rivers: Ganga)*		
Group 10	Sahibganj	Declining aquatic biodiversity Unemployment Agricultural insignificance
WEST BENGAL *(Rivers: Hooghly)*		
Group 11	Nadia	Pollution Poverty
HIMACHAL PRADESH *(Rivers: Yamuna)*		
Group 12	Sirmaur	Water Pollution Lack of solid waste management No help from Government during natural hazards or disaster Lack of awareness of millets Land erosion Crop yield decline Impact on human health

Under the overarching theme of 'declining freshwater biodiversity', three core issues were identified, viz. I) direct exploitation of riverine resources, II) pollution, and III) unsustainable and unregulated land use and land cover change (Figure 3).

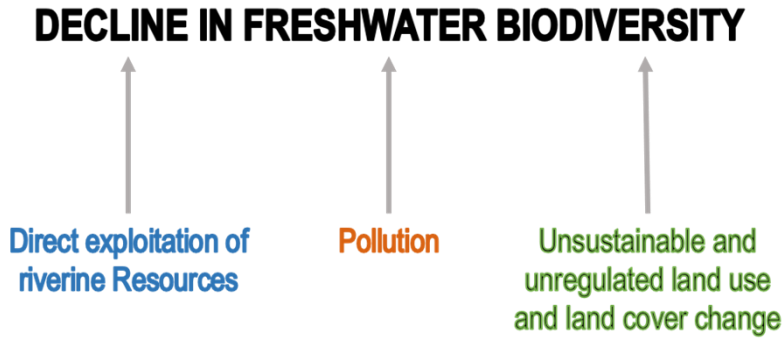


Figure 3. Key drivers of change identified for declining freshwater biodiversity in the Ganga River basin

3.1 Direct Exploitation of Riverine Resources

A. Problem Tree

Excessive and unsustainable direct exploitation of riverine and associated resources is not only directly impacting populations of aquatic fauna but is also adversely affecting entire aquatic ecosystems. This exploitation is manifested in the form of: (i) unlawful killing of aquatic wildlife, (ii) overfishing, (iii) overexploitation of freshwater resources (including both surface water and groundwater), and (iv) excessive and unscientific sand mining (Figure 4).

(i) Unlawful killing of aquatic wildlife

Illegal wildlife trade and personal consumption (for culinary, medicinal, and other uses) were identified as proximate causes of unlawful killing of aquatic wildlife. Tradition, myth, lack of awareness, and declining rural livelihoods were cited as the underlying causes of illegal wildlife trade and personal consumption. The lack of and decline in rural livelihoods was attributed to falling agricultural productivity and profitability, declining fish revenue, lack of alternative livelihood options, unemployment, and health issues.

Declining agricultural productivity and profitability were ascribed to reduced agricultural yield, high costs of conventional farming practices, rising human-animal conflict, and inadequate supporting infrastructure such as storage facilities and farming equipment [as described below in sub-section 3.3.A.(i) Agricultural expansion and intensification].

Declining fish revenue was attributed to a lack of government support and reduced fish catch, which in turn resulted from a declining fish population caused by habitat degradation and unsustainable fishing practices.

Lack of alternative livelihoods was attributed to inadequate skill development programmes, poor implementation of government schemes, and insufficient support for indigenous knowledge, arts, and crafts.

Unemployment was ascribed to the lack of employment opportunities, primarily due to inadequate government support—stemming from the absence of local community involvement in policy and decision-making and minimal benefits from government schemes. Additional contributing factors included geographic remoteness, low wages, poor family planning linked to low levels of education and awareness, and lack of or poor education due to a lack of motivation and awareness, poor standards of primary education, limited availability of skilled teachers, and inadequate opportunities for teacher upskilling.

Health issues were linked to a lack of physical exercise, inadequate food rations, insufficient healthcare facilities, poor sanitation and cleanliness due to lack of awareness, unsafe drinking water caused by water pollution, and an increase in disease vectors resulting from inadequate waste management by factories and waterlogging. The failure to install waste management infrastructure—despite it being mandatory under government rules and regulations—was cited as the reason for inadequate waste management by factories. This failure was attributed to a lack of supervision, stemming from the remote location and distance from the district headquarters. Waterlogging was attributed to lack of or unscientific government intervention, obstruction of rainfed rivers from draining into the main perennial river due to embankment construction, and poor water supply infrastructure resulting from a lack of accountability and the absence of formal handover to government departments and PRIs.

(ii) Overfishing

Unregulated and unsustainable fishing practices—specifically, the year-round use of monofilament fishing nets with fine mesh sizes—were identified as the proximate causes of overfishing. Distal causes included weak governance and regulatory enforcement (partially due to corruption), lack of awareness, absence of alternative livelihoods (which constrains adaptive capacity in the face of declining fish catch) and lack of capacity in sustainable fishing practices.

(iii) Overexploitation of freshwater resources (including both surface water and groundwater)

Diversion and abstraction of surface water through the construction of dams and barrages, along with excessive and unnecessary groundwater extraction—primarily to support water-intensive agricultural practices—were identified as proximate causes of the overexploitation of freshwater resources.

(iv) Excessive and unscientific sand mining

The causal factors contributing to excessive and unscientific sand mining include illegal extraction (driven by weak governance and regulatory enforcement, partially due to corruption), over-allocation through government tenders, and a lack of public awareness.

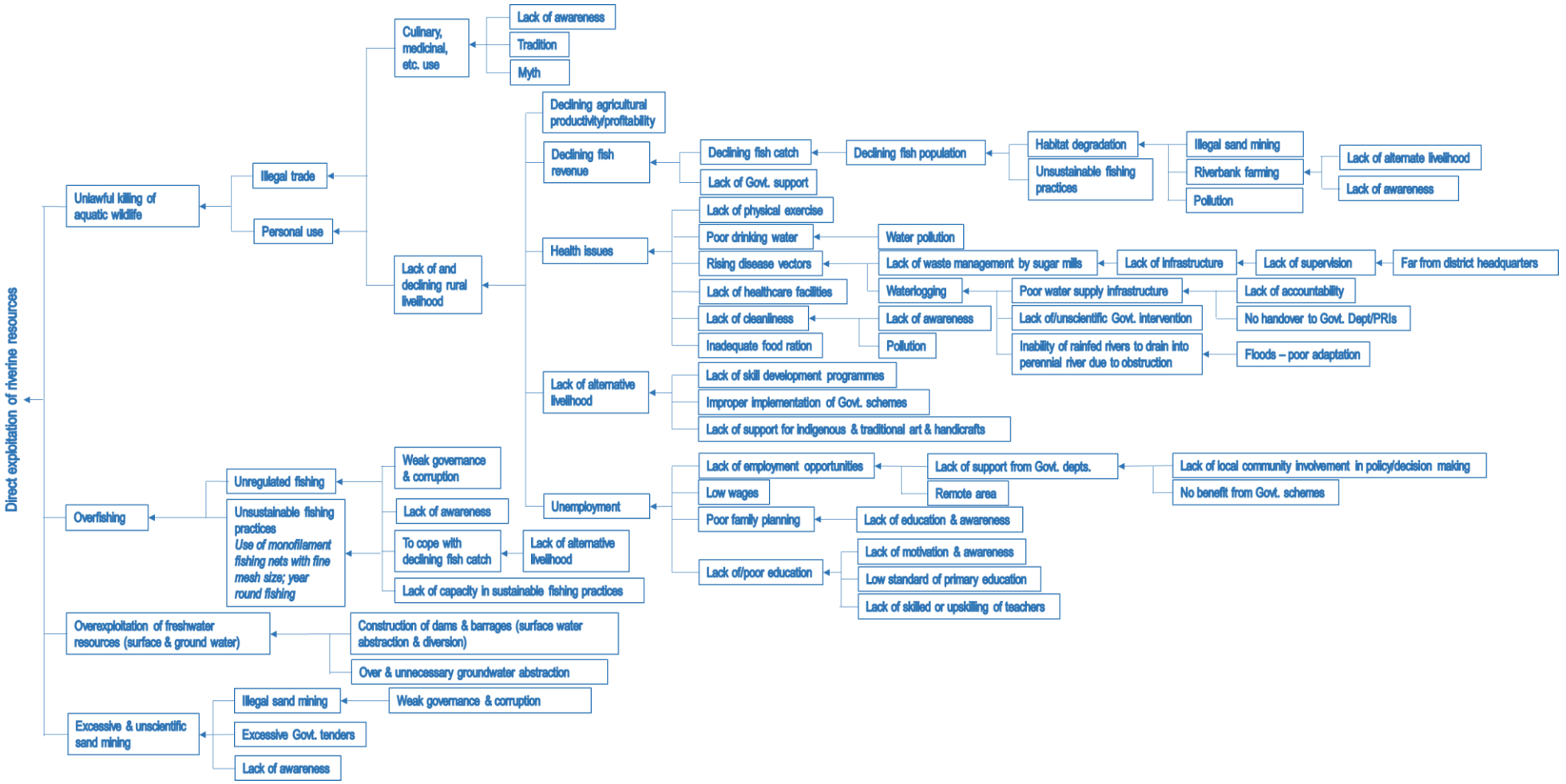


Figure 4. Problem tree mapped for direct exploitation of riverine resources

B. Solution Tree

Solutions presented by the respondents aimed to promote the sustainable utilisation of riverine resources through (i) curbing the unlawful killing of aquatic wildlife, (ii) promoting sustainable fishing, (iii) ensuring the sustainable use of freshwater resources (including both surface water and groundwater), and (iv) promoting responsible and scientific sand mining (Figure 5). These included

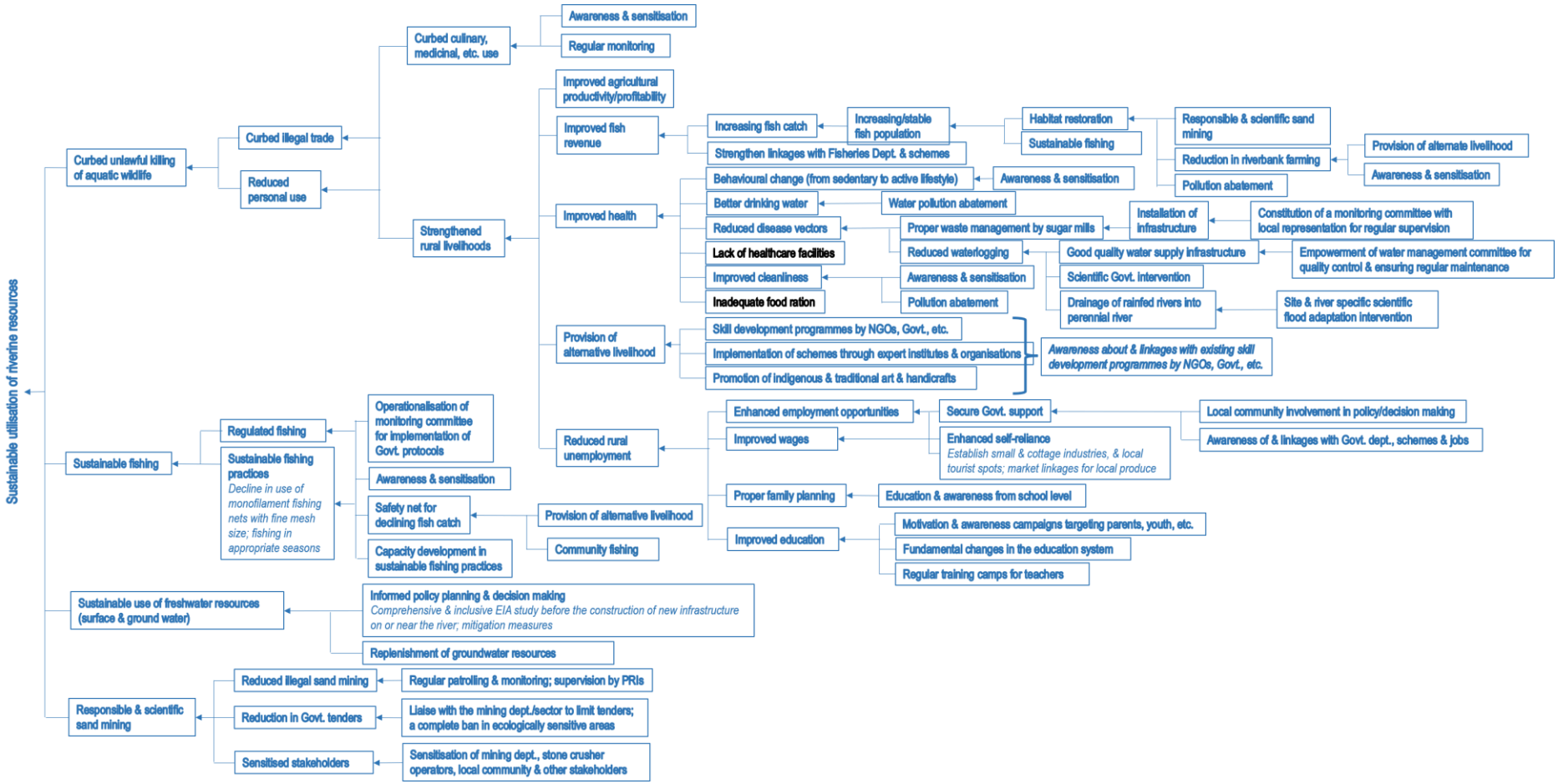
(i) *Curbing the unlawful killing of aquatic wildlife* by curtailing poaching for illegal trade and personal consumption through targeted awareness and sensitisation programmes, enhanced monitoring, and strengthening rural livelihoods. A multi-pronged approach was recommended for strengthening rural livelihoods. This included improving agricultural productivity or profitability [as described below in sub-section 3.3.B.(i) Agricultural expansion and intensification], increasing fisher's income, ensuring better health, providing alternative livelihoods, and reducing rural unemployment.

To increase fisher's income, it was proposed that linkages with fisheries department and its schemes may be strengthened, and the decline in fish populations may be reversed through habitat restoration and the promotion of sustainable fishing practices to improve fish catch. Responsible and scientific sand mining, pollution abatement, and reduction in riverbank farming through provision of alternate livelihood, and targeted awareness campaigns were recommended for restoring habitat.

Improved health was envisioned through lifestyle changes (from sedentary to active) through a targeted awareness campaign; improved access to safe drinking water through pollution abatement; vector control through effective effluent management enforced by a monitoring committee with local representation, and reduced waterlogging through site- and river-specific scientific flood adaptation, and provision of good quality water supply infrastructure by empowering the water management committee to ensure quality control and regular maintenance; and improved cleanliness through pollution abatement and awareness generation.

Alternate livelihood opportunities may be provided through skill development programmes by government, NGOs, etc., implementation of government schemes through expert institutions and organisations, and promotion of indigenous and traditional arts and handicrafts. Awareness about and access to existing skill development programmes by Government Departments and Agencies, NGOs, etc. may also be enhanced.

Reduction in rural unemployment was envisioned through job creation, improving rural wages, promotion of family planning through education and awareness, and enhanced employability through better education. Employment opportunities may be created through participatory policy and decision making; improved awareness and access to government schemes and jobs, and promotion of self-reliance by strengthening rural economy. Interventions proposed for strengthening rural economy included the development of small and cottage industries, establishment of local tourist destinations, and creation of market linkages for local produce; which would also contribute to improved rural wages. To improve rural education, suggested measures included motivation and awareness campaigns targeting parents and youth to increase school attendance, advocating for fundamental reforms in the education system such as better infrastructure, curriculum aligned with industry needs and better access to technology, and regular teacher training programmes for upskilling of educators.



Note: No solutions were provided for the issues written in black

Figure 5. Solution tree mapped for direct exploitation of riverine resources

(ii) *Promoting sustainable fishing* by checking unregulated fishing, and curtailing harmful practices through the adoption of eco-friendly methods, such as using larger mesh-size fishing nets made of biodegradable material, and restricting fishing during breeding season and in identified spawning grounds. This can be achieved through the operationalisation of village- or block-level monitoring committees to ensure implementation of and adherence to government protocols; awareness and sensitisation of fishers about relevant rules, regulations, and sustainable practices; capacity building; and provision of alternative livelihoods as a safety net against declining fish catches.

(iii) *Ensuring the sustainable use and management of freshwater resources (surface water and groundwater)* through informed policy planning and decision-making, supported by comprehensive and inclusive Environmental Impact Assessments (EIA) for proposed infrastructure projects on the river or in its immediate vicinity, with clear mitigation measures outlined. Promote groundwater replenishment through scientific afforestation, including protective measures for planted trees; encourage responsible and regulated sand mining; and ensure sustainable groundwater use by monitoring extraction levels, and promoting the cultivation of water-efficient crops, such as millets, through targeted awareness and sensitization programmes.

(iv) *Promoting responsible and scientific sand mining* by curtailing illegal extraction through regular patrolling and monitoring, with active engagement of Panchayati Raj Institutions (PRIs); advocating for a reduction in government tenders and ensure scientific land allotment for sand mining by coordinating with the mining department, including pushing for a complete ban in ecologically sensitive areas; and sensitizing relevant stakeholders, such as government departments, stone crusher operators, and local communities, on the ecological impacts of unregulated and unplanned sand mining.

3.2 Pollution

A. Problem Tree

Pollution is causing the degradation of aquatic ecosystems, directly impacting both biodiversity and human well-being. It can be categorized into three thematic areas: (i) soil pollution and degradation, (ii) water pollution, and (iii) air pollution (Figure 6).

(i) Soil pollution and degradation

Soil pollution and degradation were attributed to the extensive use of agrochemicals, monoculture of crops such as rice, unsustainable road development, post-flood waterlogging, and damage to agricultural fields caused by illegal fisheries—specifically, the illegal conversion of farmland into shrimp farms along the West Bengal coastline.

(ii) Water pollution

Water pollution was attributed to multiple factors. These included discharge of untreated industrial effluents into rivers due to the lack of waste management infrastructure in factories; diesel emissions from motorboats; the discharge of untreated sewage into rivers; solid waste pollution, particularly from plastic; flooding; increased sediment load in water resulting from the dumping of landslide and construction debris into rivers and streams; non-point sources of pollution, specifically agricultural runoff; the disposal of human and cattle carcasses into rivers due to lack of awareness (about alternatives and impacts); immersion of cremation ashes into rivers; and open defecation driven by lack of toilets, mental

block, and traditional beliefs. Biodiversity loss was also noted as a consequence and indicator of worsening pollution.

Open drains and inadequate rural waste management infrastructure—caused by insufficient or poorly allocated funds to PRIs, and low public awareness—were cited as key reasons for the continued discharge of untreated sewage into rivers. Solid waste pollution was linked to absence or inadequacy of solid waste management infrastructure, mismanagement of waste generated during fairs and festivals, household waste dumping, deposition of religious waste due to lack of awareness, and excessive plastic consumption. Pollution from agricultural runoff was associated with the extensive use of agrochemicals, and riverbank farming driven by lack of alternative livelihood options and poor awareness.

(iii) Air pollution

Air pollution was linked to dust particles from sand mining dumpers and stone crushers; ash from brick kilns, rice mills, and forest fires; and the emission of poisonous gases and soot from kerosene motor vans.

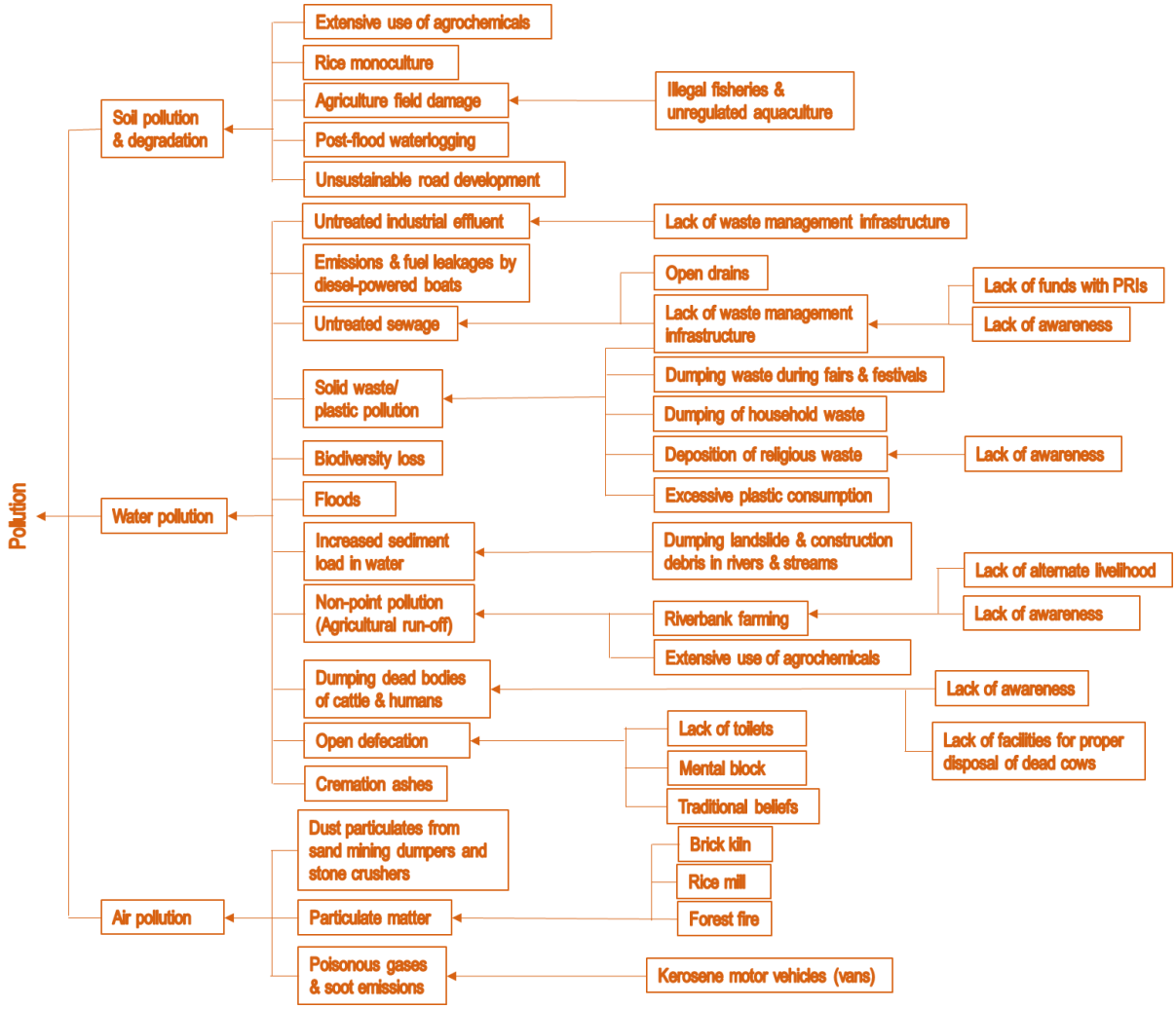


Figure 6. Problem tree mapped for pollution

B. Solution Tree

To improve habitat quality, respondents recommended remedial measures for pollution targeting soil, water, and air pollution (Figure 7). These included

(i) *Soil pollution and degradation* remedial measures focus on addressing conventional agricultural practices, such as the excessive use of agrochemicals and crop monoculture, through interventions that reduce agrochemical use [as described below in sub-section 3.3.B.(i) Agricultural expansion and intensification] and promote intercropping, crop rotation, etc., and other sustainable practices. Agricultural field damage caused by illegal fisheries may be mitigated by improving compliance with government rules and regulations through enhanced monitoring, penalties, and other enforcement mechanisms. Damage from post-flood waterlogging may be addressed through flood mitigation strategies such as wetland conservation, site- and river-specific embankment designs, etc. Additionally, planned and informed road development was recommended to mitigate damage resulting from unsustainable road construction practices.

(ii) *Water pollution* remedial measures comprise a multi-faceted approach that tackled both the point and non-point sources of pollution through efficient waste management, ecological solutions, behavioural change, and planned sustainable development. Strategies for efficient waste management included the installation of effluent treatment plants (ETPs) and sewage treatment plants (STPs); implementation of rural waste management schemes (Resource Recovery Centre); construction of covered drains; door-to-door waste collection; strategically placed garbage bins/vats for everyday use and during local fairs; construction of public and private toilets; establishment of electric crematoria for both humans and animal cremation; designated sites for the deposition of cremation ashes; expansion of cleaning staff; and participatory monitoring to ensure compliance with government norms. Ecological solutions recommended included biodiversity and wetland conservation. To induce or promote behavioural change, a targeted awareness and sensitisation campaign was recommended to reduce dumping of household and religious waste in or near rivers, plastic consumption, disposal of human and animal carcass in rivers, and open defecation. Planned sustainable development strategies were proposed to reduce or eliminate dumping of landslide and construction debris in rivers and streams [as described below in sub-section 3.3.B.(iii) Decline in rivers, wetlands, and other waterbodies]; restrict consumption and production of single-use plastic through regulatory and enforcement frameworks that promote a circular economy and sustainable living; and promote sustainable agricultural practices to reduce agrochemical use [as described below in sub-section 3.3.B.(i) Agricultural expansion and intensification]. Additionally, it was recommended that technological, regulatory, and behavioural interventions may be designed and implemented by experts to mitigate emissions and fuel leakages by diesel-powered boats.

(iii) *Air pollution* remedial measures target dust particulates from sand mining dumpers and stone crushers; particulate matter from brick kilns, rice mills, and forest fires; and emission of poisonous gases and particulates from kerosene motor vehicles (vans). Recommended strategies included the creation of alternate routes for dumpers, and afforestation along these routes and the periphery of stone crushers; the establishment and enforcement of pollution control regulations for factories, brick kilns, and rice mills; and a ban on kerosene-powered vans.

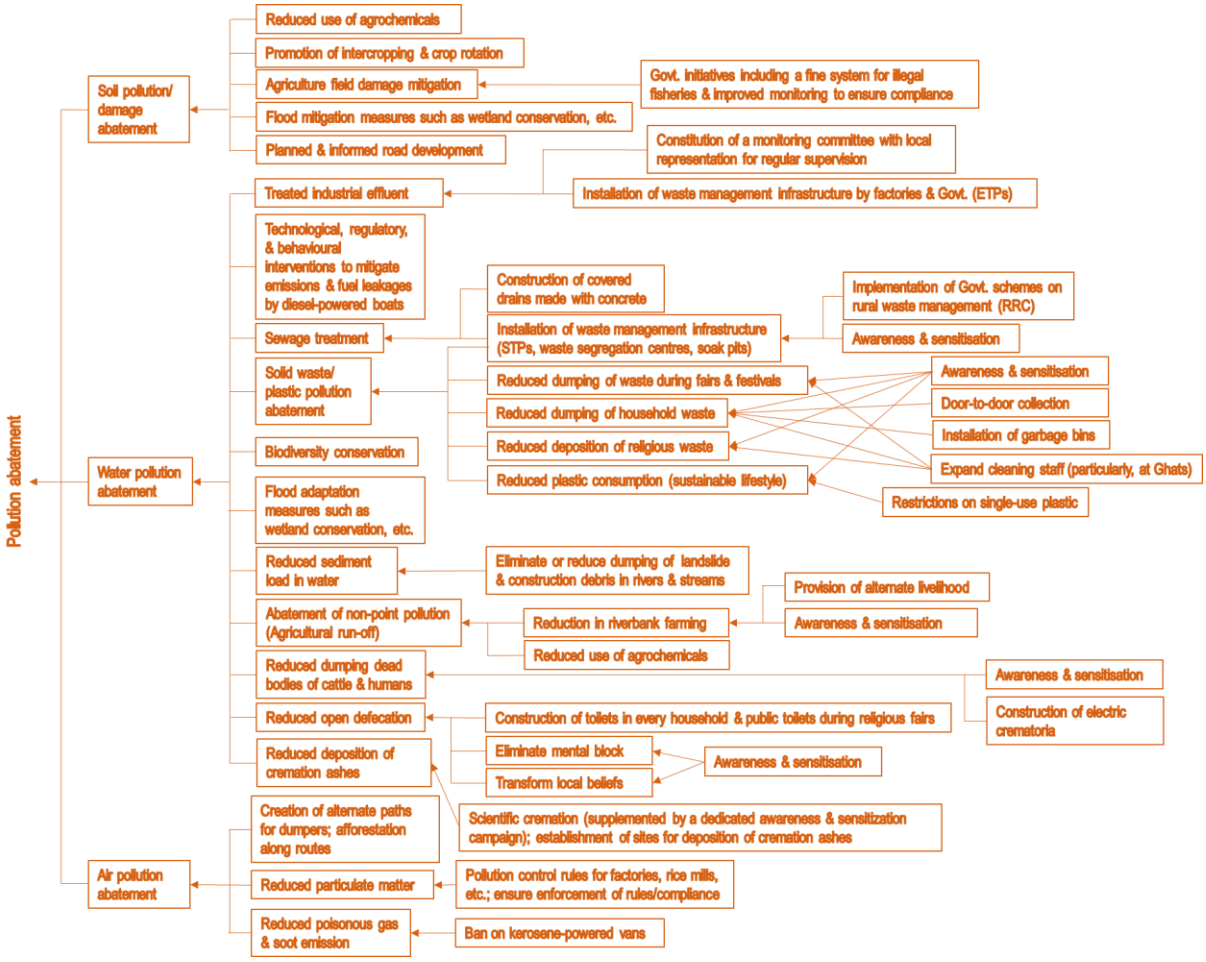


Figure 7. Solution tree mapped for pollution

3.3 Unsustainable and Unregulated Land Use and Land Cover (LULC) Change

A. Problem Tree

Unsustainable and unregulated land use and land cover (LULC) change is leading to the loss and degradation of aquatic habitats, posing a significant threat to associated biodiversity. This change in LULC is manifested as (i) agricultural expansion and intensification, (ii) urban sprawl, (iii) decline in rivers, wetlands, and other waterbodies, (iv) inland fisheries expansion, (v) riverbank and soil erosion, (vi) change in river morphology, and (vii) excessive and unscientific sand mining (Figure 8).

(i) Agricultural expansion and intensification

Agricultural expansion and intensification were attributed to declining agricultural productivity and profitability and lack of alternative livelihoods. The decline in agricultural productivity and profitability was linked to reduced agricultural yield, high costs of conventional farming practices, rising human-animal conflict, and inadequate supporting infrastructure such as storage facilities and farming equipment (Figure 9). Reduced agricultural yield was further associated with inadequate irrigation, declining soil fertility, riverbank and soil erosion, air pollution, and climatic factors such as low rainfall. Floods, deforestation, changes in river morphology, excessive and unscientific sand mining, and non-resilient

adaptation infrastructure stemming from lack of site-specific considerations and poor quality were cited as the causes for riverbank and soil erosion.

Inadequate irrigation was linked to reduced water availability—due to falling groundwater levels (in the plains) and the dumping of landslide and construction debris into rivers and streams (in the hills)—as well as the lack of rainwater harvesting and poor infrastructure. Declining groundwater levels were attributed to deforestation and reduced tree cover; excessive and unscientific sand mining; and over and unnecessary exploitation of groundwater due to cultivation of water-intensive crops and poor adoption of millets, resulting from higher price of commercial crops and lack of awareness about millets. A combination of un- and poorly planned development, frequent landslides and flash floods, and poor adaptation and mitigation (both government and private) was cited as the reason behind dumping of landslide and construction debris into rivers and streams.

Declining soil fertility was associated with post-flood waterlogging and the extensive use of agrochemicals. Lack of awareness, lack of alternatives, the pursuit of higher yields, and poor adoption of sustainable farming practices were cited as reasons for the extensive use of agrochemicals. The poor uptake of sustainable agriculture was ascribed to a decline in domesticated cattle; the absence of a safety net and insurance for traditional crops; lower returns on investment due to small landholdings, and lower prices and yields of traditional crops; and lack of awareness and capacity, stemming from inadequate government outreach, limited knowledge and technical know-how, and weak peer-to-peer communication due to declining social capital.

Seven causes were identified for rising human-animal conflict: deforestation; habitat disturbances causing wildlife to migrate; increased extraction of wild fruits (reducing food availability for wildlife); concentrated farming on small land parcels; dumping of food waste (attracts wildlife); increasing areas of barren farmland due to youth outmigration; and a rise in the population of feral cows and rhesus macaques.

(ii) Urban sprawl

Urban sprawl is driven by rural-urban migration due to low labour wages and lack of employment opportunities in rural areas.

(iii) Decline in rivers, wetlands, and other waterbodies

The decline in freshwater ecosystems, such as rivers and wetlands, was attributed to multiple factors. These included encroachment on public lands, including wetlands and other waterbodies, due to weak governance and corruption; river fragmentation caused by the construction of dams and barrages; reduced river water levels and flow due to surface water abstraction and diversion (through dams, barrages, and a vast network of canals), overexploitation of groundwater, unpredictable rainfall, and deforestation; and the dumping of landslide and construction debris into rivers and streams, particularly in hilly regions.

(iv) Inland fisheries expansion

Lack of alternative livelihood was cited as the reason for expansion of inland fisheries.

(v) Riverbank and soil erosion

Riverbank and soil erosion were attributed to post-flood waterlogging, deforestation, changes in river morphology, excessive and unscientific sand mining, and non-resilient adaptation infrastructure resulting from poor quality and lack of site-specific considerations.

(vi) Change in river morphology

Change in river morphology may be attributed to both natural and anthropogenic factors. Anthropogenic drivers cited include riverbank and soil erosion, as well as excessive and unscientific sand mining.

(vii) Excessive and unscientific sand mining

[Described above in sub-section 3.1. Direct exploitation of riverine resources, part A.(iv) Excessive and unscientific sand mining]

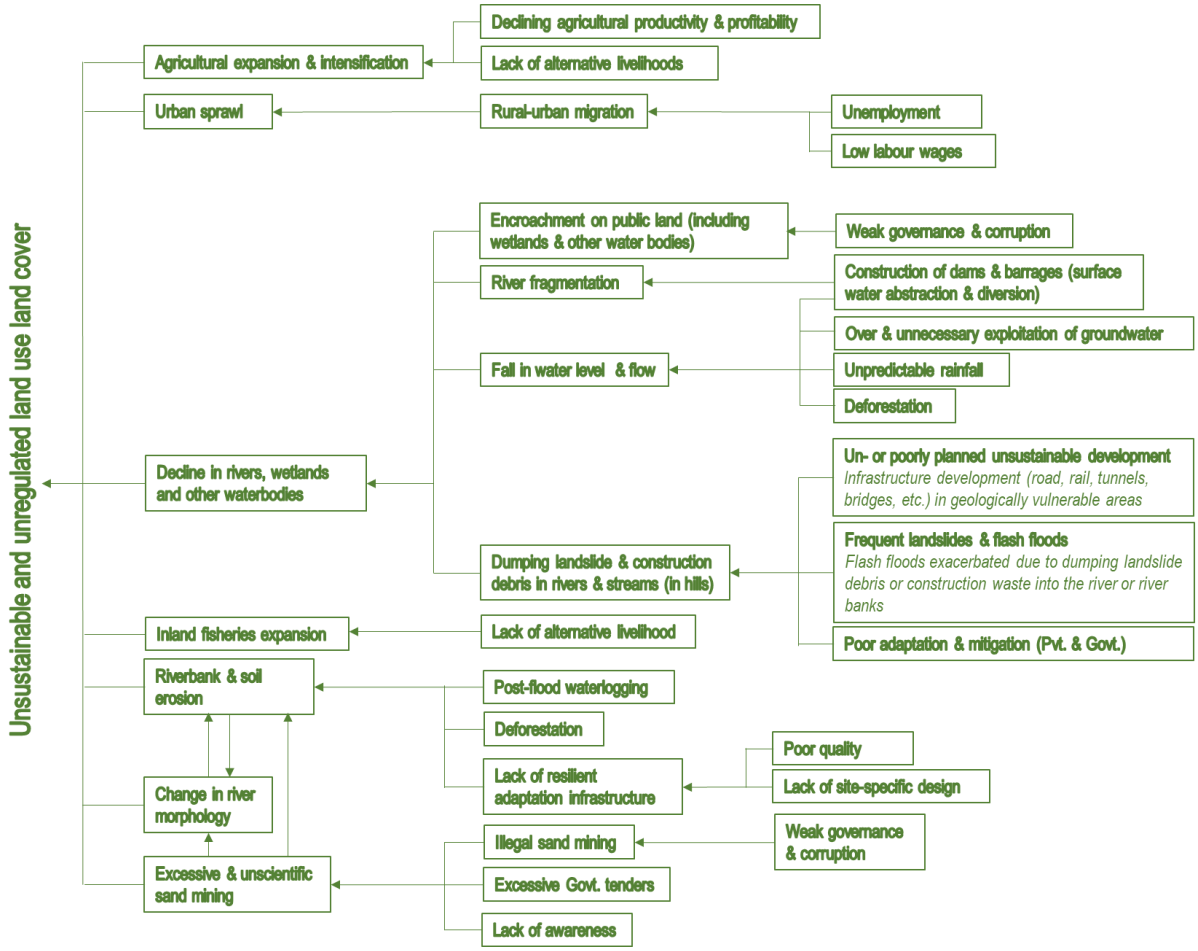


Figure 8. Problem tree mapped for unsustainable and unregulated land use and land cover change

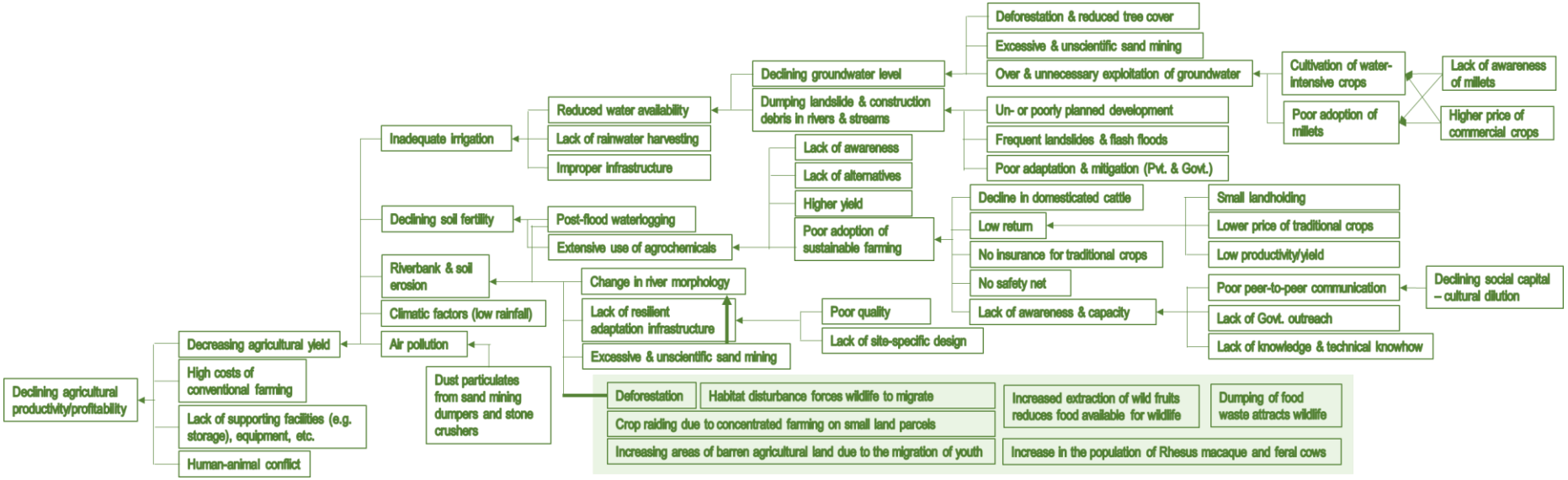


Figure 9. Problem tree mapped for declining agricultural productivity and profitability

B. Solution Tree

Solutions recommended by the respondents aimed to achieve sustainable and regulated land use land cover management by addressing (i) agricultural expansion and intensification, (ii) urban sprawl, (iii) decline in rivers, wetlands, and other waterbodies, (iv) inland fisheries expansion, (v) riverbank and soil erosion, (vi) change in river morphology, and (vii) excessive and unscientific sand mining (Figure 10). These included

(i) *Agricultural expansion and intensification*: Prevention or reversal of agricultural expansion and intensification through enhancement of agricultural productivity and profitability, and provision of alternate livelihoods. Strategies to improve agricultural productivity and profitability focused on improving agricultural yield, strengthening supporting infrastructure and equipment, and mitigating human-animal conflict (Figure 11). Measures to improve agricultural yield focused on ensuring adequate water for irrigation, enhancing soil fertility, reducing riverbank and soil erosion [as described below in sub-section 3.3.B.(v) Riverbank and soil erosion], and mitigating air pollution [as described above in sub-section 3.2.B.(iii) Air pollution].

Interventions to improve water availability and soil fertility included the promotion of sustainable agricultural practices such as rainwater harvesting, cultivation of water-efficient crops like millets, replacing agrochemicals with greener alternatives, etc. through a targeted awareness and sensitisation campaign, capacity building, provision of raw materials, linkages with government departments, financial assistance (to address low return, lack of insurance for traditional crops and lack of safety net), and strengthening of social capital. Other suggested measures included effective climate change adaptation and mitigation, planned sustainable development, promotion of responsible and scientific sand mining, and increasing tree cover through scientific afforestation and protection of planted trees.

Human-animal conflict mitigation strategies focused on preserving and enhancing tree cover and food availability for wildlife in the forest through scientific afforestation, plantation of fruit-bearing trees in forests, fostering an emotional connection between local communities and forests to reduce overextraction of forest resources; creation of physical barriers such as fencing; behavioural change campaigns promoting sustainable lifestyles, particularly related to waste generation, disposal and management; reversing or preventing outmigration of youth to revive barren or abandoned agricultural land; and population management of crop raiders like rhesus macaques (*Macaca mulatta*) and feral cattle.

(ii) *Urban sprawl*: Control urban sprawl by reversing or reducing rural-urban migration through reducing rural unemployment and increasing rural wages [as described above in sub-section 3.1. Direct exploitation of riverine resources, part B.(i)].

(iii) *Decline in rivers, wetlands, and other waterbodies*: Reverse or reduce the decline in area under rivers, wetlands, and other waterbodies through a multi-pronged approach that addresses encroachment, river fragmentation, declining in water levels and flow, and the dumping of landslide and construction debris into rivers and streams. Facilitate proper management and authorised used of public land (including village wetlands and other waterbodies) by combating encroachment and ensuring compliance with statutory measures. Promote planned and inclusive river development through informed policy planning and decision-making, supported by comprehensive and inclusive EIAs for proposed infrastructure projects on or near rivers, with clear mitigation measures outlined. Augment water levels and flow through

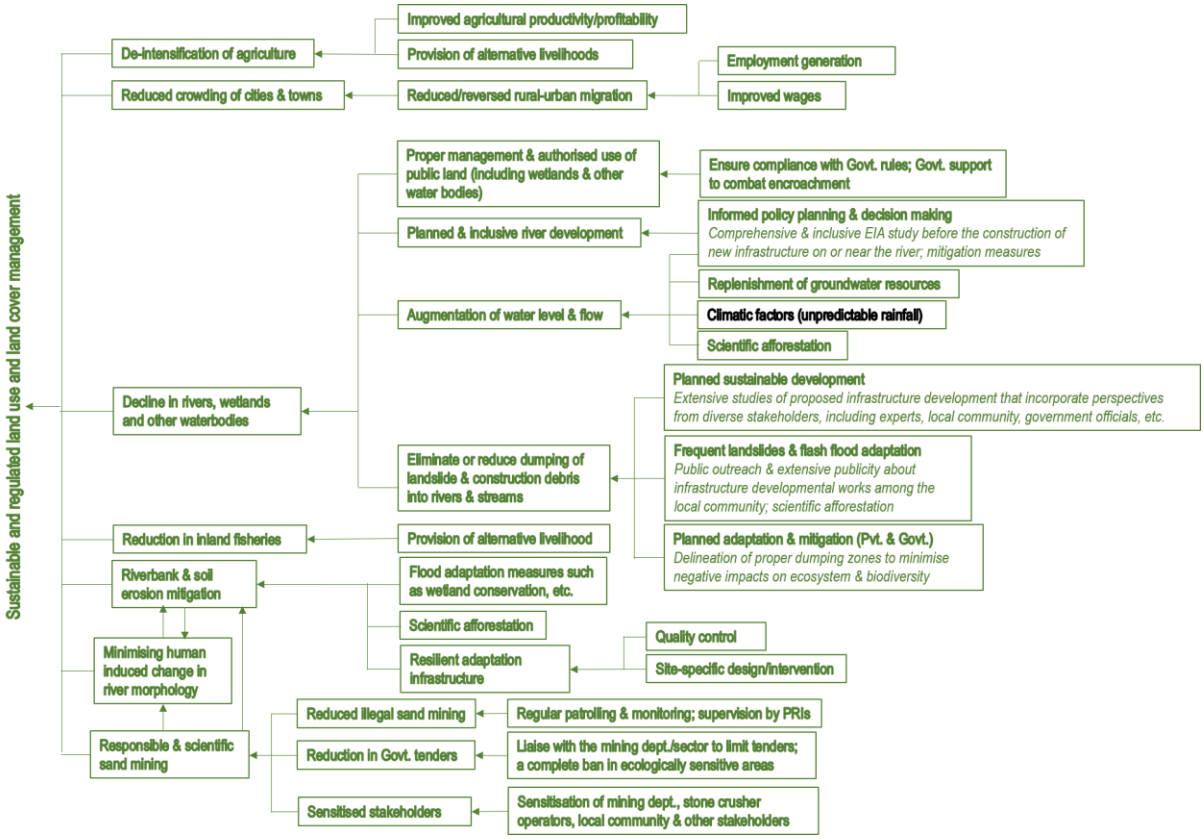
informed policy planning and decision-making, replenishment of groundwater, climate change mitigation, and scientific afforestation. Eliminate or reduce dumping of landslide and construction debris into rivers and streams through planned sustainable development, supported by extensive studies of proposed infrastructure development that incorporate perspectives from diverse stakeholders, including experts, local community, government officials, etc.; adaptation and mitigation measures for landslides and flash floods, including public outreach and extensive publicity about infrastructure developmental works among the local community, and scientific afforestation; and planned adaptation and mitigation (public and private), such as the delineation of proper dumping zones to minimise negative impacts on ecosystem and biodiversity.

(iv) *Inland fisheries expansion*: Curtail the expansion of inland fisheries by providing alternate livelihoods.

(v) *Riverbank and soil erosion*: Mitigation of riverbank and soil erosion through ecological solutions (such as wetland conservation), site- and river-specific adaptation infrastructure of good quality, scientific afforestation, minimising human-induced changes in river morphology, and the promotion of responsible and scientific sand mining.

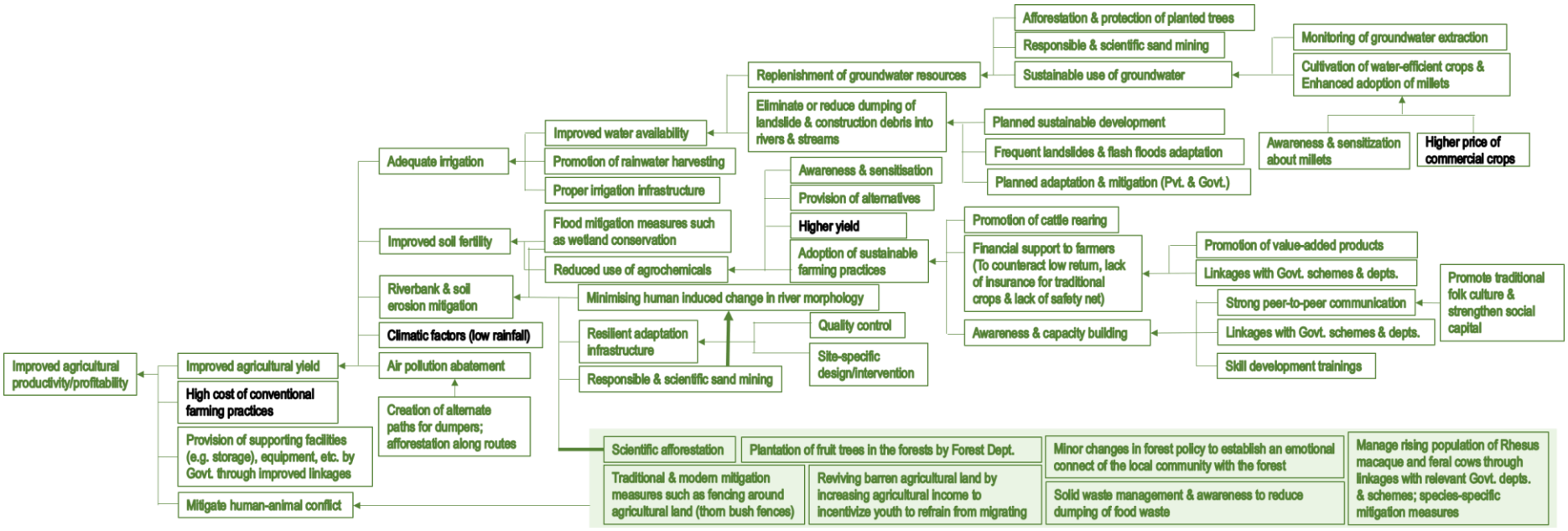
(vi) *Change in river morphology*: Minimise human-induced changes in river morphology through the promotion of responsible and scientific sand mining and the mitigation of riverbank and soil erosion.

(vii) *Excessive and unscientific sand mining*: [Described above in sub-section 3.1. Direct exploitation of riverine resources, part B.(iv)]



Note: No solution was provided for the issue written in black

Figure 10. Solution tree mapped for unsustainable and unregulated land use and land cover change



Note: No solutions were provided for the issues written in black

Figure 11. Solution tree mapped for declining agricultural productivity and profitability

4. Discussion

Biodiversity loss in the Ganga River basin is not the result of a singular factor, but of cumulative and interlinked pressures, namely the direct exploitation of riverine resources, pollution, and unsustainable and unregulated land use and land cover change. These pressures are rooted in deeper systemic issues, including institutional and governance failures, socio-economic inequities, limited knowledge and awareness, and technological and infrastructure deficits (Table 3). A major impediment to designing and implementing effective place-based conservation interventions is the limited understanding of these issues at the grassroots, and of community perceptions regarding possible solutions. The solution-oriented consultations conducted with Gram Panchayat members and representatives across six basin states through participatory FGDs and problem and solution tree analyses yielded a range of practical, community-driven insights grounded in local knowledge and experiential understanding, aimed at enhancing the sustainability of aquatic and water resources, improving livelihoods, and conserving biodiversity.

The FGDs revealed a complex and deeply interconnected web of drivers underlying freshwater biodiversity loss in the Ganga River basin, consistent with the broader literature on biodiversity loss in large river systems, which identifies governance failures, socio-economic marginalisation, limited awareness, infrastructure deficits, and climate change as the primary drivers of freshwater biodiversity decline globally (Tickner et al., 2025; Maasri et al., 2022).

The primacy of institutional and governance failures as a root cause is a recurring theme in conservation literature and is particularly pronounced in the context of large, transboundary river systems such as the Ganga, where multi-tiered governance structures, weak inter-departmental coordination, and limited community participation in decision-making create significant implementation gaps (Siddiqui & Malik, 2025; Hong et al., 2025; Hanasz, 2017; Das & Tamminga, 2012). The findings of this study corroborate this, with weak governance, inadequate regulatory enforcement, and the absence of participatory policy planning identified as foundational drivers that undermine the effectiveness of all other conservation interventions. Deficiencies in administrative capacity and a lack of accountability have created a governance vacuum that facilitates illegal activities such as unregulated sand mining and fishing, while weak inter-departmental linkages and limited community access to government schemes further constrain conservation efforts at the grassroots level. The pivotal role of Gram Panchayats in bridging this governance gap is underscored by the 73rd Constitutional Amendment Act, 1992, which devolves significant administrative and developmental responsibilities to the village level, making them uniquely positioned to enforce compliance with environmental regulations, facilitate community participation in conservation planning, and mainstream biodiversity considerations in village development plans (Government of India, 1950a; b). To overcome the institutional inertia identified in this study, a shift from top-down enforcement to devolved, participatory governance is essential — one in which Gram Panchayats transition from being passive recipients of government directives to active managers of their natural capital. As Gadgil (1992) asserted, conservation is most effective when it is conducted "as if people matter."

Socio-economic inequities emerged as a critical indirect driver of freshwater biodiversity loss, operating primarily through the pathway of livelihood insecurity and resource dependency. The lack of alternative livelihoods was consistently identified across groups and states as a proximate cause of overfishing, agricultural expansion and intensification, and unsustainable sand mining — findings that are well-

documented in the conservation literature on poverty-environment linkages (Asif & Van Arragon, 2024; Brummett, 2022; Untari et al., 2022; Nunan, 2015; Fisher et al., 2012). A central theme emerging from the FGDs was the perception of biodiversity conservation not as a detached ecological goal, but as a livelihood imperative — participants consistently linked declining biodiversity with reduced rural livelihoods and increased vulnerability, consistent with recent literature positing that freshwater ecosystems provide essential safety-net functions for rural households (Dobriyal et al., 2022). The decline in traditional riverine resources such as fish and medicinal plants, and the resulting unemployment, highlight the risk of livelihood displacement when ecosystems degrade, underscoring the need for mainstreaming biodiversity in village development planning to prioritise the restoration of ecosystem services that underpin local economies. Of particular note is the identification of youth outmigration as a distinct socio-economic driver, leading to the abandonment of agricultural land, declining social capital, and increased human-wildlife conflict. Decoupling rural wellbeing from ecological degradation through the promotion of alternative, nature-based livelihoods such as eco-tourism and sustainable agriculture is therefore essential for long-term conservation sustainability.

The role of limited knowledge and awareness as a barrier to sustainable resource use was evident across all groups, with poor ecological literacy, the persistence of traditions and myths, and declining peer-to-peer communication identified as key constraints. Participants highlighted the pervasive impact of hidden drivers such as agrochemical runoff and improper solid waste management, whose cumulative impact on freshwater biodiversity is significant (Balkrishna et al., 2024). The poor awareness and adoption of water-efficient and climate-resilient crops such as millets is particularly significant, given that the cultivation of water-intensive crops was identified as a major driver of groundwater overexploitation — a finding that highlights the potential of promoting traditional, climate-resilient agricultural practices as a nature-based solution for freshwater conservation, consistent with the broader agenda of sustainable agriculture under the Kunming-Montreal Global Biodiversity Framework (Convention on Biological Diversity, 2022).

Technological and infrastructure deficits, particularly the lack of eco-sensitive, site-specific, and well-maintained infrastructure for water resource management, waste management, and sustainable fishing, were identified as critical gaps constraining conservation efforts at the grassroots level. The absence of formal handover protocols for infrastructure to PRIs — resulting in poor maintenance and functionality — points to a systemic failure in the decentralisation of infrastructure management, and reinforces the need for strengthening the administrative and financial capacity of Gram Panchayats to manage local environmental infrastructure. The localised manifestations of broader basin-wide stressors, such as riverine pollution and waterlogging identified by groups across Uttar Pradesh and Bihar, further emphasise the need for decentralised, village-specific interventions that address infrastructure deficits in a site- and context-specific manner (Balkrishna et al., 2024).

Climate change and natural hazard vulnerability emerged as a significant cross-cutting driver, exacerbating all other categories of root causes. The identification of unpredictable rainfall, floods, landslides, and poor adaptation infrastructure as key drivers of freshwater biodiversity loss is consistent with projections for the Ganga River basin under climate change scenarios, which anticipate increased variability in monsoon rainfall, more frequent extreme weather events, and accelerated glacial retreat in the upper basin (Wijngaard et al., 2017; Vinke et al., 2017; Mittal et al., 2014). The findings underscore

the need for climate-resilient, site- and river-specific adaptation strategies that are developed in consultation with local communities and integrated into village development planning.

The Driver-Pressure-State-Impact-Response (DPSIR) framework was used to analyse the findings of the FGDs and to systematically examine the causal linkages between the underlying drivers of freshwater biodiversity loss, the direct pressures they generate, the resulting environmental state, the societal and ecological impacts, and the responses required to address them (Table 4). The co-occurrence of multiple pressures across the same river stretches points to a cumulative stress dynamic, wherein individual pressures, while manageable in isolation, collectively overwhelm the ecological resilience of freshwater ecosystems (Vörösmarty et al., 2010). The participants reported several environmental concerns, including loss of aquatic biodiversity, river pollution, reduced water levels and flow, declining groundwater levels, and riverbank erosion. Of particular significance is the reported decline in populations of flagship aquatic species such as the Gangetic dolphin (*Platanista gangetica*) and freshwater turtles, which serve as indicators of broader ecosystem health and are recognised as priority species for conservation under the Namami Gange programme. The reported decline in traditional ecological knowledge and river stewardship is an additional concern, as the erosion of this knowledge base reduces the community's capacity to monitor, respond to, and adapt to environmental change. The societal and ecological impacts identified, including declining fish catches and fish revenue, loss of agricultural livelihoods, health issues from polluted water, increased flood vulnerability, and cultural disconnection from rivers, disproportionately affect the most economically and socially marginalised members of riverside communities, including small-scale fisherfolk, marginal farmers, and women, reinforcing the poverty-environment trap identified at the driver level (Nunan, 2015; Fisher et al., 2012). The responses identified by the participants span ecological, infrastructural, institutional, and social and behavioural dimensions, reflecting a shared recognition of the need for a multi-pronged approach to freshwater biodiversity conservation. The identification of nature-based livelihoods and the revival of traditional conservation practices as key responses is consistent with the growing body of evidence supporting the integration of nature-based solutions and traditional ecological knowledge into conservation planning (Berkes, 2017; Cohen-Shacham et al., 2016).

Table 3. The underlying root causes of biodiversity loss in the Ganga River basin, and the recommended solutions to address them

Category	Underlying Root Causes	Recommended Solutions
Institutional and governance failures *Deficiencies in administrative capacity, enforcement, policy coherence, and decentralisation*	• Lack of government oversight, accountability, and compliance with rules and regulations, leading to illegal sand mining, unregulated fishing, inadequate waste management by factories, and poor-quality control in adaptation infrastructure • Weak governance, particularly in the enforcement of regulations pertaining to sand mining and fishing • Inadequate or conflicting incentives for environmentally sound practices, such as sustainable agriculture and fishing • Excessive government tenders and unscientific land allotment for sand mining • Lack of quality, comprehensive, and inclusive Environmental Impact Assessments (EIAs) for infrastructure projects • Poor adoption of mitigation measures in river development projects and infrastructure in the immediate vicinity of rivers • Weak inter-departmental linkages • Weak departmental linkages with local communities, limiting access to government schemes • Lack of participatory policy planning and decision-making, including limited local community involvement in land-use and river development decisions • Inadequate capacity and outreach in implementing government schemes	• Strengthen regulatory enforcement and government oversight through participatory monitoring committees with local representation • Combat weak governance through transparency mechanisms, independent oversight, and accountability frameworks • Develop incentive frameworks for sustainable agriculture, fishing, and sand mining • Ensure comprehensive and inclusive EIAs with clear mitigation measures for all infrastructure projects on or near rivers • Reduce government tenders and ensure scientific land allotment for sand mining, including complete bans in ecologically sensitive areas • Strengthen inter-departmental and community linkages to improve access to and implementation of government schemes • Promote participatory policy planning and decision-making to ensure local community involvement in land-use and river development decisions

Category	Underlying Root Causes	Recommended Solutions
Socio-economic inequities *Livelihood insecurity, demographic pressures, and socio-economic marginalisation driving habitat degradation and heavy resource dependency*	• Lack of alternative livelihoods leading to overfishing and agricultural expansion and intensification • Economic homogeneity leading to lack of employment opportunities, low wages, and inability of rural communities to cope with declining agricultural productivity, profitability, and fish revenue • Youth outmigration leading to abandonment of agricultural land, declining social capital, and increased human-wildlife conflict • Uneducated or poorly educated rural population due to low uptake of education, stemming from lack of motivation and awareness, and a sub-standard, under-resourced rural education system with inadequately trained teaching staff • Inadequate support for indigenous and traditional arts and handicrafts • Small landholdings limiting agricultural productivity and economic resilience	• Provide alternative livelihood opportunities through skill development programmes, implementation of government schemes, and promotion of indigenous and traditional arts and handicrafts • Create rural employment opportunities through participatory policy and decision-making, improved access to government schemes, and promotion of rural self-reliance through small and cottage industries, local tourism, and market linkages for local produce • Improve rural wages and reduce unemployment through strengthening of the rural economy • Reverse or reduce youth outmigration by improving rural employment opportunities, wages, and quality of life • Improve rural education through awareness campaigns, fundamental reforms in the education system, and regular teacher training programmes
Limited knowledge and awareness *Limited ecological and environmental literacy, insufficient behaviour change, and weak community engagement*	• Lack of awareness about and capacity in sustainable agricultural and fishing practices • Lack of awareness about and poor adoption of water-efficient and climate-resilient crops such as millets, contributing to groundwater overexploitation • Poor peer-to-peer communication due to declining social capital and cultural dilution • Uneducated or poorly educated rural population	• Conduct targeted awareness and sensitisation campaigns on sustainable agricultural and fishing practices, responsible waste management, and the ecological significance of freshwater biodiversity • Promote awareness and adoption of water-efficient and climate-resilient crops such as millets through targeted outreach, capacity building, financial assistance, and linkages with government departments

Category	Underlying Root Causes	Recommended Solutions
	• Traditions and myths driving unsustainable practices such as disposal of animal carcasses and cremation ashes in rivers	• Promote capacity building in sustainable practices through government outreach, NGOs, and expert institutions • Strengthen social capital and peer-to-peer communication networks at the village level • Address traditions and myths through culturally sensitive awareness programmes
Technological and infrastructure deficits *Lack of quality, context-specific, and sustainable supporting infrastructure*	• Lack of supporting technology and infrastructure for sustainable fishing practices and mitigation measures in river development projects, road construction, and sand mining • Lack of eco-sensitive infrastructure for water resource management • Inadequate site- and context-specific adaptation and mitigation infrastructure for flood management and riverbank erosion • Infrastructural development in geologically vulnerable and climatically sensitive regions • Lack of rainwater harvesting infrastructure contributing to water scarcity and irrigation inadequacy • Inadequate, sustainable, and efficient waste management infrastructure • Lack of accountability and absence of formal handover of infrastructure to government departments and Panchayati Raj Institutions (PRIs), resulting in poor maintenance and functionality	• Develop and promote eco-sensitive, site- and context-specific infrastructure for water resource management, flood mitigation, and riverbank erosion control • Ensure planned and informed infrastructure development in geologically vulnerable and climatically sensitive regions, supported by comprehensive stakeholder consultations and EIAs • Promote rainwater harvesting and other water conservation technologies to improve water availability for irrigation and groundwater replenishment • Establish efficient waste management infrastructure, including effluent treatment plants, sewage treatment plants, covered drains, and solid waste management facilities • Promote sustainable fishing technology, including use of larger mesh-size, biodegradable fishing nets • Establish accountability frameworks and formal handover protocols for infrastructure to government departments and PRIs to ensure quality control and regular maintenance

Category	Underlying Root Causes	Recommended Solutions
Climate change and natural hazard vulnerability *Exposure to climate variability and extreme events exacerbating existing socio-economic and ecological pressures*	• Unpredictable and declining rainfall adversely affecting agricultural productivity and river water levels • Increased frequency and intensity of floods and flash floods causing riverbank erosion, post-flood waterlogging, and habitat degradation • Frequent landslides in hilly regions leading to dumping of debris in rivers and streams, reducing water availability and quality • Poor and non-resilient climate change adaptation and mitigation at both government and community levels • Non-resilient adaptation infrastructure resulting from lack of site-specific design and poor quality, exacerbating the impacts of floods and riverbank erosion	• Develop and implement effective, site- and river-specific climate change adaptation and mitigation strategies for floods, landslides, and flash floods • Promote scientific afforestation and protection of planted trees to improve groundwater recharge, reduce soil erosion, and enhance climate resilience • Delineate proper debris dumping zones and develop planned adaptation and mitigation measures for landslide and construction debris to minimise impacts on freshwater ecosystems • Strengthen early warning systems and community preparedness for extreme weather events • Incorporate climate resilience into the design and construction of all infrastructure in geologically vulnerable and climatically sensitive regions

Table 4: Driver-Pressure-State-Impact-Response (DPSIR) Framework: Analysis of Drivers and Solutions in the Ganga River basin

DPSIR Element	Description
Drivers (D) *Underlying socio-economic, institutional, cultural, and climatic factors that shape human-environment interactions*	Poverty, lack of alternative livelihoods, and declining agricultural productivity and profitability
	Youth outmigration and declining social capital
	Population pressure and urbanisation
	Low levels of education and awareness
	Weak governance, lack of government oversight, and institutional fragmentation
	Ritual and cultural practices adversely affecting river health
	Climate change and natural hazard vulnerability
	Unplanned and poorly regulated infrastructure development
Pressures (P) *Direct stressors resulting from human activity that degrade environmental quality and function*	Unregulated and unsustainable fishing practices, including use of monofilament nets with fine mesh size and year-round fishing
	Excessive and unscientific sand mining and riverbank encroachments
	Construction of dams and barrages causing river fragmentation and reduced flow
	Overexploitation of surface water and groundwater
	Discharge of untreated sewage, industrial effluents, and solid waste into rivers
	Agricultural runoff from excessive use of agrochemicals
	Riverbank farming
	Deforestation and reduced tree cover
	Dumping of landslide and construction debris into rivers and streams
	Poor sanitation practices, including open defecation and disposal of carcasses and cremation ashes in rivers
State (S) *Condition of the environment and ecosystem health affected by persistent pressures*	Loss of aquatic biodiversity, including fish, Gangetic dolphins (*Platanista gangetica*), and freshwater turtles
	River pollution and deterioration of water quality
	River fragmentation, reduced water levels and flow, and ecosystem degradation
	Declining groundwater levels
	Riverbank and soil erosion

	Reduced water retention and increased flooding
	Decline in traditional ecological knowledge and river stewardship
Impact (I) *Societal and ecological consequences resulting from degraded environmental state*	Declining fish catch and fish revenue, adversely impacting the livelihoods of fishing communities
	Loss of livelihoods among farmers and fisherfolk due to declining agricultural productivity and aquatic biodiversity
	Health issues from polluted drinking water and increased disease vectors
	Waterlogging and increased flood vulnerability of riverside communities
	Decline in ecosystem services, including clean water, fertile land, and flood regulation
	Migration due to livelihood insecurity
	Cultural loss and disconnection from rivers
Response (R) *Measures aimed at mitigating drivers and pressures, improving environmental state, and reducing societal and ecological impacts*	**Ecological**
	Wetland conservation and restoration, erosion control, and scientific afforestation
	Infrastructural
	Improved sanitation infrastructure, including sewage treatment plants, covered drains, and public toilets
	Eco-sensitive, site- and river-specific infrastructure for water resource management and flood mitigation
	Mainstreaming ecological considerations into infrastructure development
	Institutional
	Strengthening regulatory enforcement, and inter-departmental coordination
	Participatory policy planning and decision-making with active involvement of PRIs
	River health monitoring committees at the grassroots
	Social and Behavioural
	Targeted awareness and sensitisation campaigns on sustainable practices and ecological significance of freshwater biodiversity
	Promotion of sustainable and nature-based livelihoods, including eco-tourism and sustainable agriculture
	Capacity building in sustainable fishing, farming, and waste management practices
	Revival and promotion of traditional conservation practices

Collectively, the findings highlight the need for an integrated, multi-sectoral approach to freshwater biodiversity conservation in the Ganga River basin — one that simultaneously addresses governance gaps, socio-economic inequities, knowledge deficits, infrastructure limitations, and climate vulnerability. Gram Panchayats are not merely passive stakeholders in this process, but active knowledge holders and governance actors whose engagement is essential for developing contextually relevant, equitable, and sustainable conservation strategies. The drivers and solutions identified through the participatory focus group discussion (FGD) process may inform the preparation of village microplans centred on mainstreaming biodiversity conservation in village development planning in select villages along the Ganga River and its tributaries. The grassroots-level insights generated through this exercise may further contribute to actionable, village-specific conservation and development interventions, as well as broader policy and regulatory frameworks for the Ganga basin. Aligning with Target 14 of the Convention on Biological Diversity Kunming-Montreal Global Biodiversity Framework, which calls for the full integration of biodiversity values across all levels of government, mainstreaming biodiversity conservation in village development planning directly operationalises international biodiversity commitments at the grassroots level, demonstrating the potential of participatory, community-led conservation planning as a pathway to biodiversity mainstreaming at scale (Convention on Biological Diversity, 2022).

5. Conclusion

Gram Panchayats in the Ganga River basin possess an experientially grounded understanding of the drivers of freshwater biodiversity decline, which is both ecologically insightful and deeply embedded in the socioeconomic realities of riverside communities. The participatory FGD process revealed that biodiversity loss in the basin is not the result of a singular or isolated cause, but of a complex, deeply interconnected web of pressures, encompassing the direct exploitation of riverine resources, pollution, and unsustainable land use and land cover change, rooted in systemic institutional, socio-economic, knowledge, infrastructure, and climatic deficits. The institutional and governance failures manifesting in weak regulatory enforcement, limited participatory planning, and poor inter-departmental coordination, underscore the critical importance of strengthening the administrative, financial, and governance capacity of Gram Panchayats. This requires a form of participatory governance wherein Gram Panchayats are empowered not merely as recipients of government directives, but as active managers and stewards of their natural capital. The inextricable linkage between rural livelihoods and freshwater ecosystem health underscores the imperative of treating biodiversity conservation as a livelihood imperative rather than a detached ecological goal. The identification of youth outmigration, economic homogeneity, and declining social capital as distinct socio-economic drivers highlights the cascading consequences of rural marginalisation for biodiversity, and reinforces the need for conservation strategies that simultaneously address ecological and socioeconomic vulnerabilities. Promoting alternative and nature-based livelihoods, strengthening rural economies, improving access to education, and reversing youth outmigration are therefore not merely welfare interventions, but are essential conservation strategies.

The consistency of drivers and impacts identified across diverse geographic, cultural, and socioeconomic contexts, from the glacial headwaters of Uttarakhand to the deltaic plains of West Bengal, points to the pervasive and systemic nature of the challenges facing the Ganga River basin, and reinforces the need for a basin-wide, yet locally grounded, approach to freshwater biodiversity conservation. The diversity of solutions proposed by the participants, ranging from village-level monitoring committees to scientific

afforestation, rainwater harvesting, and the revival of traditional conservation practices, demonstrates the diverse repository of contextually relevant, community-driven knowledge that can inform effective conservation planning. The DPSIR analysis further underscores that sustainable conservation outcomes cannot be achieved through isolated, sector-specific interventions. Nature-based solutions, traditional ecological knowledge, and participatory governance must be integrated into a coherent, multi-sectoral conservation strategy that is co-designed with the communities most directly dependent on, and most acutely affected by, freshwater biodiversity.

The findings of this study may inform the preparation of village microplans centred on mainstreaming biodiversity conservation in village development planning for select villages along the Ganga River and its tributaries. These village microplans provide a model for operationalising Target 14 of the Kunming-Montreal Global Biodiversity Framework, which calls for the full integration of biodiversity values across all levels of government, at the grassroots level, and for demonstrating that participatory, community-led conservation planning is not only feasible but essential for achieving biodiversity mainstreaming at scale.

Mainstreaming biodiversity conservation in village development planning is not merely a policy requirement under international frameworks, but a foundational step towards achieving a sustainable, equitable, and biodiversity-positive development paradigm in the Ganga River basin. Gram Panchayats, as the lowest and most direct tier of governance at the grassroots, are uniquely positioned to lead this transition, provided they are adequately sensitised, equipped, supported, and empowered to do so. The 'Ganga Biodiversity Conservation Initiative' provides a replicable model for bridging the gap between national basin-wide conservation objectives and local developmental needs, and for placing communities at the centre of the long-term sustainability of the Ganga River basin.

5.1 Recommendations

Based on the findings of this study, the following recommendations are proposed for mainstreaming biodiversity conservation into village development planning in the Ganga River basin:

- *Strengthen participatory governance*: Empower Gram Panchayats to actively participate in land-use planning, river development decision-making, and regulatory enforcement through the establishment of village-level biodiversity and river health monitoring committees, operationalisation of participatory monitoring mechanisms, and strengthening of inter-departmental linkages.
- *Promote livelihood diversification and nature-based solutions*: Invest in skill development, promotion of indigenous arts and handicrafts, responsible tourism, sustainable agriculture, and other nature-based solutions to reduce resource dependency.
- *Scale up awareness and capacity building*: Conduct targeted, culturally sensitive, and community-specific awareness and sensitisation campaigns on the ecological significance of freshwater biodiversity, sustainable agricultural and fishing practices, and responsible waste management, with a particular focus on reversing traditions and myths that drive unsustainable practices.
- *Invest in eco-sensitive and climate-resilient infrastructure*: Prioritise the development of site- and context-specific infrastructure for water resource management, waste management, flood mitigation, and riverbank erosion control, with formal handover protocols to PRIs to ensure quality control and regular maintenance.

- *Address climate vulnerability*: Develop and implement climate-resilient, site- and river-specific adaptation strategies in consultation with local communities, incorporating early warning systems, scientific afforestation, rainwater harvesting, and the promotion of climate-resilient crops such as millets.
- *Integrate biodiversity into the Gram Panchayat Development Plan (GPDP)*: Incorporate biodiversity conservation targets, ecosystem-based indicators, and nature-based solutions into the GPDP as a standard component of village development planning, using the village micro plans developed under this study as a replicable model.
- *Institutionalise the village microplan approach*: Scale up the village microplan model developed under the NMCG-WII Ganga Biodiversity Conservation Initiative to other villages and river stretches across the Ganga River basin, and explore its replication in other ecologically significant river basins in India, as a pathway to achieving biodiversity mainstreaming at scale under the Kunming-Montreal Global Biodiversity Framework.

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Appendix I

Focus Group Discussion: Problem Tree

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
Uttarakhand	Chamoli, Tehri Garhwal, Uttarkashi	Bhagirathi, Alaknanda, Ganga	Natural and human-caused disasters	Unsustainable development of infrastructure (road, rail, tunnels, bridges, etc.) in geologically vulnerable areas			
				Frequent landslides			
				Flash floods due to dumping landslide debris or construction waste into the river or river banks. It also harms the biodiversity of the slope.			
				Dumping up soil debris near natural streams makes water unavailable for agriculture and domestic use.			
			Lack of awareness	Lack of awareness about the livelihood schemes in the area.			
				Schemes related to storage house, equipment, training and marketing are not promoted properly.			
				Cultural dilution which affects communication and sharing of information among the locals			
			Agriculture	Improper irrigation facility in the upper region			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Excessive use of chemical fertilizer has led to the infertility of the soil			
				Lack of organic farming due to the declining domestication of cattle and sheep			
				Lack of rainwater harvesting facilities			
				Inadequate price for local traditional crops			
				No cold or dry storage facility			
				No insurance for traditional crops			
			Human-wildlife conflict	Crop raiding due to concentrated farming in small land			
				Increasing areas of barren agricultural land due to the migration of youth			
				Deforestation			
				Increased procurement of wild fruits decreases the food supply for wild boars, monkeys, langurs, and bears, among other animals.			
				Mining of minerals disturbs the biodiversity of the area and forces them to migrate			
				Dumping of food material and waste attracts wild animals			
Uttar Pradesh		Ganga		River bank Farming			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
	Bijnor, Muzaffarnagar, Bulandshahr, Sambhal		Pollution (water, soil & solid waste)	Dumping of waste during festivals and fairs	• The municipal dumping zone is built inside the village • No STP & ETP		
				Dumping industrial and domestic waste			
			Lack of government support	Lack of Protected Area			
				Encroachment on public land			
				Lack of proper arrangements for pilgrims			
				Lack of road connectivity			
			Lack of livelihood	Low return on agriculture	Human-wildlife conflict	Increase in the population of *Rhesus macaque* and feral cows	
					High cost of conventional farming practices	Lack of awareness	
	Farrukhabad, Kannauj, Shahjahanpur	Ganga, Ramganga, Kali	Declining rural livelihood	Health issues	Rising disease vectors	Lack of waste management by sugar mills	Lack of infrastructure ← Lack of supervision ← Far from district headquarters
						Waterlogging	Poor water supply infrastructure ← (Lack of accountability + No handover to Govt. Dept/PRIs)
							Floods ← Climate Change
				Declining agricultural production	Waterlogging	Poor water supply infrastructure	Lack of accountability
							No handover to Govt. Dept/PRIs
						Floods	Climate Change
					Soil erosion	Floods	Climate Change
						Lack of resilient infrastructure	Poor quality
							Lack of site-specific design
						Illegal sand mining	Law and order issues
					Declining soil fertility	Floods	Climate Change
						Intensive use of agri inputs	

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
						Poor adoption of sustainable farming	Small landholding
							Low productivity
							No safety net
				Declining fish catch	Habitat degradation	Illegal sand mining	Law and order issues
						Riverbank farming	
					Use of monofilament nets	Lack of supervision	
						Law and order issues	
						To cope with declining fish catch	Lack of alternate livelihoods
			Declining biodiversity	Habitat degradation	Illegal sand mining	Law and order issues	
					Riverbank farming		
				Use of monofilament fishing nets	Lack of supervision		
					Law and order issues		
					To cope with declining fish catch	Lack of alternate livelihoods	
				Intensive use of agri inputs			
	Prayagraj, Kaushambi	Ganga, Yamuna	Declining aquatic biodiversity	River pollution	Excessive use of agrochemicals		
					Dumping of waste from cultural fairs and festivals, domestic waste, and dead bodies		
					Sludge and effluent from factories		
					Non-segregation of waste		
				Decrease in water level	Unnecessary exploitation of groundwater		
					Lack of rainwater harvesting		
					Unpredictable rainfall due to climate change		
					Deforestation		
				Over-exploitation of riverine resources	Lack of awareness		
					Poaching of aquatic species		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Soil erosion		
					Illegal sand mining		
					Encroachment on river banks		
					River fragmentation from dams and barrages		
	Etawah	Yamuna, Chambal	Lack of livelihood	Poor education	Low standard of primary education		
					Lack of awareness among people		
					Lack of teacher training systems		
				Lack of employment opportunities	Inactive administration		
					Remote area		
				Lack of alternate livelihood	Lack of skill development training programmes		
					Improper implementation of useful schemes		
				Reduction in agricultural production	Rising human-wildlife conflict viz., crop raiding		
	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	Ghaghra, Rapti	Declining biodiversity	Pollution	Religious waste		
					Agricultural runoff		
					Plastic pollution		
					Solid waste		
					Inflow of untreated sewage		
					Lack of awareness		
				Habitat loss	Illegal mining		
					Soil erosion		
					Encroachment on water bodies		
				Lack of employment	Unregulated fishing		
					No local tourist spot and its maintenance near the river		
					Illegal trade and poaching of migratory species		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Lack of support from Govt. departments	No benefit from Govt. schemes		
					No involvement of local people in decision/policy making		
	Mirzapur, Jaunpur, Varanasi, Chandauli	Ganga, Gomti	Declining biodiversity	Pollution	Agrochemicals		
					Solid waste/plastic/religious materials		
					Sewage inflow		
					Floods		
				Lack of awareness	Lack of awareness/ outreach by Govt. departments		
				Encroachment on riverbanks & public lands	Lack of Govt. support & oversight		
			Declining rural livelihood	Declining agricultural productivity & profitability	Crop depredation by feral cattle		
					Falling water level		
				Declining fish revenue	Low fish catch	Declining fish population	
					Lack of support by the Fishery Dept.		
				Health issues	Lack of health facilities		
					Diseases post floods	Waterlogging post floods	
					Lack of cleanliness	Lack of awareness	
					Drinking water issues		
					Inadequate food ration		
					Lack of physical exercise		
					Air and water pollution		
				Unemployment	Lack of employment opportunities/livelihood options		
Bihar	Bhagalpur, Katihar	Ganga, Kosi	Water Pollution	Conventional farming practices (agrochemicals)	Overuse of chemical fertilizers for higher yield		
					Overuse of pesticides and insecticides		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Wastewater discharge	Lack of treatment plants		
					Open drainage system		
				Open defecation	Lack of toilets		
					Mental block		
					Traditional beliefs		
			Poaching of turtles and migratory and native birds	Illegal trade			
				Culinary use			
				Medicinal use due to myths			
				Traditional use			
			Sand and soil mining	Illegal mining without licenses			
				Excessive Government tenders			
				Overexploitation			
			Land and soil erosion (riverbank, forest, village and agricultural area)	Floods			
				Change in river morphology			
				Illegal mining			
	West Champaran, Vaishali	Ganga, Gandak	Declining aquatic biodiversity	Habitat degradation	Riverbank farming	Lack of awareness	
						Lack of alternate livelihood	
					Sand mining	Lack of awareness	
					Overfishing	Lack of alternate livelihood	
			Riverine pollution	Agrochemicals	Lack of awareness		
					Lack of alternatives		
				Lack of proper solid and liquid waste disposal mechanisms	Lack of awareness		
				Dumping religious waste into the river	Lack of awareness		
			Waterlogging	Inability of rainfed rivers to drain into the perennial river due to obstruction			
				Lack of Govt. intervention			
Jharkhand	Sahibganj	Ganga	Declining aquatic biodiversity	Water pollution	Untreated industrial waste		
					Agrochemical seepage		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Solid waste/plastic pollution	Excessive plastic consumption		
					Lack of proper waste management		
				Land erosion	Deforestation		
					Flash floods		
					Sand mining		
				Unsustainable fishing practices	Use of fine mesh size fishing nets		
				Lack of awareness			
			Unemployment	Lack of support from the govt			
				Low labour wages			
				Lack of education	Lack of motivation for education		
				Lack of support for indigenous knowledge and traditional art			
				Rural-urban migration			
			Agricultural insignificance	Low yield	No seed distribution from govt		
					Lack of agricultural knowledge and other information		
					Lack of Agricultural equipment		
					Climatic factors such as low rainfall		
West Bengal	Nadia	Hooghly	Pollution	Water pollution	Habitat degradation	Biodiversity loss	Fall in fish diversity and population ← Illegal fishing
							Fall in migratory birds ← Snails and fishes reduced
						Siltation	Cremation ashes deposited in water

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Water quality degradation	Household puja materials deposition in water	Lack of awareness
						Dumping dead body of domestic cattle in water	
						Boats emit diesel in water	
				Soil damage	Reduced soil fertility and Nitrogen	Pesticides used by farmers	Awareness issues
					Monoculture of rice	No use of water sprinkler provided by Govt.	
					Agricultural field damage	Illegal fishery	
						Unsustainable road development and promoting	
				Air pollution	Fly ash emission	Brick factory and forest fire	
						Rice mill	
					Poisonous gas and soot emission	Kerosene motor van	
			Poverty	Resource depletion	Food scarcity		
				Lack of employment	Improper family planning	Lack of education & awareness	
Himachal Pradesh	Sirmaur	Yamuna	Water Pollution	Wastewater from factories is released without treatment			
			Lack of solid waste management	Panchayat does not have funds			
			No help from Govt. during natural hazards or disaster	News does not reach the govt on time			
			Poor adoption of millet cultivation	• Commercial crops prevail as they have a better market price • Lack of awareness of millets			
			Land erosion	Deepening of Yamuna River	Sand and boulder mining		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
			Crop yield is affected Impact on human health	Air pollution	Dumpers from mining sites ply through the village causing dust to fly		

Appendix II

Focus Group Discussion: Solution Tree

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
Uttarakhand	Chamoli, Tehri Garhwal, Uttarkashi	Bhagirathi, Alaknanda, Ganga	Natural and human-induced disasters	Proper survey of the area by community-based participation			
				Extended publicity of the infrastructure developmental works in the area among locals			
				Proper dumping zones must be developed without harming the biodiversity of the area			
			Enhance awareness	Promotion of health, education, and alternate livelihood opportunities			
				Publicity of government schemes through various multimedia			
				Promoting the traditional folk culture to engage the locals and promote brotherhood and communication			
			Agriculture	Building irrigation facility by directing the natural streams for water storage			
				• Promotion of traditional, natural and organic farming • Establishing linkages and organising regular training programmes with the concerned department			
				Promotion of domestication of A2 cattle and sheep			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Promoting rainwater harvesting			
				Promoting value-added products for fruits due to their lower shelf life			
				Collaboration with the concerned departments for building of storage facility in Gram Panchayat or Gram Sabha.			
				Providing adequate insurance to local traditional minor crops to promote their growth and demand in the market.			
			Mitigating human-wildlife conflict	Traditional and modern fencing around agricultural land (thorn bush fences)			
				• Promoting agriculture to revive the barren agricultural lands • Ensuring regular income through agriculture to the youth to discourage migration among them			
				• Plantation of fruit trees in the forest for wild animals • Minor changes in forest policy to help the local community establish an emotional connect with the forest resources			
Uttar Pradesh	Bijnor, Muzaffarnagar,	Ganga	Pollution (water, soil & solid waste)	A plan should be passed for traditional farming, medicinal plantation, etc. in marshy lands			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
	Bulandshahr, Sambhal			The number of cleaning workers should be increased at ghats			
				Proper disposal of industrial and domestic waste through the construction of STPs & ETPs			
			Lack of government support				
				Awareness of government schemes			
				Proper arrangements for pilgrims & ensure compliance with rules			
				Improve road connectivity			
			Lack of livelihood	Enhance agricultural profitability	Awareness about human-wildlife conflict mitigation measures		
					Provide organic products and methodology for organic and natural farming		
				Alternate livelihood			
	Farrukhabad, Kannauj, Shahjahanpur	Ganga, Ramganga, Kali	Strengthened rural livelihoods	Improved health	Reduced disease vectors	Proper waste management by sugar mills	Installation of waste management infrastructure by sugar mills A monitoring committee may be constituted
						Proper management of household waste	Operationalisation of the village RRC
						Reduce waterlogging	Good quality water supply infrastructure ← Water management committee must be empowered ← Quality control + regular maintenance

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Enhance agricultural productivity	Reduced waterlogging	Good quality water supply infrastructure	Water management committee must be empowered ← Quality control + regular maintenance
					Reduced Soil erosion		
						Resilient infrastructure	Scientific afforestation along riverbanks
							Site-specific designs for flood mitigation infrastructure
					Improved soil fertility		
						Adoption of organic farming	• Financial assistance by Govt. • Capacity building • Awareness of Govt. schemes Panchayat land may be leased to enhance local livelihoods
				Enhanced fish catch			
					Reduced use of monofilament fishing nets	• Operationalise Monitoring Committee • Awareness and sensitization	
						Safety net for reduced riverine fish catch	• Community fishing • Skill development
			Conserving biodiversity				

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Reduce the use of monofilament fishing nets	• Operationalise Monitoring Committee • Awareness and sensitization		
					Safety net for reduced riverine fish catch	• Community fishing • Skill development	
				Adoption of organic farming	• Financial assistance by Govt. • Capacity building • Awareness of Govt. schemes • Panchayat land may be leased to enhance local livelihoods		
	Prayagraj, Kaushambi	Ganga, Yamuna	Enhancing biodiversity	Reduce river pollution	Promote organic farming and provide financial support to the farmers		
					• Collection and recycling of flower waste into incense sticks • Construction of STPs • Construction of electric crematoria as well as building of crematorium units 500m away from the riverbed • Installation of garbage bins, and door-to-door collection of waste		
					• Construction of RRC • Spreading awareness among the locals		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Improve water level	Monitoring of exploitation of water resources		
					Promoting rainwater harvesting		
					Regular plantation drives and their conservation		
				Reduce exploitation of riverine resources	Awareness rallies and conducting awareness programmes through multiple media.		
					Implementation of strict protocols for the fishing community by the concerned department to prohibit the use of fine fishing nets.		
					Plantation of deep-rooted plants		
					Strict patrolling against illegal mining		
					Conduct an EIA study before the construction of new infrastructure on or near the river		
	Etawah	Ganga, Yamuna	Improve local livelihood	Improve education	Changes in the education system		
					• Awareness and sensitization programme • The importance of education should be imparted to the parents		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Regular training camps for teachers		
				Employment generation	Strengthen linkages with Govt. departments		
					• Establish small and cottage industries • Establish market linkages for local products		
				Enhance alternate livelihoods	Skill development training programmes by NGOs		
					Providing local livelihood resources through various institutes and organisations		
				Improve agricultural production	• Planting fruit trees in the forest to reduce crop raiding in agricultural fields with the help of the forest department. • Planting thorn bushes as fencing around the residential area and agricultural fields		
	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	Ghaghra, Rapti	Biodiversity conservation	Decline in pollution			
					Promote organic farming		
					Control on single-use plastic		
					Proper solid waste management		
					STP establishment		
					Awareness campaigns		
				Habitat regeneration	A complete ban on mining activities		
					• Effective tree plantation		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					• Boulders and proper embankment		
					Restoration of local water bodies (Ponds & wells)		
				Employment generation	• Regulated fishing • Fishing in local water bodies		
					Development of local tourist spots and *pakka* ghats		
					Provide alternate livelihood opportunities		
				Enhance Govt. support through strengthened linkages	Cooperation between local people and Govt. department		
					Involvement of local community in policy-making		
	Mirzapur, Jaunpur, Varanasi, Chandauli	Ganga, Gomti	Conserving biodiversity	Mitigate pollution	Promotion of organic, natural & millet farming through awareness & sensitisation, capacity building & provision of organic inputs		
					• Awareness & sensitisation regarding solid waste pollution & its management • Proper cleaning staff • Installation of garbage bins, particularly at ghats • Engagement of religious groups		
					Support of District Administration to treat		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					sewage or stop it inflow into the river		
					Afforestation to mitigate impact of floods		
				Enhance awareness	• Sensitization of local community to conservation significance of freshwater biodiversity through awareness rallies, street plays, etc. (stakeholder specific awareness programmes) • Strengthening linkages with District Administration, Govt. depts., etc.		
				Proper management & authorised use of public lands & river bank	Strengthen linkages with District Administration		
			Enhancing rural livelihood	Improve agricultural productivity & profitability			
					Afforestation		
				Improve revenue from fishing	Increase in fish catch	Capacity building in sustainable fishing practices & provision of necessary gear to enhance fish population	
					Strengthen linkages with Fishery Dept., & Govt. schemes		
				Better health	Provision of health facilities by Govt.		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Provision of medicines during floods & cleaning supplies; pest control		
					Improved cleanliness	• Awareness & sensitisation • Proper cleaning staff	
					Better drinking water	• Govt. support • Water pollution	
					• Support of District Administration to treat sewage or stop it inflow into the river • Afforestation		
				Reduce unemployment	• Skill development training in value addition to locally sourced products by local institutions/ organisations • Strengthening and capacity building of existing SHGs, including linkages with banks		
Bihar	Bhagalpur, Katihar	Ganga, Kosi	Reducing water Pollution	Promote sustainable agriculture	• Capacity building on natural and organic farming • Provide different Govt. schemes for farmers by the agricultural department		

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Reduce wastewater discharge	Construction of soak pit for household wastewater treatment		
					Construction of concrete and cover drainage system		
				Curb open defecation	Toilets in every household		
					Awareness of using toilets		
					Toilets at every Ghat to be used during various religious occasions		
			Curbing poaching of turtles and migratory and native birds	Curb illegal trade	Regular monitoring		
				Curb consumption by the local community	Sensitization and awareness by Ganga Praharis and local representatives		
			Minimising the impact of sand and soil mining	Curb illegal mining without licenses	Discussion with the mining department regarding illegal sand and soil mining and regular monitoring of the river-bed area		
				Reduce Government tenders			
				Curb overexploitation			
			Minimising land and soil erosion (riverbank, forest, village and agricultural area)	Minimise the impact of floods	• Construction of check dams using boulders • Tree plantation in different affected areas • Grass plantation along boundaries of agricultural land		
				Manage change in the river course			
				Curb illegal mining			
	West Champaran, Vaishali	Ganga, Gandak	Conserve aquatic biodiversity	Improve habitat	Reduce riverbank farming	Awareness and sensitization	
						Provision of alternate livelihood	
					Reduce sand mining	Awareness and sensitization	

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Reduce overfishing	Provision of alternate livelihood	
			Reduce riverine pollution	Reduce the use of agrochemicals	Awareness and sensitization		
					Provision of organic alternatives		
				Proper solid and liquid waste disposal mechanisms	• Awareness and sensitization • Door-to-door collection of household waste		
				Stop dumping religious waste into the river	Awareness and sensitization		
			Reduce waterlogging	Installation of proper infrastructure			
				Govt. intervention			
Jharkhand	Sahibganj	Ganga	Conservation of aquatic biodiversity	Reduce water pollution	Establishment of ETPs/ STPs		
					• Promotion of organic fertilizer • Promote cultivation of millets		
				Reduce solid waste/ plastic pollution	Establishment of Waste Segregation Centre		
				Curb land erosion	Afforestation drives		
					To increase the water depth construction of a pond is required		
					Prohibit sand mining		
				Promote sustainable fishing practices	Capacity building in sustainable fishing practices		
				Awareness of aquatic species			
			Reduce unemployment	Support from Govt.			
				Increase the labour wages			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
				Promotion of education	Motivate the youth to education		
				Promotion of Indigenous knowledge and traditional art			
				Proper circulation of govt job information			
			Reduce agricultural insignificance	Enhance yield	Timely distribution of seeds to farmers		
					Capacity building in organic farming		
					Provide agricultural equipment		
					Proper irrigation facility		
West Bengal	Nadia	Hooghly	Pollution control	Water pollution control	Habitat management	Biodiversity restoration	Illegal fishing prohibition ← Awareness of fishermen and local people
							Increase in migratory Birds ← Pond and Canal restoration
						Reduction of siltation	Scientific cremation set up by Govt.
					Water quality improvisation	Reduced deposition of household puja materials in water	Awareness and sensitization of local people and boatman
						Reduced dumping of dead body of domestic cattle in water	
						Diesel emission by boats mitigated	
				Soil damage control	Soil fertility increase	Organic agricultural practices	Awareness of farmers
					Establishment of crop rotation practices	Use of water sprinklers	

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
					Mitigating agricultural field damage	Govt. initiatives including a fine system for illegal fisheries	
						Management rules for construction system More local involvement in Agriculture	
				Air pollution reduction	Reduced fly ash emission	Pollution control rules for factories and rice mill	
					Reduced poisonous gas and soot	Ban on kerosene-powered vans	
			Poverty reduction	Equitable benefit sharing	Increase of agriculture and proper storage system		
				Reduced unemployment	Proper family planning	Increased education and training from the school level	
Himachal Pradesh	Sirmaur	Yamuna	Water pollution abatement	• Factories should have infrastructure within their premises to treat the wastewater before releasing it. • Representatives from Gram Panchayat should meet the factory representative and urge them for the same.			
			Solid waste management	• Gram Panchayat should talk to the government and take advantage of the existing schemes to obtain land to set up a solid waste management system for the village. • Awareness and sensitization of panchayat towards waste management.			

State	Districts	Rivers	Primary	Secondary	Tertiary	Quaternary	Quinary
			Enhanced Govt. support during natural hazards or disaster	Improved linkages with Govt. departments and timely communication of information			
			Awareness about millets	Awareness and sensitization of panchayat towards millets.			
			Reduced land erosion	Gram panchayats should meet with stone crusher representatives to sensitize them and urge them to mine in the leased area.			
			Improved crop yield	Stone crusher owners should create an alternative path for trucks outside the village to avoid impacting the villagers.			
			Impact on human health mitigated				

ANNEXURE I

PLANNING AND MANAGEMENT FOR AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN FOR A CLEAN GANGA

Community-based aquatic species conservation and outreach in Ganga River basin

Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning

Date: 31st July 2024 to 2nd August 2024

Venue: The Auditorium, Wildlife Institute of India
Dehradun, Uttarakhand – 248002.

Detailed Workshop Report

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

PLANNING AND MANAGEMENT FOR AQUATIC SPECIES CONSERVATION AND MAINTENANCE OF ECOSYSTEM SERVICES IN THE GANGA RIVER BASIN FOR A CLEAN GANGA

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WORKSHOP DETAILS

Topic	**Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning**
Organizer	**Wildlife Institute of India**
Sponsor	**National Mission for Clean Ganga, Ministry of Jal Shakti**
Venue	**The Auditorium, Wildlife Institute of India, Dehradun, Uttarakhand – 248002.**
Date	**31st July 2024 to 2nd August 2024**

Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga: Community-based aquatic species conservation and outreach in Ganga River basin

A detailed workshop report on 'Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning'.

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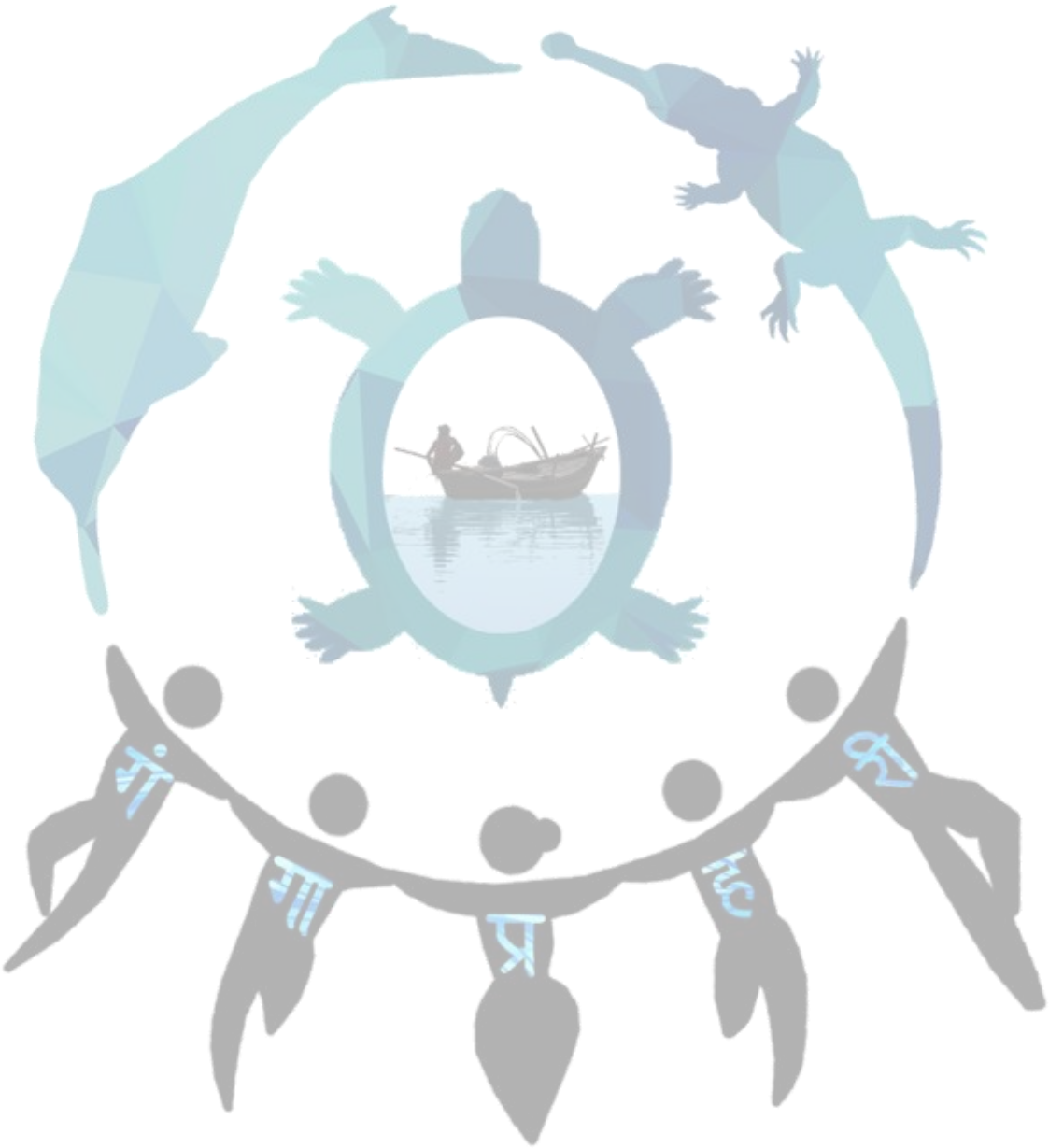
Gram Panchayats

Ganga Prahari

Local Community

NMCG-WII team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The Wildlife Institute of India (WII) organised a three-day training workshop entitled "Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning" from 31st July 2024 to 2nd August 2024, at the WII campus in Dehradun, India. The workshop was conducted under the National Mission for Clean Ganga (NMCG) funded Ganga Biodiversity Conservation Initiative – Phase II, entitled "Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga". The workshop aimed to sensitise Panchayati Raj members on biodiversity conservation and promote awareness and knowledge-sharing on sustainable approaches to village-level development, while encouraging innovative ideas for sustainable rural development. The objectives of the workshop were (a) to sensitise and create awareness among Panchayati Raj members on the importance of biodiversity conservation and sustainable natural resource management; (b) to provide a platform for participants to discuss, exchange knowledge, and share experiences on sustainable approaches to village-level development; (c) to encourage the generation and promotion of innovative ideas and strategies for achieving sustainable rural development while conserving biodiversity; and (d) to strengthen the understanding of the role of local governance institutions in integrating biodiversity conservation into village development planning.

BACKGROUND

The Ganga River is India's National River and holds immense ecological, cultural, social, and economic significance. The river basin supports diverse ecosystems and rich biodiversity, including several threatened aquatic species such as the Gangetic dolphin, gharial, freshwater turtles, otters, and migratory birds, while sustaining millions of people through agriculture, fisheries, cultural practices, and ecosystem services. Spread across approximately 26.3% of India's geographical area, the Ganga River basin comprises an intricate network of rivers, tributaries, wetlands, floodplains, forests, and human settlements across multiple states. Major tributaries such as the Yamuna, Ramganga, Ghaghara, Gandak, Kosi, Chambal, and Gomti play a crucial role in maintaining the hydrological and ecological integrity of the basin and serve as important habitats and breeding grounds for aquatic biodiversity.

Despite its significance, the Ganga River basin is increasingly facing environmental and developmental challenges arising from pollution, habitat degradation, unsustainable extraction of natural resources, declining river flows, land-use changes, erosion, and increasing anthropogenic pressures. Tributaries and associated wetlands, which are ecologically important components of the river system, also contribute substantial pollution loads into the Ganga and are subjected to various forms of environmental degradation. These pressures have adversely affected biodiversity, ecosystem functioning, and the livelihoods of river-dependent communities, thereby highlighting the need for integrated and basin-scale conservation approaches that combine ecological sustainability with socio-economic development.

Recognising the ecological and socio-cultural importance of the Ganga River, the Government of India launched the Namami Gange Programme to achieve the objectives of "*Aviral* and *Nirmal Dhara*" and ensure the ecological integrity of the river system. Under this initiative, the Wildlife Institute of India (WII) was designated as the lead knowledge partner to spearhead aquatic biodiversity conservation and was entrusted with the project "Biodiversity Conservation and Ganga Rejuvenation" (2016–2019), implemented across the five mainstem Ganga states, namely Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal. The project focused on science-based conservation planning, ecological monitoring, biodiversity assessment, stakeholder engagement, rescue and rehabilitation efforts,

livelihood enhancement, and awareness generation for conservation of the Ganga River and its biodiversity.

The findings and experiences from Phase I of the project highlighted that effective conservation of the Ganga and its biodiversity cannot be achieved solely through interventions along the mainstem river and requires addressing ecological and anthropogenic pressures across the entire river basin. Tributaries and floodplain wetlands not only contribute significantly to pollution loads entering the Ganga but also provide critical habitats and breeding grounds for several keystone aquatic species. Recognising the need for basin-scale conservation planning, the initiative was expanded in Phase II (2020–2026) as "Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga." The expanded programme emphasized integrated river basin management, strengthening socio-ecological linkages, stakeholder participation, livelihood development, institutional strengthening, and mainstreaming conservation concerns into local planning and governance frameworks.

The NMCG-WII Ganga Biodiversity Conservation Initiative, phases I and II, has demonstrated that conservation of river ecosystems requires active participation of local communities and grassroots institutions. Community-based conservation approaches, particularly those involving Panchayati Raj Institutions and local stakeholders, are essential for promoting sustainable resource management, enhancing environmental stewardship, and ensuring long-term conservation outcomes. Initiatives such as the Ganga Prahari programme have shown how local communities can actively contribute towards biodiversity conservation, cleanliness drives, awareness generation, sustainable livelihoods, and river monitoring activities. The project also emphasized the importance of creating platforms for dialogue, strengthening institutional capacities, and integrating biodiversity conservation into local development planning processes.

Panchayati Raj Institutions, particularly Gram Panchayats, play a vital role in village-level governance and implementation of developmental activities. Gram Pradhans and elected representatives are directly involved in decision-making related to natural resource management, sanitation, waste management, livelihood generation, agriculture, and local infrastructure development. Their active involvement is therefore critical for mainstreaming biodiversity conservation into village-level development planning and promoting sustainable management of natural resources within the Ganga basin. Sensitizing Panchayati Raj representatives about the ecological significance of the Ganga River system, the relationship between ecosystem health and community well-being, and the importance of conservation-oriented planning can significantly strengthen participatory and sustainable rural development initiatives.

In this context, the workshop on "Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning" was organized to create awareness among Gram Pradhans and Panchayati Raj representatives from select stretches of the Ganga River and its tributaries. The workshop aimed to provide a platform for dialogue, knowledge-sharing, and discussion on biodiversity conservation, local environmental challenges, and sustainable village-level development approaches. It also sought to encourage participants to share experiences, identify locally relevant solutions, and strengthen the role of Panchayati Raj Institutions in integrating biodiversity conservation into village development planning through community participation and informed decision-making.

AGENDA

Key stakeholders and experts working in the fields of biodiversity conservation and rural development, from both the public and private sectors, shared their experiences, insights, and best practices on promoting sustainable village-level development and strengthening community participation in biodiversity conservation. The final agenda was as follows,

Time	Session	Resource Person
Day 1 – 31st July 2024 Inaugural Session		
1000-1035 hrs	Registration	
1035-1043 hrs	Welcome address	Hemlata Khanduri, Ecodevelopment Officer
1043-1055 hrs	Aim and objectives of the workshop	Dr. Pariva Dobriyal, Project Scientist
1055-1115 hrs	Address by Dr. S.A. Hussain, Former Scientist G, WII, and Project Manager NMCG-WII Ganga Biodiversity Conservation Initiative	
1115-1125 hrs	Address by Dr. Ruchi Badola, Dean Faculty of Wildlife Sciences, WII, and Principal Investigator NMCG-WII Ganga Biodiversity Conservation Initiative	
1125-1200 hrs	Key address by Chief Guest Shri G. Asok Kumar (IAS), DG NMCG (former)	
1200-1230 hrs	**Group photo and Tea Break**	
1230-1250 hrs	Presentation on the National Mission for Clean Ganga by the Chief Guest Shri G. Asok Kumar (IAS), DG NMCG (former	
1250-1300 hrs	Vote of thanks	Dr. Uttaran Bandhopadhyay, Project Scientist
Technical Session I: Introduction of NMCG-WII Ganga Biodiversity Conservation Initiative		
1300-1325 hrs	WII-NMCG project – Biodiversity Conservation and Ganga Rejuvenation: an overview	Dr. Pariva Dobriyal, Project Scientist
1325-1350 hrs	Biodiversity of Ganga River Basin: An overview	Dr. Neeraj Mahar, Project Scientist
1350-1445 hrs	**Lunch**	
Technical Session II: Role of Panchayats and other local institutions in conservation of river ecosystems		
1445-1545 hrs	Role of village Panchayats and other local institutions in plastic waste management	Shri Anoop Nautiyal, Founder, Social Development for Communities
1545-1635 hrs	Linking village level development and environmental conservation actions	Dr. Vinita, DPRO Dehradun
1635-1650 hrs	Role of Panchayats in rescuing distressed animals	Dr. Anupam Srivastava, Coordinator-Rescue and Rehabilitation

1650-1730 hrs	**Tea**	
Day 2 – 1st August 2024 **Field Visits**		
0830-1130 hrs	Visit to Himalayan Environmental Studies and Conservation Organization (HESCO)	Prashant Tariyal, Vinita Sagar, Mukesh Deorari, Kalash Bhardwaj, Abhimanyu Singh
1130-1140 hrs	**Tea**	
1230-1330 hrs	Visit to Social Development for Communities (SDC) Plastic Waste Collection and Segregation Unit	Uttaran Bandhopadhyay, Sakshi Rana, Priyanka Munesh
1330-1430 hrs	**Lunch**	
1430 hrs onwards	Visit to Forest Research Institute (FRI)	Prashant Tariyal, Abhimanyu, Uttaran, Mukesh, Vinita, Krishna, Priyanka
Day 3 – 2nd August 2024 **Technical Session III: Nature-based Solutions**		
0930-1100 hrs	Sustainable agriculture in Ganga River Basin: challenges and opportunities	Anupama Koliyal, Subject Matter Specialist
Technical Session IV: Consultation for strategies designing		
1100-1240 hrs	Focus Group Discussion: Identifying conservation issues and possible solution	NMCG-WII project personnel and participants
1230-1245 hrs	**Tea**	
1245-1430 hrs	Consultation for developing strategies for effective development and conservation in Ganga River and its tributaries	NMCG-WII project personnel
1430-1515 hrs	**Lunch**	
1515-1610 hrs	Consultation for developing strategies for effective development and conservation in Ganga River and its tributaries	NMCG-WII project personnel
Valedictory Function		
1610-1645 hrs	Valedictory Session	Dr. Ruchi Badola, Dean WII and PI NMCG-WII Programme Dr. S.A. Hussain, Former Scientist G WII & Project Manager
1645-1730 hrs	Consultation for developing strategies… contd.	NMCG-WII project personnel
1730 onwards	**Tea**	

PARTICIPANTS

Shri G. Asok Kumar, an officer of the Indian Administrative Services, and former Director General NMCG served as the Chief Guest of the workshop. Members of the Gram Panchayats (village councils), including Gram Pradhans (village heads), ward members, Block Development Council (BDC) members, and representatives from Gram Panchayats where elected members were unable to attend, participated in the workshop. The participants represented select stretches of the Ganga River and its tributaries. Overall, 58 individuals participated, representing six basin states, namely Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, West Bengal, and Himachal Pradesh, and 12 rivers of the Ganga River system, namely the Bhagirathi, Alaknanda, Ganga, Yamuna, Ramganga, Kali, Chambal, Ghaghra, Rapti, Gomti, Kosi, and Gandak (Appendices I and II).

The subject matter experts for the workshop included Shri Anoop Nautiyal, Founder of the Social Development for Communities (SDC) Foundation; Dr. Vinita, District Panchayati Raj Officer (DPRO) at the Department of Panchayati Raj, Dehradun district, Uttarakhand; and Dr. Pariva Dobriyal (Project Scientist III), Dr. Anupam Srivastava (Coordinator – Rescue and Rehabilitation), Dr. Neeraj Mahar (Project Scientist II), and Ms. Anupama Koliyal (Subject Matter Specialist on Natural Farming – millets) with the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II.

The team from the Wildlife Institute of India included Dr. Ruchi Badola, Dean–Faculty of Wildlife Sciences, Scientist 'G', and Principal Investigator of the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II, Dr. Syed Ainul Hussain, former Scientist 'G' and Project Manager of the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II, and the NMCG-WII project personnel working in 'Component 3: Community-based aquatic species conservation and outreach in Ganga River basin'.

Fifty-eight individuals participated, representing six Ganga basin states and 12 rivers participated in the workshop

WORKSHOP HIGHLIGHTS

DAY 1

Inaugural Session

Ms. Hemlata Khanduri, Principal Project Associate, NMCG-WII Ganga Biodiversity Conservation Initiative

Ms. Hemlata Khanduri presented the welcome address. She welcomed the subject matter experts and the Gram Pradhans and their representatives from 30 districts across six Ganga basin states and highlighted the important role of Gram Pradhans and Panchayati Raj representatives in promoting biodiversity conservation and sustainable village-level development.

Dr. Pariva Dobriyal, Project Scientist III, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. Pariva Dobriyal outlined the aim and objectives of the workshop. She emphasized the importance of the platform in facilitating dialogue, knowledge exchange, and mutual learning among participants. Dr. Dobriyal also provided an overview of the thematic sessions and the schedule of the three-day workshop.

Dr. Syed Ainul Hussain, Former Scientist 'G', and Project Manager, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. S.A. Hussain addressed the gathering and encouraged the Gram Pradhans and local representatives to actively contribute towards conservation initiatives in the Ganga basin. Reflecting on his long association with river conservation, he stressed the importance of community participation, experience sharing, and collective discussions on maintaining the ecological health and cleanliness of the Ganga and its tributaries.

Dr. Ruchi Badola, Dean, Faculty of Wildlife Sciences; Scientist 'G'; and Principal Investigator, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. Ruchi Badola highlighted the crucial role of grassroots leadership in regulating local activities and promoting conservation action. She shared an inspiring example of a Ganga Prahari who later became a Gram Pradhan and contributed significantly to conservation efforts within his village. She emphasized the need for locally driven solutions for river conservation and introduced the Chief Guest, Shri G. Asok Kumar (IAS), Former Director General, National Mission for Clean Ganga (NMCG), popularly known as the "Rain Man of India."

Shri G. Asok Kumar, Indian Administrative Services (IAS), and former Director General NMCG

Shri G. Asok Kumar welcomed all participants and spoke about the importance of water conservation and community-led river rejuvenation initiatives. He highlighted the 'Catch the Rain' campaign launched under the guidance of the Hon'ble Prime Minister and discussed its contribution towards addressing groundwater challenges. Shri Kumar appreciated the role of Gram Pradhans in connecting with communities at the grassroots level and shared his experiences of working closely with local leaders. He further emphasized the importance of community participation in addressing water-related issues and strengthening the people–river connect. He also provided an overview of the progress and achievements of the NMCG programme, including activities conducted along Ganga ghats to enhance public engagement with river conservation. Concluding his address, he underscored the ecological significance of smaller tributaries in maintaining the flow and health of major rivers. A short presentation highlighting the initiatives and achievements of the NMCG programme was also delivered by Shri G. Asok Kumar.

(Left to right) Dr. Pariva Dobriyal (Project Scientist III, NMCG–WII Ganga Biodiversity Conservation Initiative), Dr. Syed Ainul Hussain (Former Scientist 'G' and Project Manager, NMCG–WII Ganga Biodiversity Conservation Initiative), Shri G. Asok Kumar (IAS and former Director General, NMCG), Dr. Ruchi Badola (Dean, Faculty of Wildlife Sciences; Scientist 'G'; and Principal Investigator, NMCG–WII Ganga Biodiversity Conservation Initiative), and Dr. Sandhya Joshi (Project Scientist III, NMCG–WII Ganga Biodiversity Conservation Initiative) during the inauguration of the workshop.

Dr. Uttaran Bandhopadhyay, Project Scientist I, NMCG-WII Ganga Biodiversity Conservation Initiative, presented the vote of thanks.

Technical Session I: Introduction to the NMCG-WII Ganga Biodiversity Conservation Initiative

NMCG-WII project – Biodiversity Conservation and Ganga Rejuvenation: an overview
— Dr. Pariva Dobriyal, Project Scientist III, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. Pariva Dobriyal provided an overview of the NMCG-WII Ganga Biodiversity Conservation Initiative, Phases I and II, which is a part of the larger Namami Gange programme, the flagship programme of the Hon'ble Prime Minister of India. She highlighted the achievements of the Phase-I of the initiative, the NMCG-funded project entitled 'Biodiversity Conservation and Ganga Rejuvenation', which aimed to develop a science-based aquatic species restoration plan for the Ganga River by involving multiple stakeholders. The project was upscaled to include 11 tributaries and sub-tributaries of the Ganga River under the project entitled 'Planning and Management for Aquatic Species Conservation and Maintenance of Ecosystem Services in the Ganga River Basin for a Clean Ganga'. The Phase-II aims to intensify the conservation efforts in identified sites along the Ganga mainstem and upscale the conservation effort to basin level for aquatic biodiversity conservation and maintenance of ecosystem services for a clean

Ganga. She elucidated the conservation significance of aquatic biodiversity, and its importance for the health of freshwater ecosystems such as rivers and wetlands. She stressed the importance of engaging stakeholders for developing a sustainable model for river and biodiversity conservation and acknowledged the pivotal role of grassroots institutions such as Gram Panchayats in the same.

Dr. Pariva Dobriyal, Project Scientist III, NMCG-WII Ganga Biodiversity Conservation Initiative, provided an overview of the NMCG-WII Ganga Biodiversity Conservation Initiative, Phases I and II, which is a part of the larger Namami Gange programme.

Biodiversity of Ganga River Basin: An overview

— Dr. Neeraj Mahar, Project Scientist II, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. Neeraj Mahar provided a brief glimpse into the journey of the Ganga River from its source, at Gaumukh in Uttarakhand, to its mouth, at Gangasagar in West Bengal, and the aquatic flora and fauna harboured in the basin's rivers, streams, and wetlands. He educated the participants on the identification of Testudines, Crocodilians, aquatic mammals, waterbirds and water-associated birds, and the conservation issues pertaining to the aforementioned taxa. He described the monitoring equipment used, and the ethics and protocols for wildlife monitoring and rescue.

Dr. Neeraj Mahar, Project Scientist II, NMCG-WII Ganga Biodiversity Conservation Initiative, provided a brief glimpse into the journey of the Ganga River.

Technical Session II: Role of Panchayats and other local institutions in conservation of river ecosystems

Role of village Panchayats and other local institutions in plastic waste management

— Shri Anoop Nautiyal, Founder, Social Development for Communities (SDC) Foundation

Shri Anoop Nautiyal delivered a lecture on sustainable plastic waste management. He commenced the session by briefing the participants on the history of plastic, the different types of plastics, and their impact on the environment. He described the Sustainable Development Goals (SDGs) and how they are reflected at the village level. He introduced the Plastic Bank Project by the SDC Foundation, highlighting its initiatives, which include segregation of plastic waste at the citizen and institution level, and timely collection, transportation and secondary level segregation of plastic waste, which is then upcycled or converted into energy. He acknowledged the efforts of the Indian Army, school students and restaurants at Maggie Point in supporting the initiative.

Shri Anoop Nautiyal, Founder, Social Development for Communities (SDC) Foundation, delivered a lecture on sustainable plastic waste management.

Linking village level development and environmental conservation actions

—Dr. Vinita, District Panchayati Raj Officer (DPRO), Department of Panchayati Raj, Government of Uttarakhand

Dr. Vinita discussed the Sustainable Development Goals (SDGs) as they apply at the grassroots level, and provided an overview of the three-tier Panchayati Raj system viz., Gram Panchayat, Panchayat Samiti and Zila Parishad. She described the rules and regulations pertaining to sanitation, with a focus on waste segregation and management. She enumerated the laws and policies that can assist Gram Pradhans (transl. 'Village Heads') and representatives in aiding biodiversity conservation. She concluded the session with a discussion on the 5 R's of waste management viz., Refuse, Reduce, Reuse, Recycle and Recover.

Role of Panchayats in rescuing distressed animals

—Dr. Anupam Srivastava, Coordinator, Rescue and Rehabilitation, NMCG-WII Ganga Biodiversity Conservation Initiative

Dr. Anupam Srivastava discussed the role of Gram Panchayats in rescuing animals in distress. He reiterated the importance of freshwater ecosystems and the biodiversity they harbour. He outlined the due process to be followed and the responsibilities of Gram Pradhans during the rescue of species in distress, emphasising duly informing and coordinating with the Forest Department and the importance of crowd management. Participants from Purba Bardhaman, West Bengal expressed interest in receiving hands-on training for rescuing and rehabilitating snakes.

Dr. Vinita, District Panchayati Raj Officer (DPRO), Department of Panchayati Raj, Government of Uttarakhand, enumerated the laws and policies that can assist Gram Pradhans (transl. 'Village Heads') and representatives in aiding biodiversity conservation.

DAY 2

Field Visits

Himalayan Environmental Studies and Conservation Organization (HESCO)

The participants visited the HESCO headquarters in Village Shuklapur, District Dehradun, Uttarakhand, and interacted with its founder Padma Bhushan, Padma Shri Dr Anil Prakash Joshi. HESCO fosters self-reliance and economic development in rural Himalayan communities by leveraging local knowledge and resources to develop and spearhead low cost, sustainable solutions in agriculture, horticulture and energy. The participants gained insights into the integrated rural development framework, as well as the techniques and practices adopted by the organization. Dr. Joshi underscored the essential role of village-level initiatives in maintaining community structure and highlighted the significant contribution of Gram Panchayats within this framework. He also discussed the global water crisis and how village development can advance alongside water conservation efforts.

Padma Bhushan, Padma Shri Dr Anil Prakash Joshi, Founder, Himalayan Environmental Studies and Conservation Organization (HESCO), briefed the participants on sustainable rural development.

The participants visited the HESCO headquarters in Village Shuklapur, District Dehradun, Uttarakhand, and gained insights into the integrated rural development framework, as well as the techniques and practices adopted by the organization.

Social Development for Communities (SDC) Foundation

The participants visited SDC Foundation's 'plastic waste segregation and learning centre' in Dehradun, Uttarakhand. SDC Foundation is an environmental action and advocacy group in Dehradun working towards building climate resilience and creating a circular economy through responsible waste management and sustainable urbanisation. The plastic waste segregation and learning centre was established under the 'Plastic Bank' project, a citizen-led initiative by the SDC Foundation and Airbus that aims to foster a sustainable mindset in urban and peri-urban areas of Dehradun through a sustained awareness campaign to instil behaviour change and responsible waste management. The plastic waste collected through a network of plastic banks in the city and its vicinity is stored and segregated at the centre for recycling and repurposing. The participants were given insight into the waste management and disposal practices adopted at the centre.

The participants visited SDC Foundation's 'plastic waste segregation and learning centre' in Dehradun, Uttarakhand.

Indian Council of Forestry Research and Education (ICFRE)

ICFRE is autonomous council under the Ministry of Environment, Forest and Climate Change, for forestry research, education and extension needs of the country. The participants visited the six museums housed at the Forest Research Institute (FRI) Dehradun, namely Silviculture Museum (evolution of forestry and drivers of change), Timber Museum (commercially important tree species and timber engineering techniques), Non Wood Forest Products (NWFP) Museum (NWFPs, and their extraction and uses), Social Forestry Museum (importance of trees in village economy and social forestry), Pathology Museum (economically significant tree diseases and timber decays), and Entomology Museum (various stages of insect pests and damage caused by them across the lifecycle of a tree, from seed to finished product).

The participants visited the six museums housed at the Forest Research Institute (FRI) Dehradun.

DAY 3

Technical Session III: Nature-based Solutions

Sustainable agriculture in Ganga River Basin: challenges and opportunities

—Ms. Anupama Koliyal, Subject Matter Specialist (Natural Farming – millets), NMCG-WII Ganga Biodiversity Conservation Initiative

Ms. Anupama Koliyal presented a talk on the adoption of sustainable agriculture as a nature-based solution (NbS) and an environmentally conscious lifestyle for the conservation of freshwater ecosystems and their associated biodiversity. The participants were educated on the importance of millet farming, including the nutritional significance of millets and their importance as climate-resilient crops. She highlighted the importance of conscious eating for human and environmental health and advocated consuming locally sourced crops and food. Millets, in particular, are an ideal food choice for Indians due to their drought- and flood-resistant properties, making them well suited to meet the challenges posed by climate change. She introduced the participants to Dr. Khader Vali, who is hailed as the 'millet man of India' for his work reviving and promoting millets as a nutritious and sustainable food and was conferred with India's fourth-highest civilian award 'Padma Shri' in 2023 for the same. In a concluding note, she encouraged the participants to incorporate millets into their diets and actively promote their cultivation.

Ms. Anupama Koliyal, Subject Matter Specialist (Natural Farming–millets), NMCG-WII Ganga Biodiversity Conservation Initiative, presented a talk on the adoption of sustainable agriculture as a nature-based solution (NbS) and an environmentally conscious lifestyle.

Technical Session IV: Consultation for Strategies Designing

Consultation for developing strategies for effective development and conservation in Ganga River and its tributaries

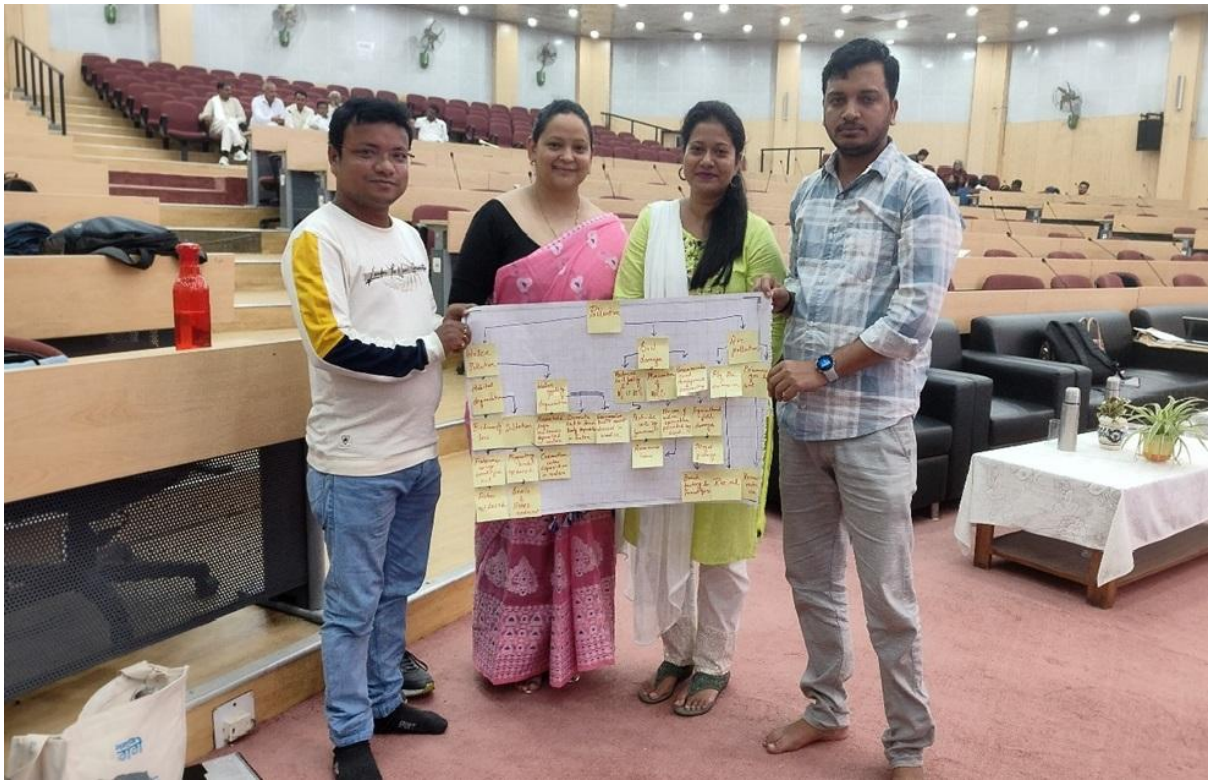
Focus group discussions (FGDs) were conducted with the participants to develop a problem and solution tree with 'declining aquatic biodiversity' as the core or central issue. The respondents/participants were sorted and divided into 12 groups based on their districts, states, and river stretches (Table 1). The FGDs centred on identifying key issues in the participants' respective villages, and proposing possible solutions for the same. The FGDs were moderated by at least three NMCG-WII project representatives working in the respective districts.

Table 1. Group-wise state, districts and rivers covered in the focus group discussions

Group	State	Districts	Rivers	No. of participants
Group 1	Uttarakhand	Chamoli, Tehri Garhwal, Uttarkashi	Bhagirathi, Alaknanda, Ganga	9
Group 2	Uttar Pradesh	Bijnor, Muzaffarnagar, Bulandshahr, Sambhal	Ganga	8
Group 3	Uttar Pradesh	Farrukhabad, Kannauj, Shahjahanpur	Ganga, Ramganga, Kali	4
Group 4	Uttar Pradesh	Prayagraj, Kaushambi	Ganga, Yamuna	6
Group 5	Uttar Pradesh	Etawah	Yamuna, Chambal	1
Group 6	Uttar Pradesh	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	Ghaghra, Rapti	10
Group 7	Uttar Pradesh	Mirzapur, Jaunpur, Varanasi, Chandauli	Ganga, Gomti	11
Group 8	Bihar	Bhagalpur, Katihar	Ganga, Kosi	2
Group 9	Bihar	West Champaran, Vaishali	Ganga, Gandak	3
Group 10	Jharkhand	Sahibganj	Ganga	2
Group 11	West Bengal	Nadia	Hooghly	1
Group 12	Himachal Pradesh	Sirmaur	Yamuna	1

The FGDs highlighted a range of environmental and socio-economic issues faced by communities across the Ganga River basin. Major concerns identified by the participants included pollution, declining biodiversity, loss of livelihoods, erosion, inadequate waste management, and impacts of natural disasters (Table 2; Appendix III). The discussions reflected the strong interlinkages between river health, biodiversity conservation, and the well-being of local communities.

Mr. Prashant Tariyal, Senior Project Associate, NMCG–WII Ganga Biodiversity Conservation Initiative, with the team from Chamoli, Tehri Garhwal, and Uttarkashi districts in Uttarakhand, brainstorming the problem and solution trees during the workshop.



Dr. Deepika Dogra, Project Scientist III, NMCG–WII Ganga Biodiversity Conservation Initiative, with the team from Nadia district, West Bengal, and the problem and solution trees drafted during the workshop.

Table 2. Group-wise primary issues identified by the participants in the focus group discussions

Group	Districts	Primary Issues Identified
UTTARAKHAND *(Rivers: Bhagirathi, Alaknanda, Ganga)*		
Group 1	Chamoli, Tehri Garhwal, Uttarkashi	• Natural and human-caused disasters • Lack of awareness • Agriculture • Human-wildlife conflict
UTTAR PRADESH *(Rivers: Ganga, Ramganga, Kali, Yamuna, Chambal, Ghaghra, Rapti, Gomti)*		
Group 2	Bijnor, Muzaffarnagar, Bulandshahr, Sambhal	• Pollution (water, soil & solid waste) • Lack of government support • Lack of livelihood
Group 3	Farrukhabad, Kannauj, Shahjahanpur	• Declining rural livelihood • Declining biodiversity
Group 4	Prayagraj, Kaushambi	• Declining aquatic biodiversity
Group 5	Etawah	• Lack of livelihood
Group 6	Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar	• Declining biodiversity
Group 7	Mirzapur, Jaunpur, Varanasi, Chandauli	• Declining biodiversity • Declining rural livelihood
BIHAR *(Rivers: Ganga, Kosi, Gandak)*		
Group 8	Bhagalpur, Katihar	• Water Pollution • Poaching of turtles and migratory and native birds • Sand and soil mining • Land and soil erosion (riverbank, forest, village and agricultural area)
Group 9	West Champaran, Vaishali	• Declining aquatic biodiversity • Riverine pollution • Waterlogging
JHARKHAND *(Rivers: Ganga)*		
Group 10	Sahibganj	• Declining aquatic biodiversity • Unemployment • Agricultural insignificance
WEST BENGAL *(Rivers: Hooghly)*		
Group 11	Nadia	• Pollution • Poverty

HIMACHAL PRADESH ***(Rivers: Yamuna)***		
Group 12	Sirmaur	• Water Pollution • Lack of solid waste management • No help from Govt. during natural hazards or disaster • Lack of awareness of millets • Land erosion • Crop yield decline • Impact on human health

The workshop culminated with the valedictory function.

WORKSHOP OUTCOMES

I. Knowledge garnered by Gram Panchayat representatives

- Enhanced understanding of the ecological significance of the Ganga River basin, its tributaries, wetlands, and associated aquatic biodiversity.
- Improved awareness regarding the interlinkages between biodiversity conservation, river health, ecosystem services, and rural livelihoods.
- Increased understanding of the role of Gram Panchayats and Panchayati Raj Institutions in integrating biodiversity conservation into village-level development planning.
- Exposure to sustainable and community-based approaches for waste management, plastic segregation, natural farming, millet cultivation, and river conservation.
- Improved understanding of nature-based solutions such as afforestation, rainwater harvesting, restoration of local water bodies, and promotion of sustainable agriculture.
- Awareness regarding conservation-friendly practices including organic farming, sustainable fishing practices, riverbank protection, and reduction of pollution loads into rivers.
- Understanding of the role of community participation, Ganga Praharis, local institutions, and government departments in biodiversity conservation and river rejuvenation initiatives.
- Exposure to practical examples of grassroots conservation and sustainable development through field visits to HESCO, SDC Foundation, and FRI Dehradun.
- Improved understanding of wildlife rescue protocols, crowd management, and coordination with Forest Departments during rescue of distressed wildlife.
- Awareness regarding relevant government schemes, institutional linkages, and opportunities for strengthening village-level conservation initiatives.

II. Problems and solutions identified by the Gram Panchayat representatives

Major Issues Identified	Key Problems Highlighted by Participants	Suggested Solutions
Pollution and waste management	Untreated sewage and industrial effluents, dumping of solid waste and religious materials, plastic pollution, lack of waste segregation systems, open drainage, and inadequate sanitation infrastructure	Establishment of STPs and ETPs, construction of solid waste management and recycling facilities, installation of garbage bins, door-to-door waste collection, awareness campaigns, improved sanitation facilities, and stricter waste disposal mechanisms
Declining aquatic biodiversity	Habitat degradation, illegal sand mining, overfishing, use of monofilament fishing nets, poaching of aquatic fauna and birds, encroachment on riverbanks and wetlands	Habitat restoration, afforestation, regulation of fishing practices, strengthened patrolling and monitoring, awareness programmes, restoration of ponds and wetlands, and stricter regulation of mining and poaching activities
Declining rural livelihoods and unemployment	Low agricultural returns, declining fish catch, lack of alternate livelihood opportunities, migration of youth, weak market linkages, and limited livelihood diversification	Promotion of organic and natural farming, millet cultivation, establishment of small and cottage industries, skill development programmes, strengthening SHGs, eco-tourism initiatives, and value addition to local products
Agricultural challenges	Excessive use of agrochemicals, declining soil fertility, poor irrigation facilities, waterlogging, crop depredation, lack of storage facilities, and low profitability of traditional crops	Promotion of organic farming, irrigation infrastructure development, rainwater harvesting, cold and dry storage facilities, crop insurance, value addition for local produce, and training on sustainable agriculture
Human–wildlife conflict	Crop raiding, abandoned agricultural lands, deforestation, and reduced natural food availability for wildlife	Plantation of fruit-bearing species in forests, fencing around agricultural lands, revival of abandoned agricultural lands, and awareness on conflict mitigation measures
Erosion, floods, and natural disasters	Riverbank erosion, flash floods, landslides, dumping of construction debris, lack of resilient infrastructure, and impacts of climate change	Scientific afforestation, construction of check dams and embankments, resilient infrastructure planning, riverbank stabilization, proper debris disposal, rainwater harvesting, and flood mitigation measures
Water scarcity and declining water levels	Overexploitation of groundwater, lack of rainwater harvesting, unpredictable rainfall, and degradation of local water bodies	Rainwater harvesting, restoration of ponds and wells, monitoring of groundwater extraction, plantation drives, and conservation of local water bodies
Lack of awareness and institutional support	Limited awareness regarding biodiversity conservation, poor outreach of government schemes, weak coordination with departments, and inadequate community participation in decision-making	Awareness and sensitization programmes, stakeholder consultations, strengthening institutional linkages, capacity building, improved dissemination of government schemes, and increased community participation in planning processes
Health and sanitation concerns	Waterborne diseases, poor waste management, lack of toilets and	Improved sanitation infrastructure, awareness on hygiene and sanitation, provision of

	sanitation facilities, and pollution-related health impacts	healthcare facilities, pest control measures, and better waste management practices
Unsustainable infrastructure and development practices	Construction activities in ecologically sensitive areas, improper mining practices, and inadequate environmental safeguards	Conducting environmental impact assessments, promoting sustainable infrastructure development, regulating mining activities, and improving community consultation during developmental planning

III. Suggestions for strengthening biodiversity conservation at the grassroots

- Strengthen the role of Gram Panchayats in biodiversity conservation through integration of conservation priorities into Gram Panchayat Development Plans (GPDPs).
- Promote community-led waste management and cleanliness initiatives at village and riverbank levels.
- Encourage organic farming, natural farming, and millet cultivation to reduce chemical pollution and improve soil and ecosystem health.
- Develop regular awareness and sensitization programmes for local communities, schools, youth groups, and religious stakeholders on river conservation and biodiversity protection.
- Strengthen participation of Ganga Praharis, SHGs, local youth, and women's groups in conservation and outreach activities.
- Promote restoration and protection of local ponds, wetlands, riverbanks, and riparian vegetation through plantation drives and habitat restoration activities.
- Improve coordination between Gram Panchayats, Forest Departments, Fisheries Departments, District Administrations, and other line departments for implementation of conservation initiatives.
- Encourage sustainable fishing practices and strengthen monitoring against illegal fishing, poaching, and sand mining activities.
- Promote livelihood diversification and skill development linked with conservation and sustainable natural resource management.
- Increase local participation in environmental decision-making and policy implementation processes.

IV. Work ahead for WII (as knowledge and training partner)

- Continue capacity-building and sensitization programmes for Panchayati Raj Institutions, Ganga Praharis, and local communities across the Ganga River basin.
- Develop simplified training modules, manuals, and awareness materials on biodiversity conservation, waste management, sustainable agriculture, and river ecosystem management for grassroots stakeholders.
- Facilitate technical guidance for integration of biodiversity conservation concerns into village-level development planning through preparation of village micro plans.

- Strengthen stakeholder engagement platforms for dialogue and collaboration among communities, Panchayats, government departments, and conservation agencies.
- Support the establishment and strengthening of community-based conservation initiatives and village-level biodiversity management activities.
- Facilitate exposure visits, demonstration sites, and field-based learning opportunities on sustainable rural development and conservation practices.
- Promote citizen science-based biodiversity monitoring and reporting mechanisms involving local communities and Panchayats.
- Strengthen awareness and outreach programmes focusing on aquatic biodiversity conservation, sustainable livelihoods, and river health.
- Support development of locally relevant nature-based solutions and community-driven conservation strategies across different river stretches.
- Document and disseminate best practices and success stories emerging from grassroots conservation initiatives within the Ganga basin.

APPENDIX I

List of participants for the workshop entitled "Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning" under the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II

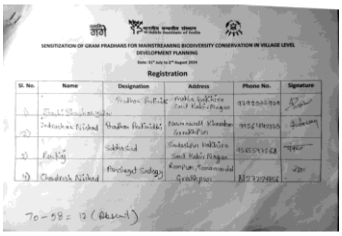
SN	Name	Designation	Village	District	State	Contact No. (+91)
1	Dharmendra Bhandari	Gram Pradhan	Manpur	Uttarkashi	Uttarakhand	9456528585
2	Arvind Jiyal	Gram Pradhan	Tungi	Tehri Garhwal	Uttarakhand	7895611409
3	Kishor Singh Kaniyal	Gram Pradhan	Tapovan	Chamoli	Uttarakhand	7500333906
4	Devendra Singh	Gram Pradhan	Devgram	Chamoli	Uttarakhand	9719072141
5	Bhagat Singh	Gram Pradhan	Palla	Chamoli	Uttarakhand	9410925642
6	Pankaj Singh	Gram Pradhan	Kalgoat	Chamoli	Uttarakhand	9760596510/ 9012709242
7	Shree dev Maratha	Gram Pradhan	Kishanpur	Uttarkashi	Uttarakhand	7579194368
8	Babita Kaushal	Ward member	Rampur Ghat	Sirmaur	Himachal Pradesh	7018942256
9	Omveer Singh	Representative	Rajghat	Bulandshahr	Uttar Pradesh	9758220178
10	Prempal Singh	Gram Pradhan	Niwari Khadar	Bulandshahr	Uttar Pradesh	9639161265
11	Naresh kumar	Gram Pradhan	Udaygarhi	Bulandshahr	Uttar Pradesh	9568417498
12	Than Singh	BDC Member	Udaygarhi	Bulandshahr	Uttar Pradesh	9690190361
13	Veerpal Singh	Gram Pradhan	Talwar	Bulandshahr	Uttar Pradesh	9627067150/ 6397273368
14	Ashish Gond	Gram Pradhan	Molnapur	Varanasi	Uttar Pradesh	9125358836
15	Arjun Prashad	Representative	Chandrawati	Varanasi	Uttar Pradesh	7897186373
16	Kailash Prasad Sahani	BDC Member	Tatepur	Varanasi	Uttar Pradesh	9918981738
17	Amit Kumar Singh	Ward member	Baraini	Mirzapur	Uttar Pradesh	9151240280
18	Sachidanand Singh	Representative	Dinapur	Varanasi	Uttar Pradesh	8299702971
19	Avdhesh Kumar	Representative	Sonbarsa	Chandauli	Uttar Pradesh	8115955161
20	Shyam Prasad	Representative	Bahraich	Jaunpur	Uttar Pradesh	7408791325

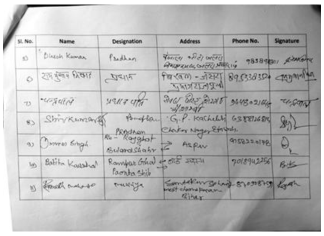
21	Ashish Kumar Singh	Ward member	Baraini	Mirzapur	Uttar Pradesh	6393230553
22	Anil Kumar	Representative	Balua	Jaunpur	Uttar Pradesh	6388413962
23	Prashant Singh	Representative	Baraini	Mirzapur	Uttar Pradesh	6393051386
24	Mukesh Kumar	Gram Pradhan	Mahamalpur	Mirzapur	Uttar Pradesh	9648408185
25	Satveer	Gram Pradhan	Nizampur	Muzaffarnagar	Uttar Pradesh	9368982330
26	Indrasan Nishad	Gram Pradhan	Nauwaawal	Gorakhpur	Uttar Pradesh	9956442770
27	Chandresh Nishad	Gram Panchayat member	Rampur	Gorakhpur	Uttar Pradesh	9956442770
28	Dharmendra Yadav	Gram Pradhan	Nawli	Mau	Uttar Pradesh	9454153932
29	Pankaj	Sabhasad	Shanichara	Sant Kabir Nagar	Uttar Pradesh	9565547568
30	Shashi Bhusan Yadav	Representative	Mahla	Sant Kabir Nagar	Uttar Pradesh	9792077979
31	Subir Hatui	Representative	Gobra	Nadia	West Bengal	9735201019
32	Ram Gulab Nishad	Gram Pradhan	Beerwal	Prayagraj	Uttar Pradesh	8953383520
33	Dinesh Kumar	Gram Pradhan	Kanjasa	Prayagraj	Uttar Pradesh	9838966411
34	Tatsat Ojha	Representative	Nasirpur	Kaushambi	Uttar Pradesh	9792629776
35	Chandrapal	Representative	Sewadha	Kaushambi	Uttar Pradesh	9648021645
36	Sanjay Kumar	Gram Pradhan	Biharghar	Muzaffarnagar	Uttar Pradesh	7668406247
37	Rajpal Singh	Gram Pradhan	Shukratal	Muzaffarnagar	Uttar Pradesh	6395511402
38	Shubham Pandey	Representative	Dinkarpur	Ayodhya	Uttar Pradesh	9125207488
39	Akhilesh Kumar Soni	Gram Pradhan	Tehseenpur	Ayodhya	Uttar Pradesh	8953252553/7953252553
40	Ram sahay	Representative	Haribandhanpur	Ayodhya	Uttar Pradesh	9198741444
41	Surendra Yadav	Representative	Ismail Nagar Sihora	Ayodhya	Uttar Pradesh	7459086495
42	Raghvendra Chaturvedi	Representative	Sanaha	Ayodhya	Uttar Pradesh	9935737334
43	Shiv Kumar Singh	Gram Pradhan	Kachhari	Etawah	Uttar Pradesh	6388126814

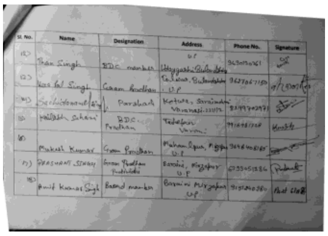
44	Devendra Singh	Representative	Kuberpur Ghat	Farrukhabad	Uttar Pradesh	9455566094/9044477701
45	Shivkumar Singh	BDC Mamber	Raghunathpur	Shahjahanpur	Uttar Pradesh	8953834424
46	Saddam	Representative	Madharpur	Kannauj	Uttar Pradesh	6307863846
47	Madan Pal	Gram Pradhan	Katri Gangpur	Kannauj	Uttar Pradesh	9956069620
48	Javed Aalam	Representative	Madanpur	West Champaran	Bihar	9934036573/9199115143
49	Ramesh Mahato	Representative	Santpur-Sohariya	West Champaran	Bihar	8709087591/7544059909
50	Arun Roy	Ward Commissioner	Konhara Ghat	Vaishali	Bihar	9934498457/9294980463
51	Ashok Kunwar	Ward Member	Surapar Tal (Gogabil Lake)	Katihar	Bihar	7870096499/9905951144
52	Mithlesh Kumar	Representative	Khawaspur	Bhagalpur	Bihar	6207534171
53	Kisan Mandal	Representative	Maskalaiyan	Sahibganj	Jharkhand	8092551160
54	Sunil Marandi	Representative	Kalyani	Sahibganj	Jharkhand	9199991007
55	Deepak Bedwal	Gram Pradhan	Nigar	Tehri Garhwal	Uttarakhand	7078116515
56	Rakesh Kumar	Representative	Nizampur Pureti	Kaushambi	Uttar Pradesh	7978065446
57	Jitendra Kumar	Representative	Shahjadpur	Kaushambi	Uttar Pradesh	8009170905
58	Gajendra Singh Panwar	Ward Member	Marki	Chamoli	Uttarakhand	8077339965

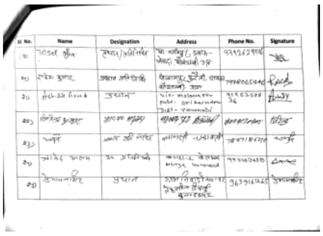
APPENDIX II

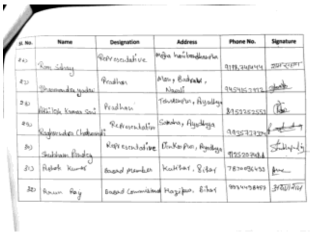
Registration sheets of the participants in the workshop entitled "Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning" under the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II

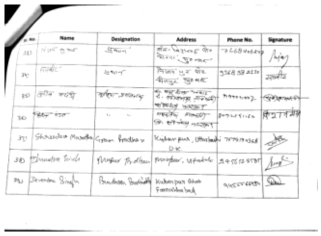


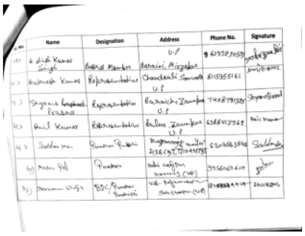


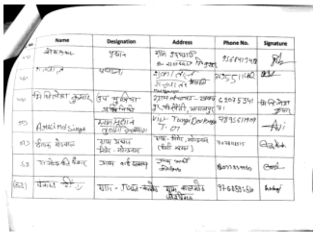


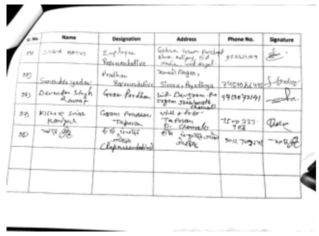






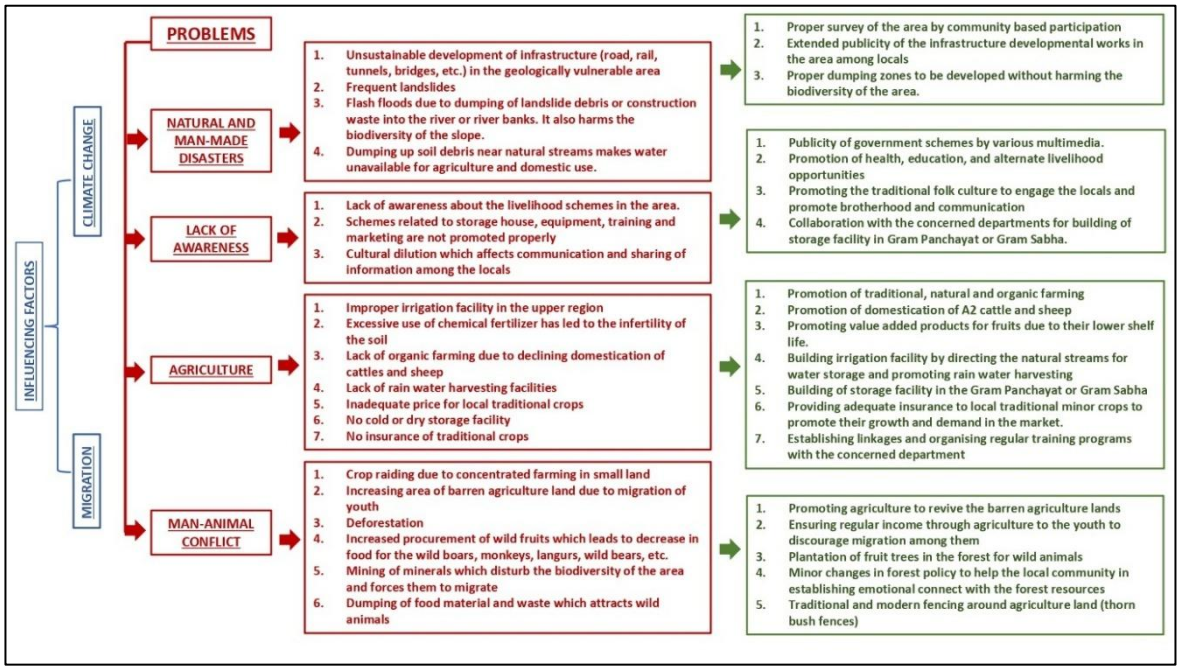




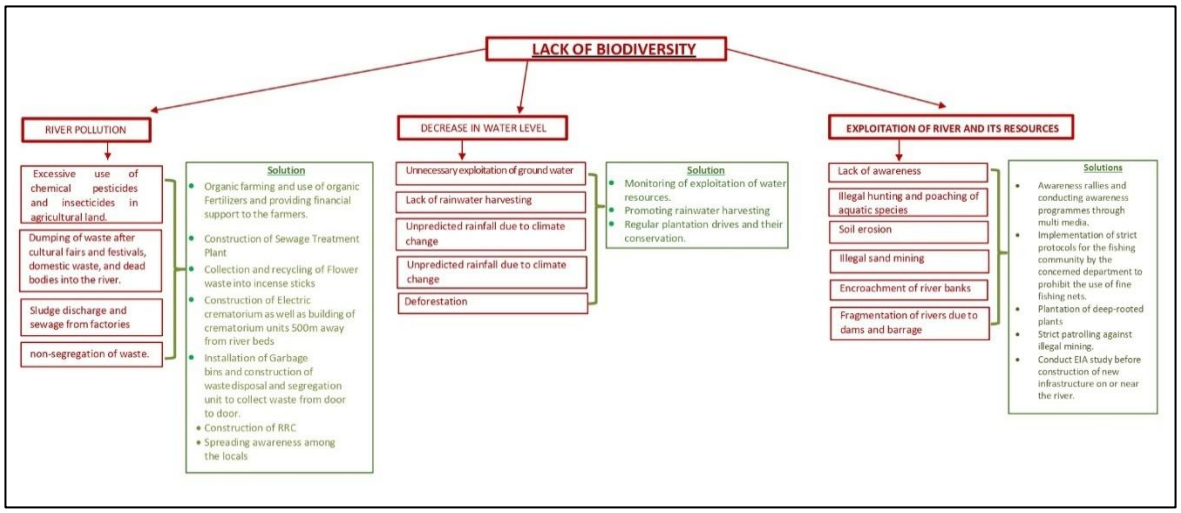


APPENDIX III

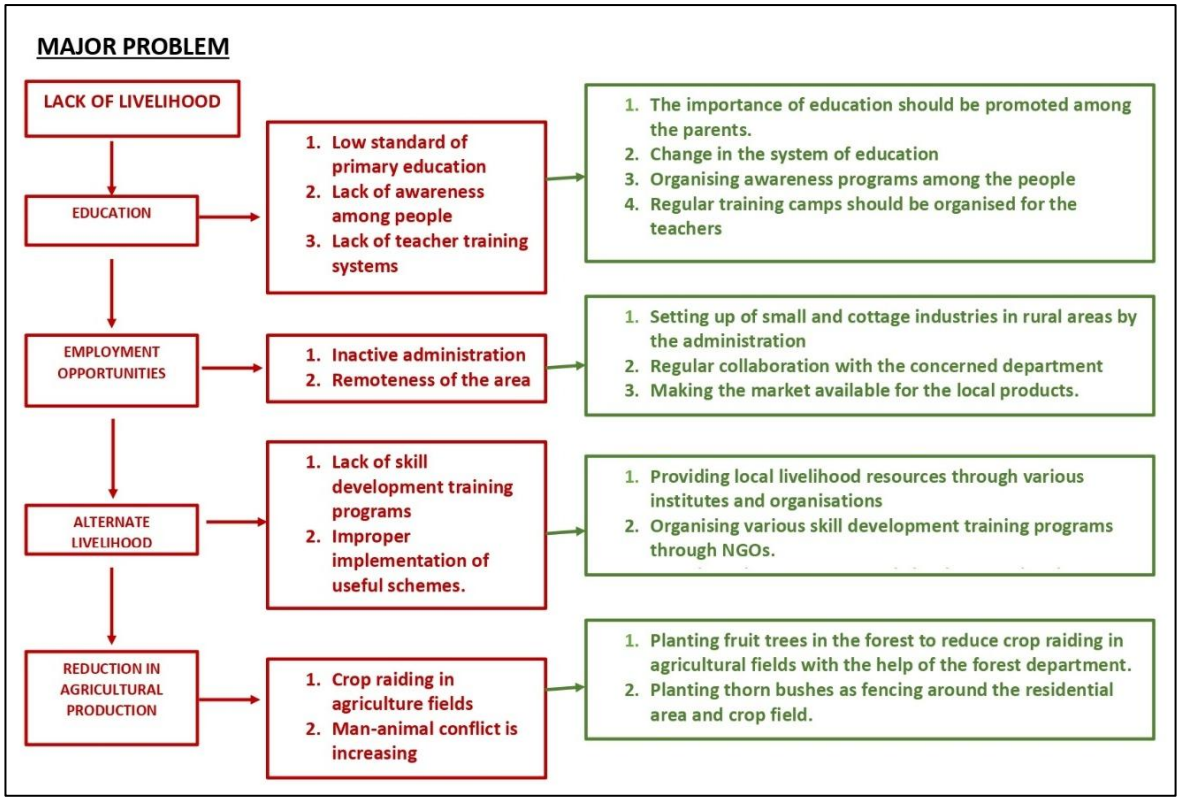
'Problem Tree' and 'Solution Tree' prepared by the participants of the workshop entitled "Sensitization of Gram Pradhans for Mainstreaming Biodiversity Conservation in Village Level Development Planning" under the NMCG-WII Ganga Biodiversity Conservation Initiative Phase-II



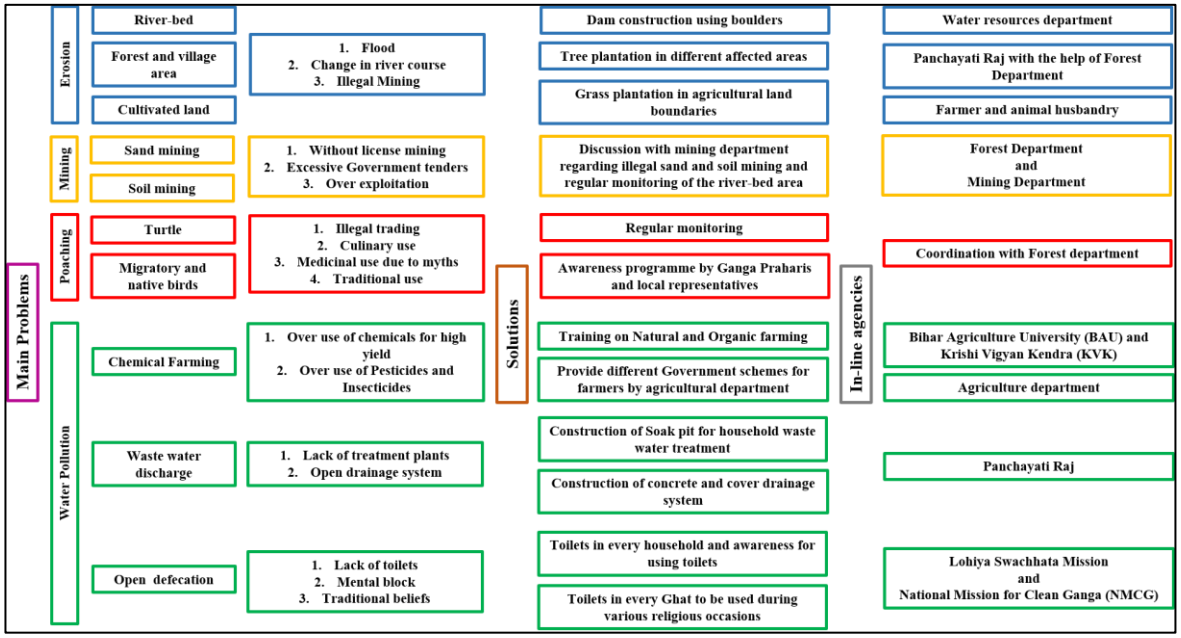
State: Uttarakhand
Districts: Chamoli, Tehri Garhwal, Uttarkashi
Rivers: Bhagirathi, Alaknanda, Ganga



State: Uttar Pradesh
Districts: Prayagraj, Kaushambi
Rivers: Ganga, Yamuna

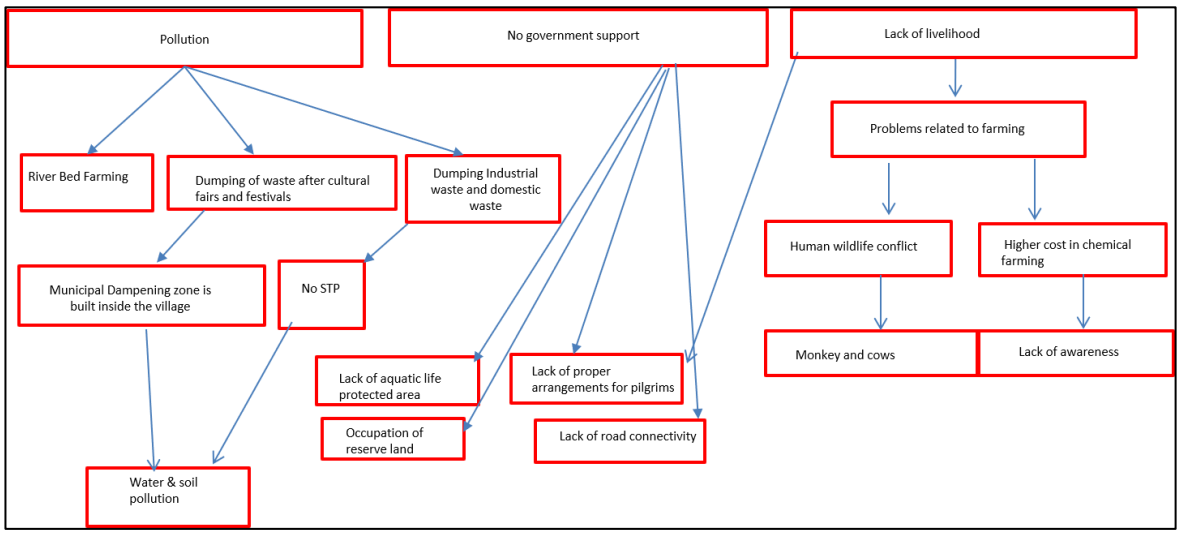


State: Uttar Pradesh
Districts: Etawah
Rivers: Yamuna, Chambal

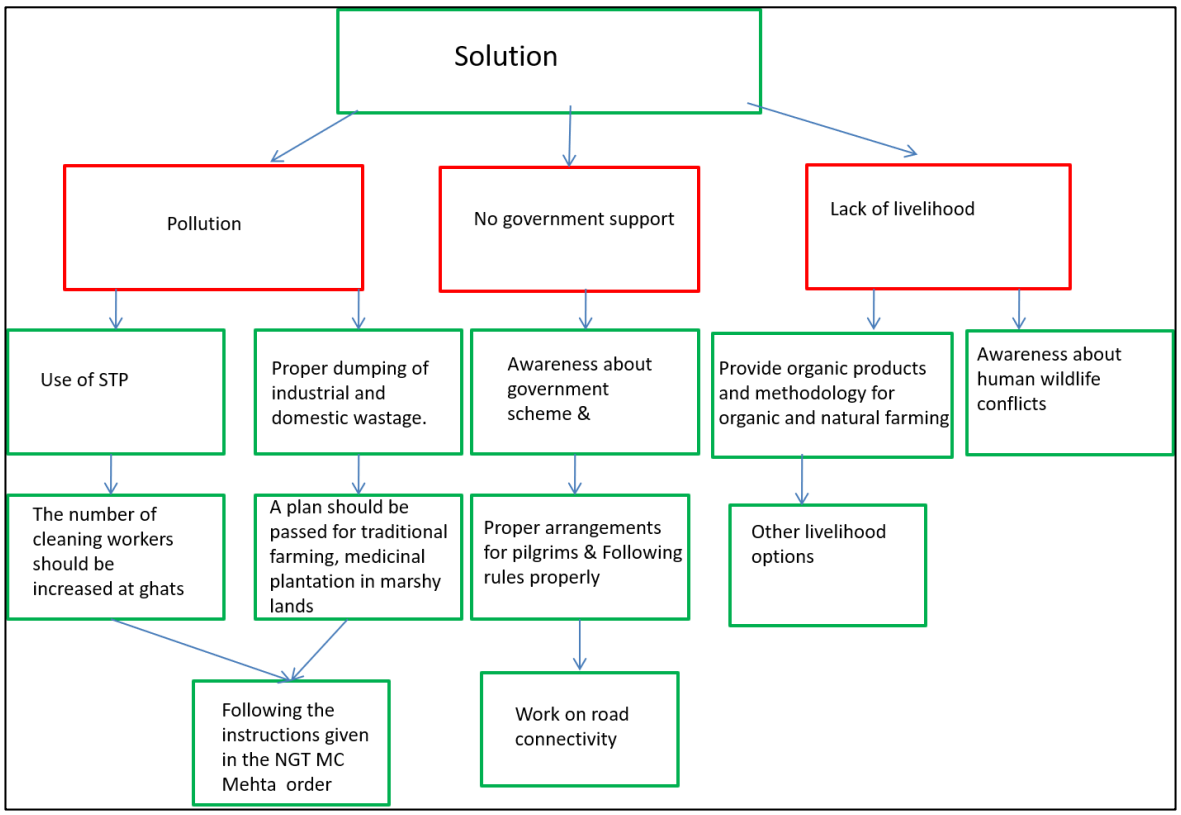


State: Bihar
Districts: Bhagalpur, Katihar
Rivers: Ganga, Kosi

Problem Tree



Solution Tree

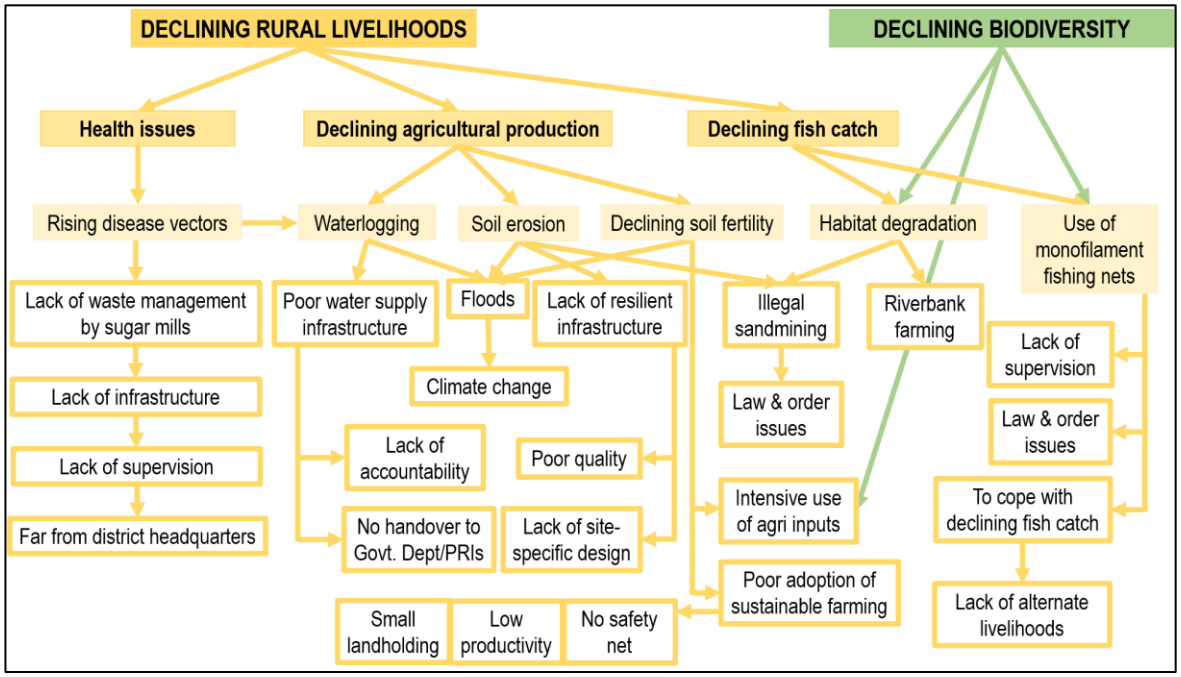


State: Uttar Pradesh

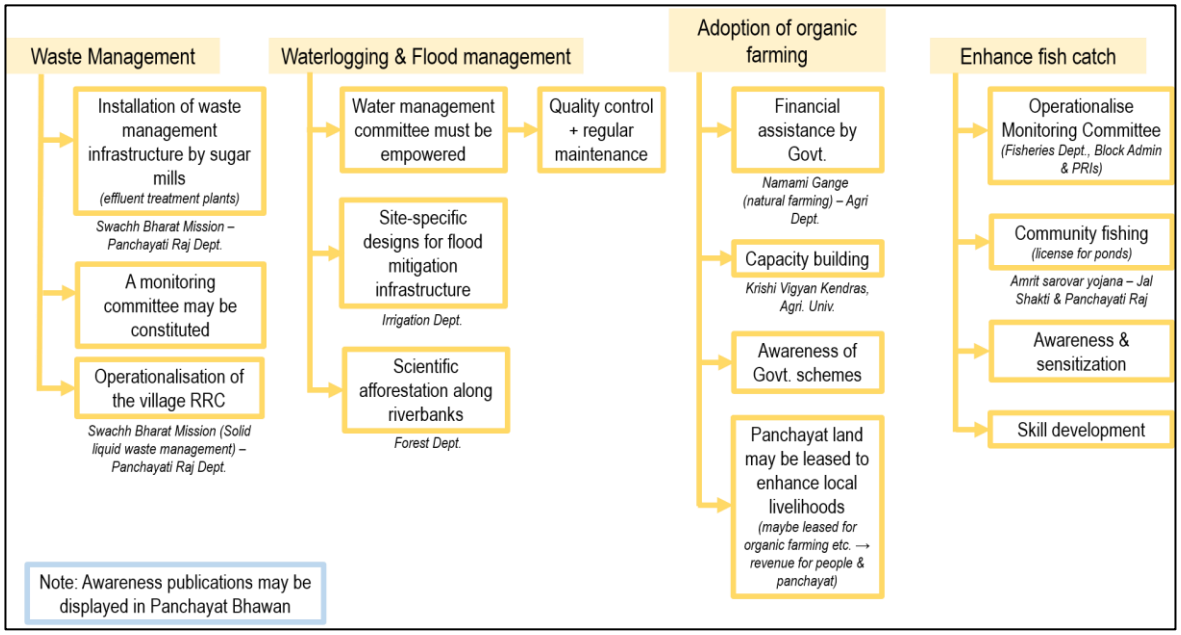
Districts: Bijnor, Muzaffarnagar, Bulandshahr, Sambhal

Rivers: Ganga

Problem Tree



Solution Tree

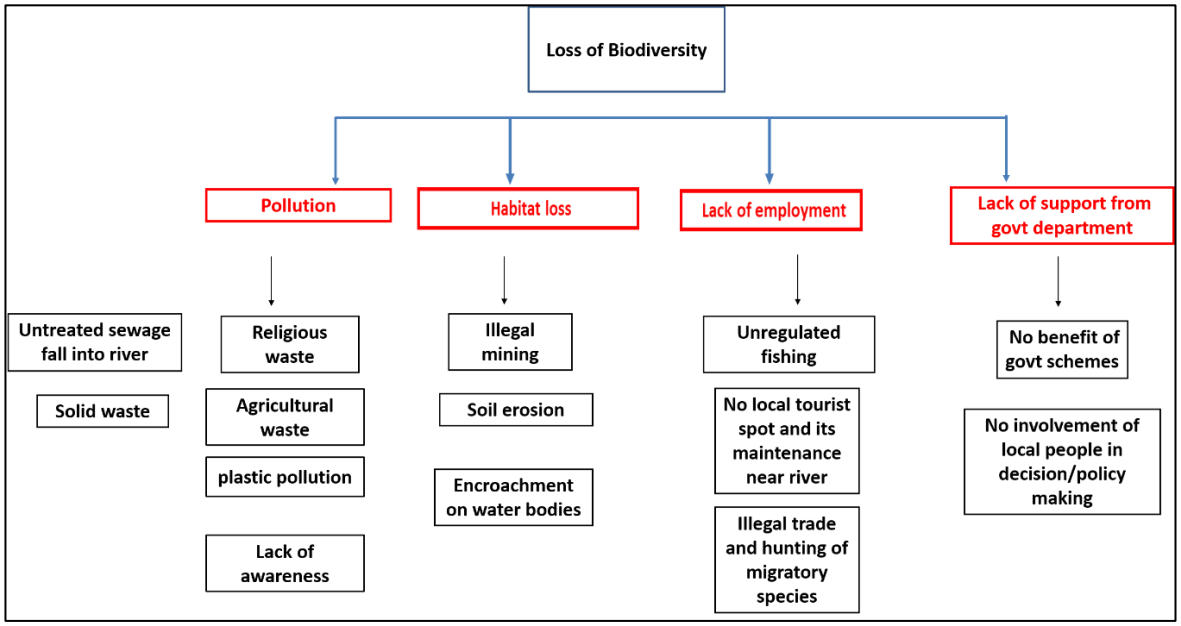


State: Uttar Pradesh

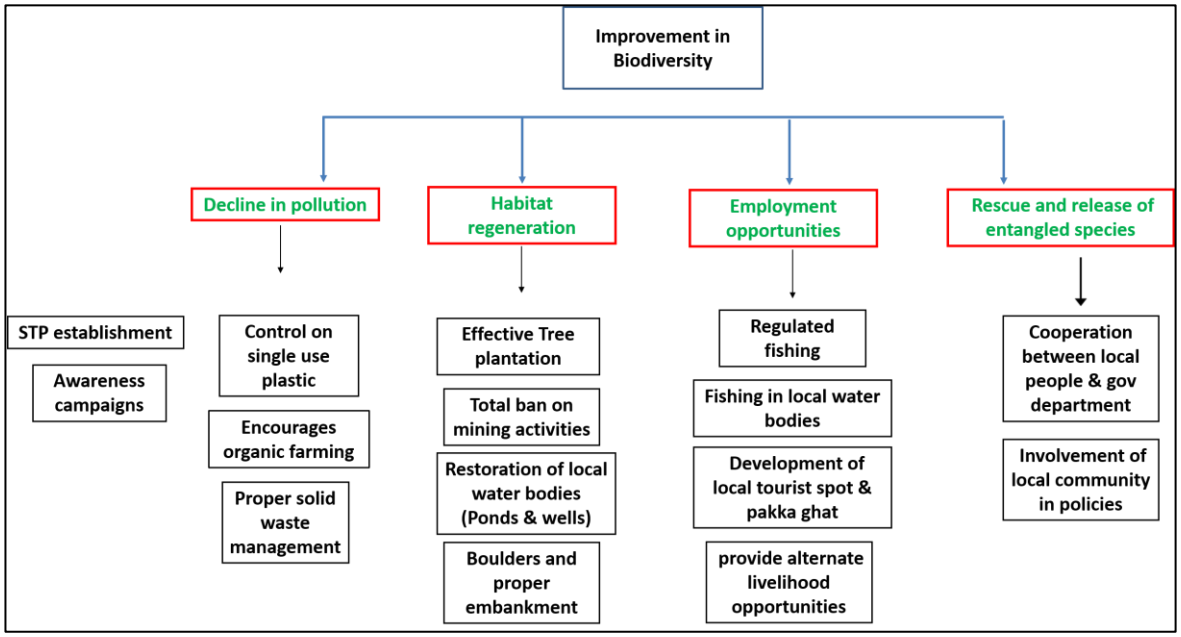
Districts: Farrukhabad, Kannauj, Shahjahanpur

Rivers: Ganga, Ramganga, Kali

Problem Tree

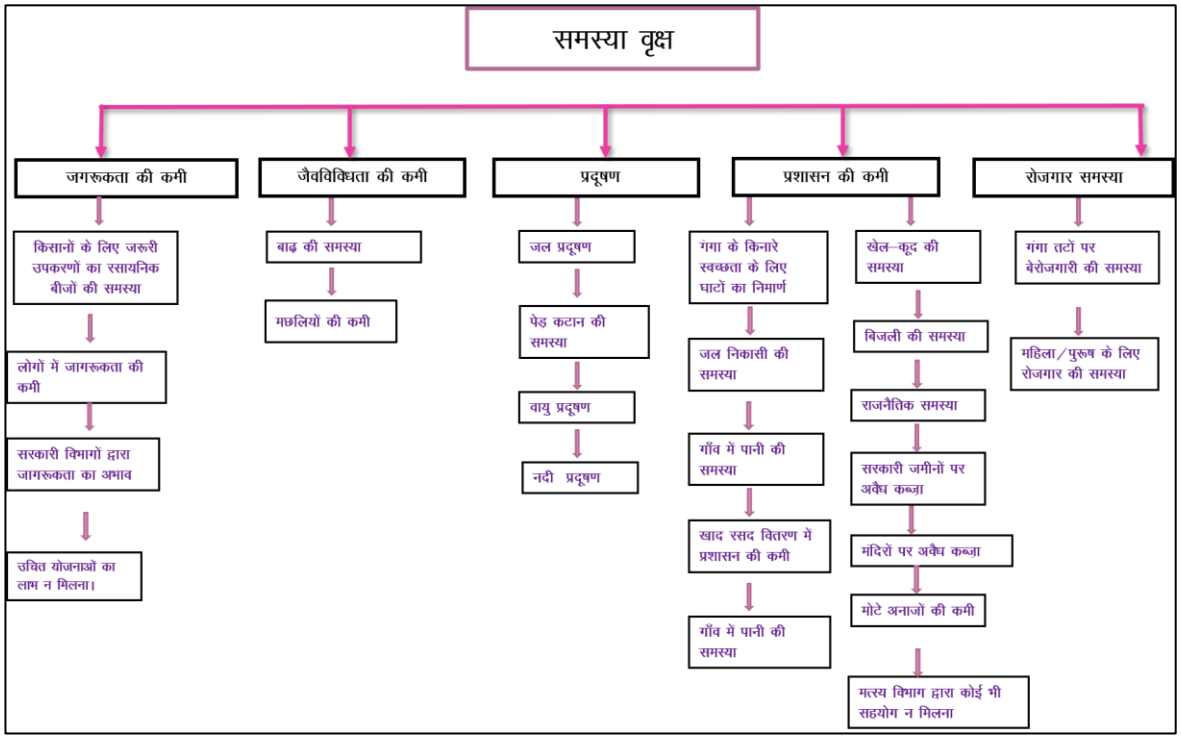


Solution Tree

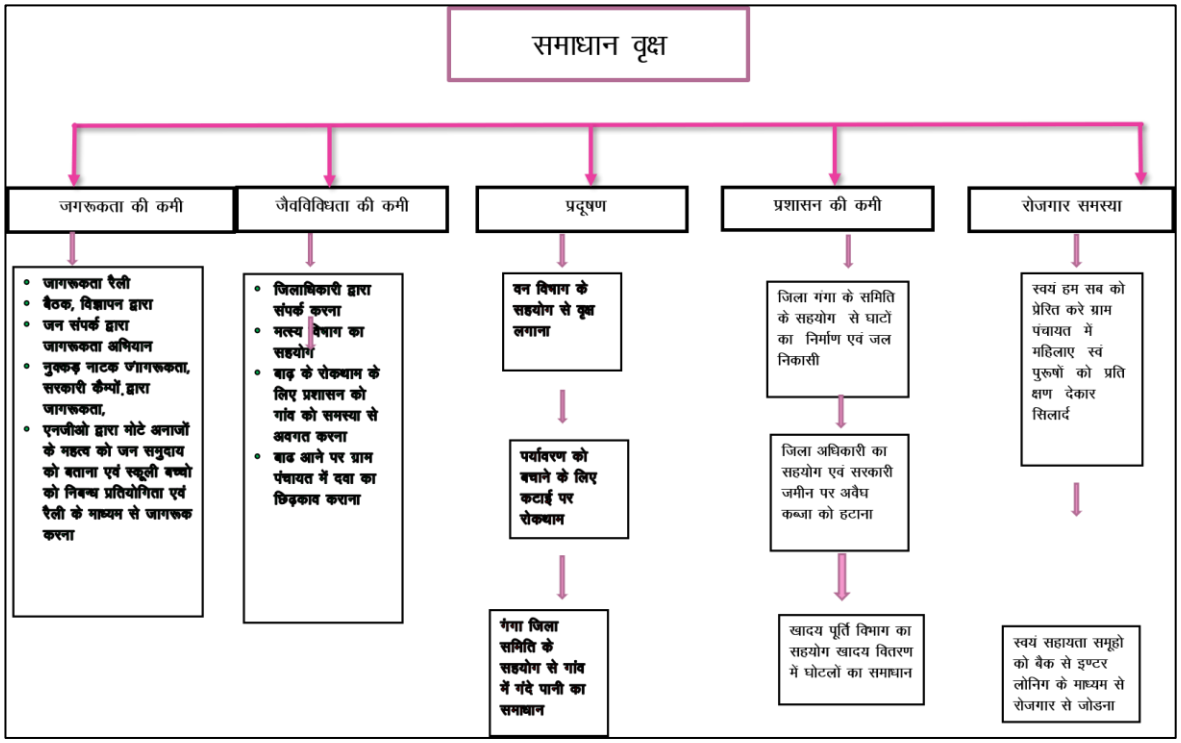


State: Uttar Pradesh
Districts: Ayodhya, Gorakhpur, Mau, Sant Kabir Nagar
Rivers: Ghaghra, Rapti

Problem Tree

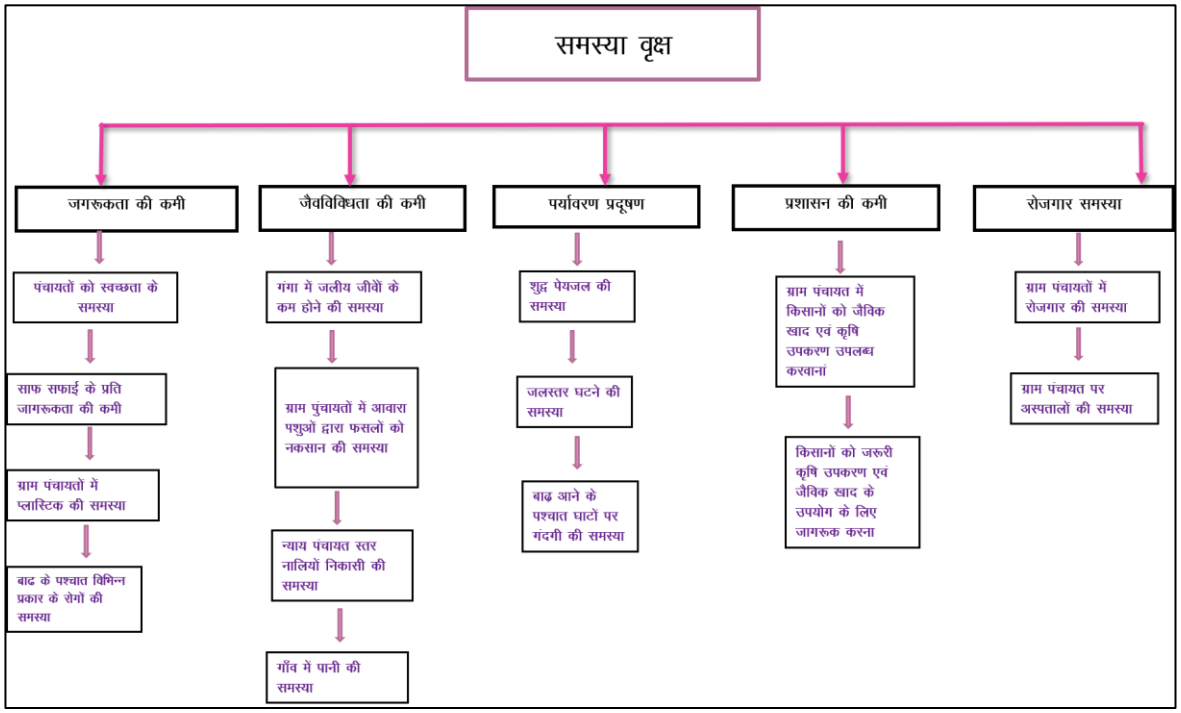


Solution Tree

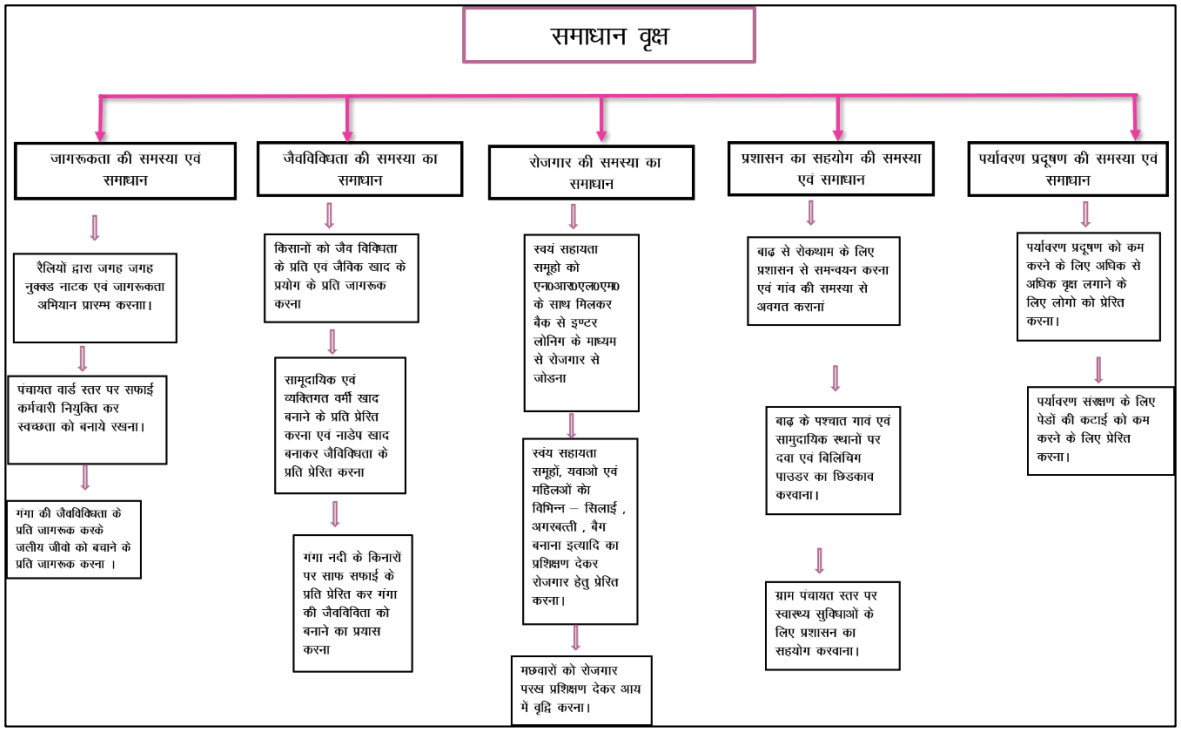


State: Uttar Pradesh
Districts: Jaunpur, Varanasi, Chandauli
Rivers: Ganga, Gomti

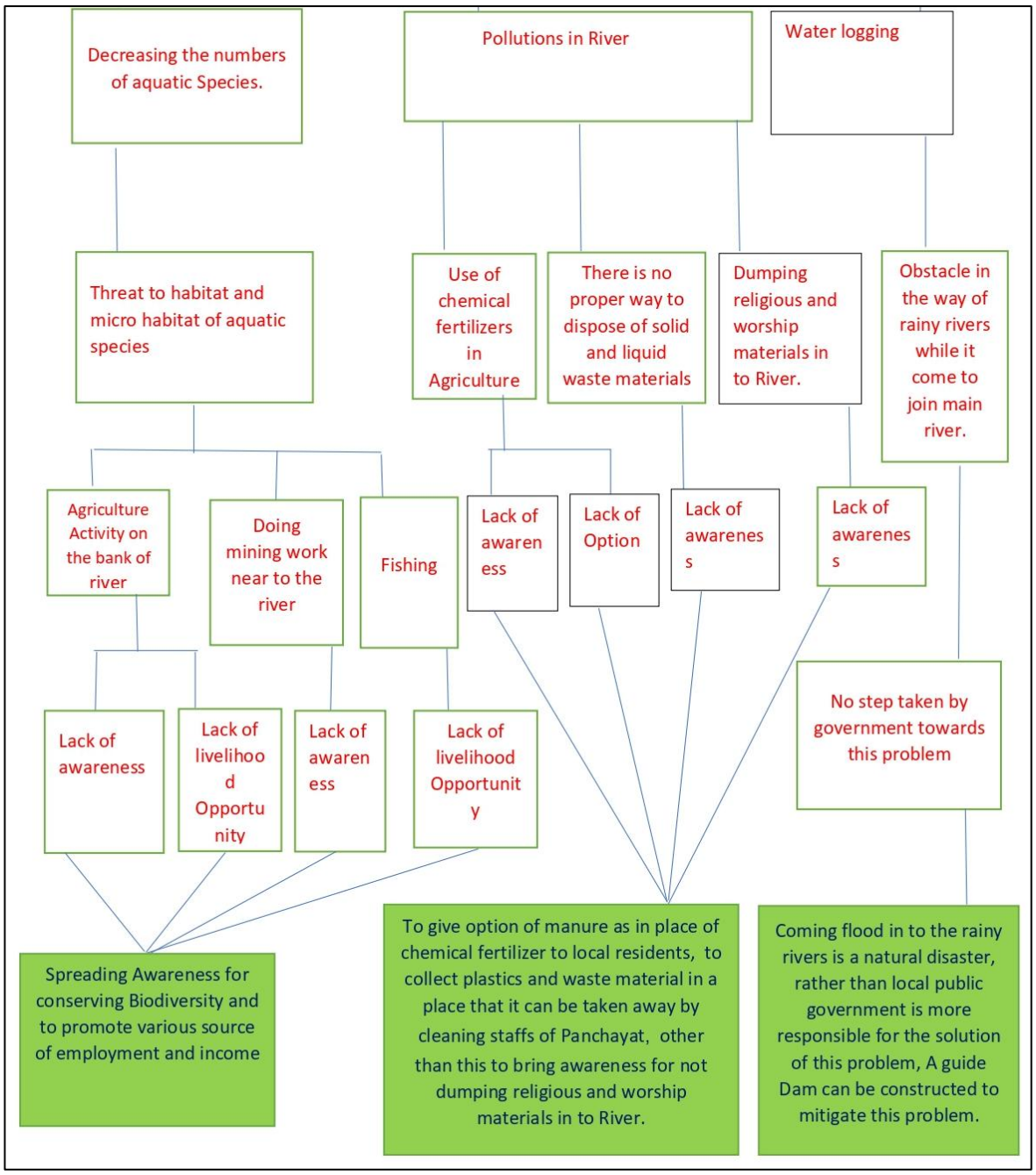
Problem Tree



Solution Tree

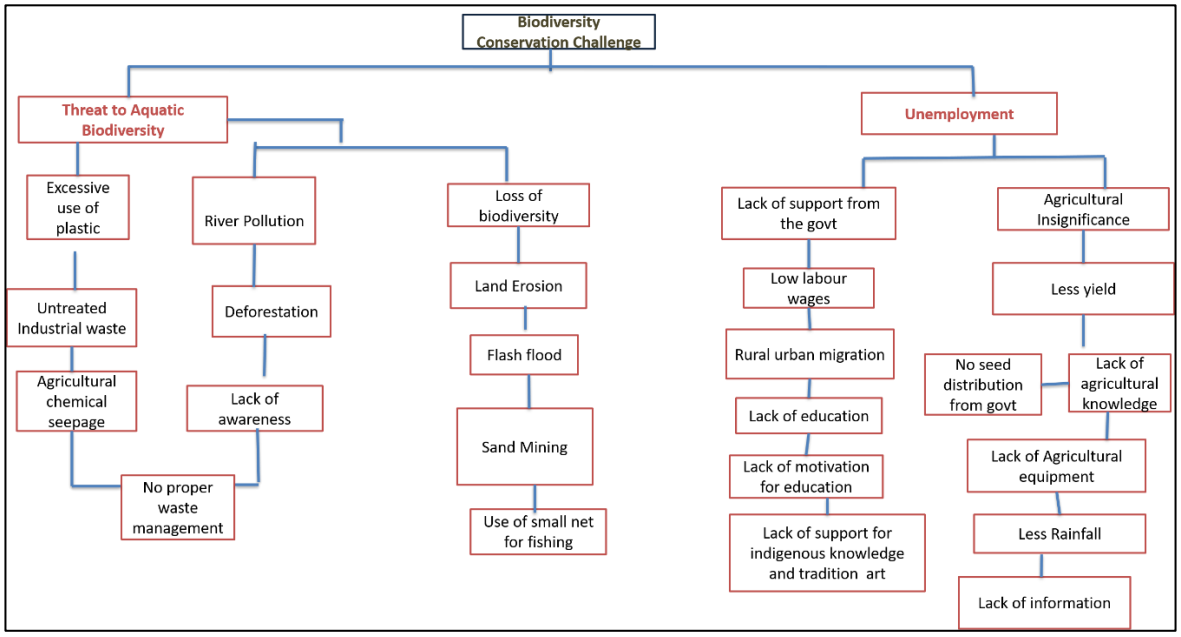


State: Uttar Pradesh
Districts: Mirzapur
Rivers: Ganga

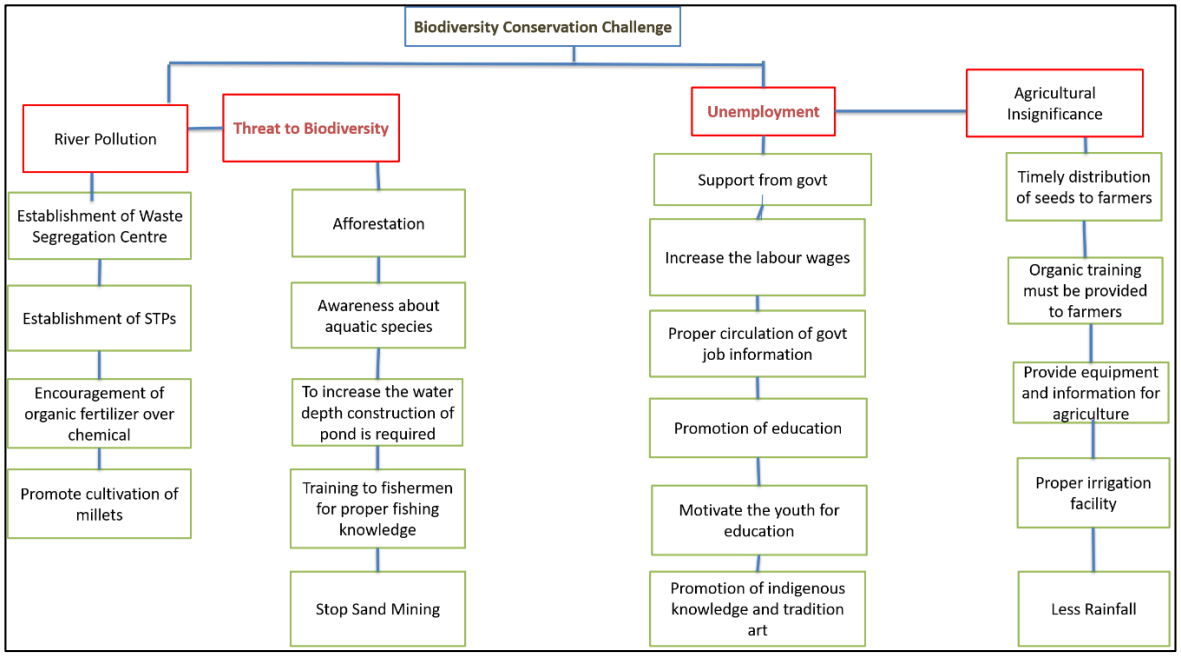


State: Bihar
Districts: West Champaran, Vaishali
Rivers: Ganga, Gandak

Problem Tree

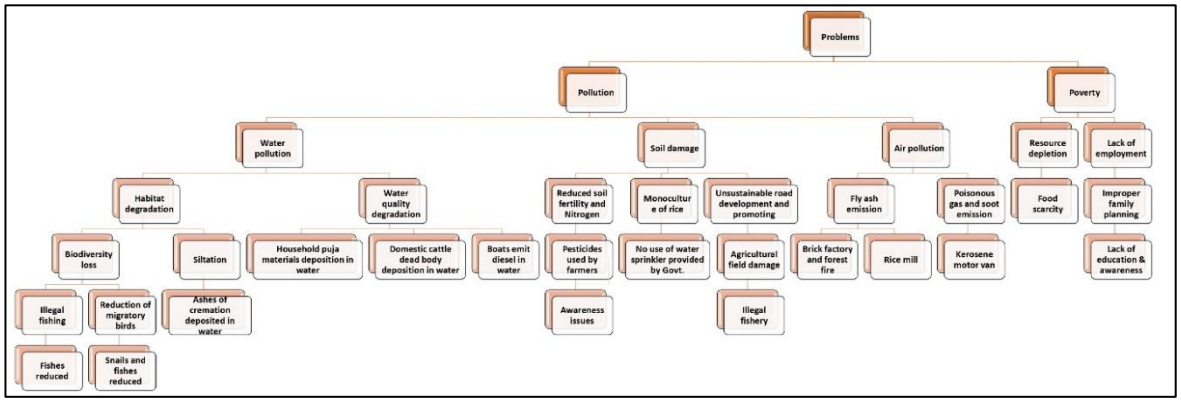


Solution Tree

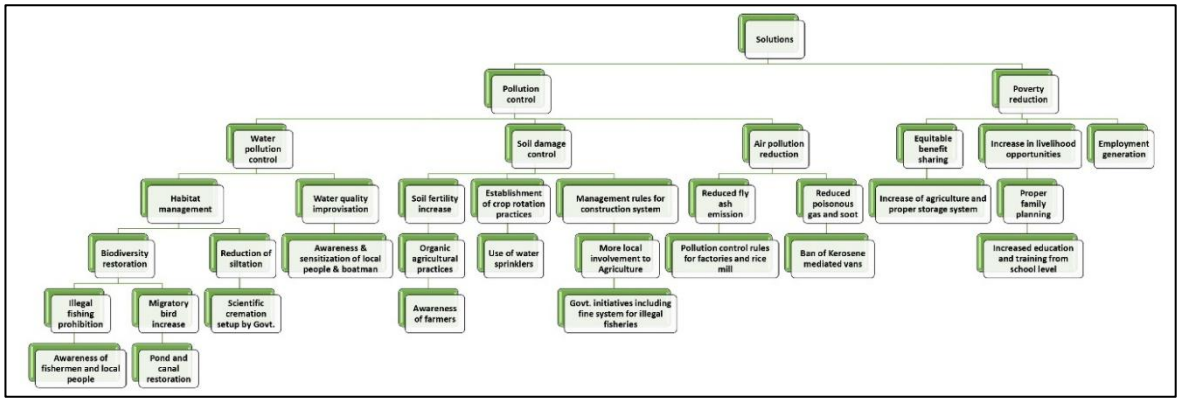


State: Jharkhand
Districts: Sahibganj
Rivers: Ganga

Problem Tree

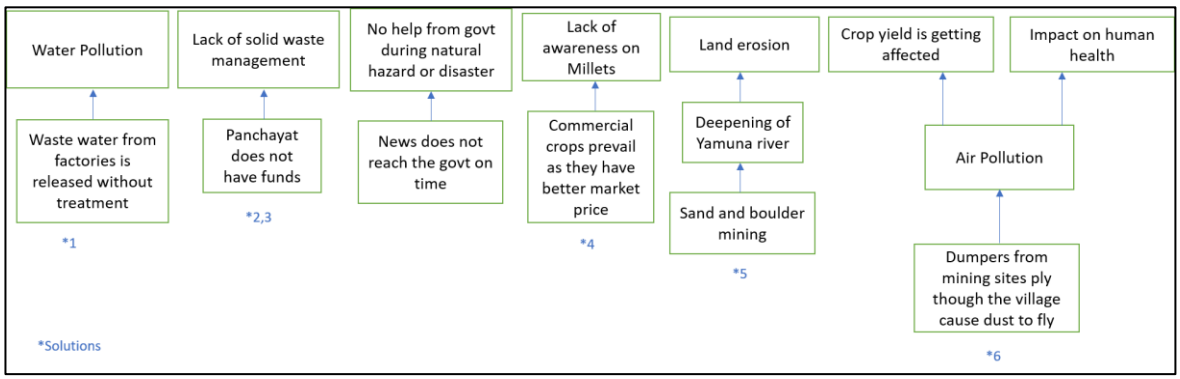


Solution Tree



State: West Bengal
Districts: Nadia
Rivers: Hooghly

Problem Tree



Solution Tree

Solutions:

1. Factories should have infrastructure within their premises to treat the wastewater before releasing it. Representatives from Gram Panchayat should meet the factory representative and urge them for the same.
2. Gram Panchayat should talk to the government and make avail of the existing schemes to get land to set up a solid waste management system for the village.
3. Awareness and sensitization of panchayat towards waste management
4. Awareness and sensitization of panchayat towards millets
5. Gram panchayat should meet the representatives from stone crusher to sensitize and urge them to mine in the area they have lease for.
6. Stone crusher owners should make an alternative path outside the village for trucks to avoid the ill-impacts on the villagers.

State: Himachal Pradesh

Districts: Sirmaur

Rivers: Yamuna

Dr. Ruchi Badola, Dean of the Faculty of Wildlife Sciences, Scientist 'G', and Principal Investigator of the NMCG–WII Ganga Biodiversity Conservation Initiative, presenting Mrs. Babita Kaushal, Ward Member of Rampur Ghat village in Sirmaur district, Himachal Pradesh.

NMCG

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Department of Water Resources,
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GACMC/NCRR

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