Building Block for

Agriculture Management

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Handbook for Urban Local Bodies Officers

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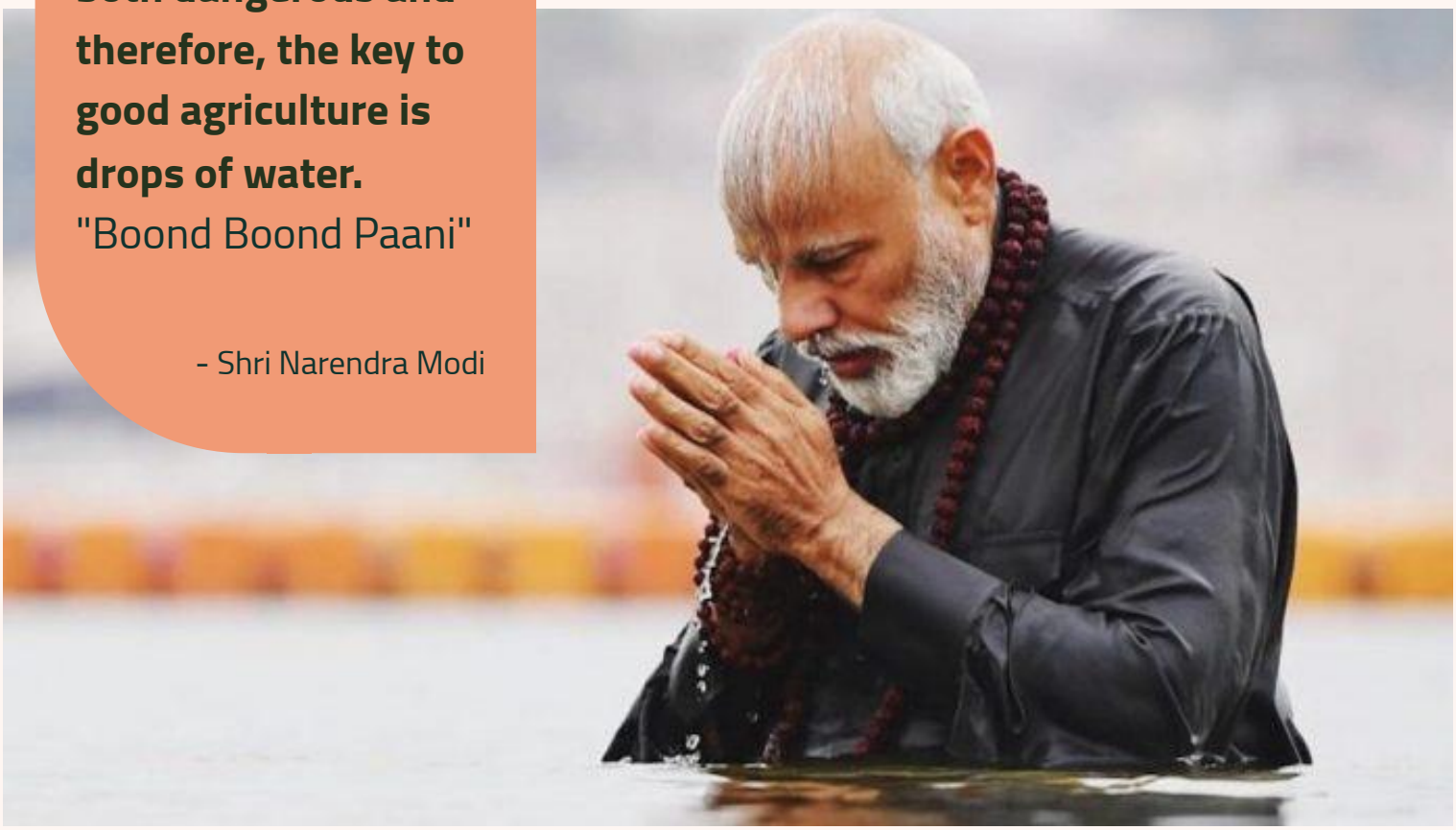
It is essential to use water judiciously and not to waste even a drop. Excess and scarcity of water are both dangerous and therefore, the key to good agriculture is drops of water.
"Boond Boond Paani"

- Shri Narendra Modi



FOREWORD

The 74th Constitutional Amendment marks a landmark moment in India's realm of urban local self-governance, creating urban local bodies (ULBs) constitutional entities with the authority to provide better governance and more effective delivery of civic services to communities. It is therefore important for the states to devolve greater responsibility, power, and resources to the ULBs through the devolution of finances and officials envisioned in the Twelfth Schedule to the Constitution.

Amidst unparalleled economic growth and a rapidly increasing population, India is faced with a series of dif cult decisions regarding its future. With a 7.4 percent average annual growth rate during the previous decade, the country will become the world's fourth largest economy in approximately two decades. Indian Institute of Public Administration, New Delhi holds the cause of *Namami Gange* programme in high priority. We have developed a complete training programme under the project "Blended Capacity Building Programme for Stakeholders of River Ganga" The modules have been developed in a clear and easy-to-understand manner for the Urban Local Bodies. Though mostly based on missions of *Namami Gange* and state governing municipal administration, it lends itself to customization to meet the special needs of other states and river bodies.

This module on Agriculture Management introduces perspectives of urban local body of cers towards trends and challenges, policies, and a framework of sustainable agricultural practices in rive Ganga basin for long term agricultural sustenance and food security. Further to bring a change in the management tools and practices for sustainable and economic ef ciency in existing agricultural practices.

S.N. Tripathi, IAS (R)
Director General, IIPA

PREFACE

Agriculture is an important sector of Indian Economy as more than half of its population relies on Agriculture as the principal source of income. Agriculture management systems play a major role in the generation and dissemination of agricultural technologies aiming at enhancing farm productivity while ensuring judicious and sustainable utilization of critical resources such as water & soil.

This handbook is intended to facilitate these efforts by outlining a model educational approach, designed to co-create and adopt evidence-based on- agricultural practices that support the livestock which are providing ecosystem services. It is intended to be used by Urban Local Bodies, researchers, and farm educators, including government officers.

The National Mission for Clean Ganga has made tremendous progress by launching a number of programs and regulatory frameworks to assist state governments with integrated management. Indian Institute of Public Administration, New Delhi has designed modules as a strategic step toward enhancing the ability of urban managers in cities. We are pleased to observe that the progress made in this direction has been chronicled as a step-by-step guide structure in these volumes. Team IIPA is confident that the module toolkit will motivate communities to reimagine their urban areas as part of the city's integrated vision and urban planning process. We look forward to collaborating with state governments and concerned citizens to protect these natural resources.

Prof. Vinod K. Sharma **Dr. Shyamli Singh**
Faculty, IIPA

Target Audience

- District collectors, Magistrates, Sub-National officials, Development Departments, and Public Services who address development and planning activities
- Officials of Urban Local Bodies, Panchayati Raj Institutions, and Smart Cities Officials who implement the program
- Academia, universities, research institutions that can help documentation and assess the related scenario
- Citizen group and civil society as a whole

Background

Agriculture is one of the most important elements of the Indian Economy as more than 75% of the workforce earns their livelihood through agriculture. The Ganga River Basin in India stretches over 860,000 km2 and is home to more than 485 million people. The population is concentrated on the plains that support extensive irrigated agriculture. This sector is under continuous threat of risks, which are exacerbated by a variety of factors like climate variability, and change, uncertainties in yields and prices, higher demand for food, and excessive use of fertilizers. These factors have a multiplier impact on streams and water bodies, soil fertility, and natural habitats. Increasing population and related socio-economic problems including poverty and hunger, poor water use efficiency, water scarcity, extreme weather events like a flood as well as drought, and unequal access to water are common concerns in the agriculture sector.

The current practices of the uncontrolled use of fertilizers, pesticides in agriculture have created serious environmental problems including unabated pollution of rivers, emission of GHGs, etc. It becomes imperative to formulate a visionary Agriculture management policy that is sustainable. This module will guide the local authorities in the state to implement sustainable agriculture practices in the future in compliance with the regulatory framework of India. This will further aid them to manage the rivers within their stretch.

Why Agriculture Management?

Agriculture is the backbone of Indian economy and is critical for food security, employment and livelihood of the people . Almost 70% of the rural households depend on agriculture. Agriculture management is the set of tools, process and best practices to optimally utilize the natural resources such as soil and water for long term agricultural sustainability. Indian agriculture ecosystem is facing multiple challenges which can be addressed through agricultural management:

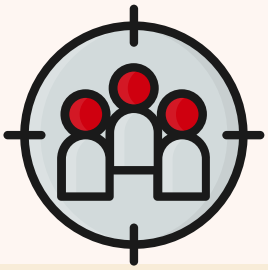
To Meet Increasing Food Demand

Environmental Challenges Interplay Socio-Economic Trend

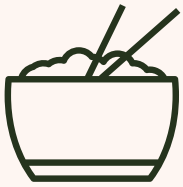
For Conservation of Natural Habitat

Meet Increasing Food Demand

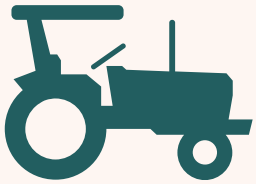
India has one of the lowest land productivity and large population to feed. By 2030 it will need to feed 1.5 Billion people and due to rising incomes and social standard per capita food consumption is also increasing



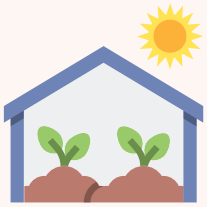
1.3 Billion People to feed



250+ million tonnes food requirement

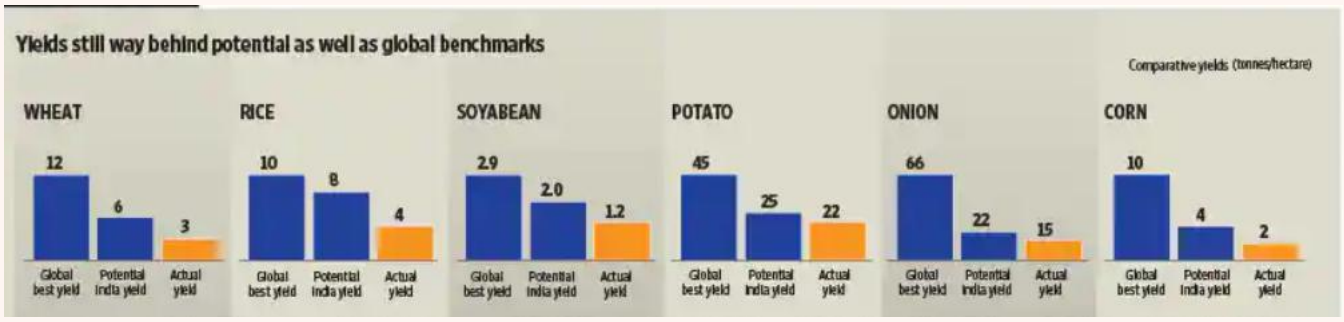


> 7% of world's total agriculture output

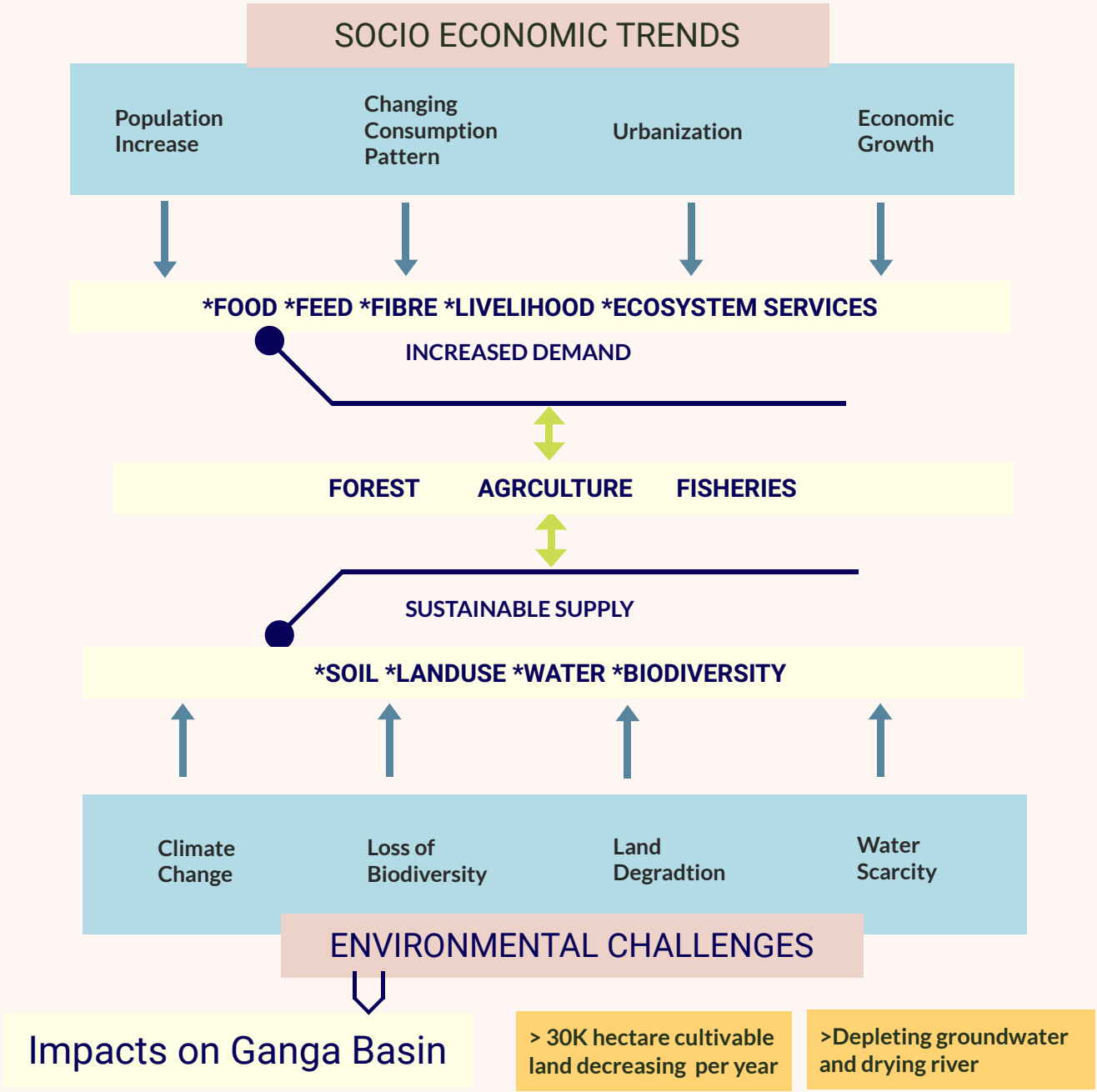


Growing Food Export

Low Agricultural Productivity



Environmental Challenges Interplay Socio-Economic Trend



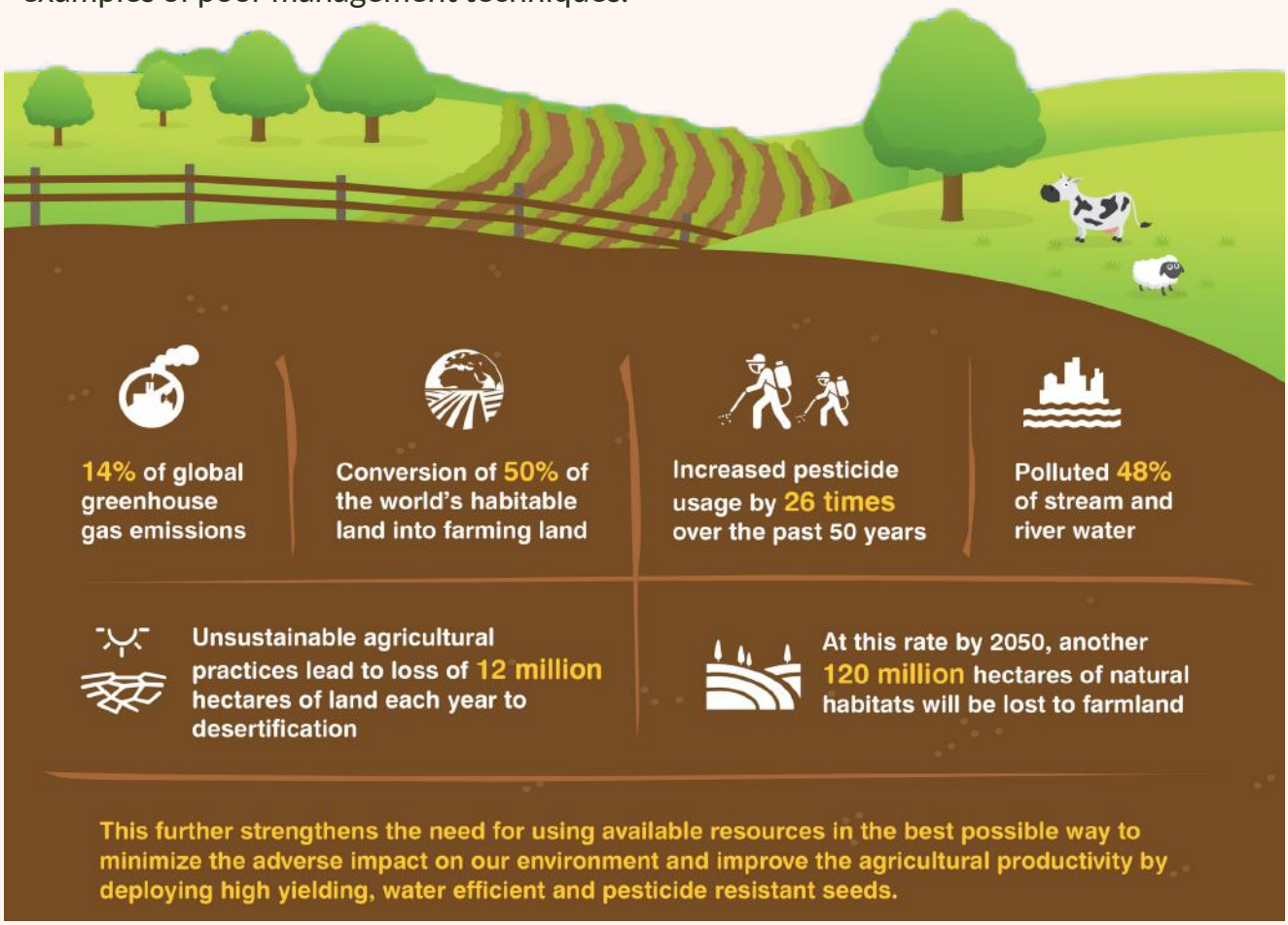
Agriculture is facing multiple environmental challenges of climate change, shrinking cultivable land and river and depleting ground water. At the same time consumption behavior is evolving towards increased demand and food varieties. In addition the urbanization and industrialization is driving labor force away from agriculture. Sustainable agriculture practices and processes are critical to address evolving socio-economic and environmental trends

Conservation of Natural Habitat

Agricultural pollution refers to biotic and abiotic byproducts of farming practices that result in contamination or degradation of the environment and surrounding ecosystem. For example:

- Nitrogen-based fertilizers produce potent greenhouse gases and can overload waterways with dangerous pollutants.
- Chemical pesticides with varying toxicological effects can contaminate our air and water or reside directly on our food. Sometimes we can clearly see (or even smell) the pollution and its source, like fertilizers traces.

Management strategies, or a lack thereof, have a significant impact on the volume and impact of these pollutants. Animal management and housing, as well as the spread of pesticides and fertilizers in worldwide agricultural practices, are all examples of management approaches. Poorly managed animal feeding operations, overgrazing, ploughing, fertilizers, and incorrect, excessive, or poorly timed irrigation are all examples of poor management techniques.

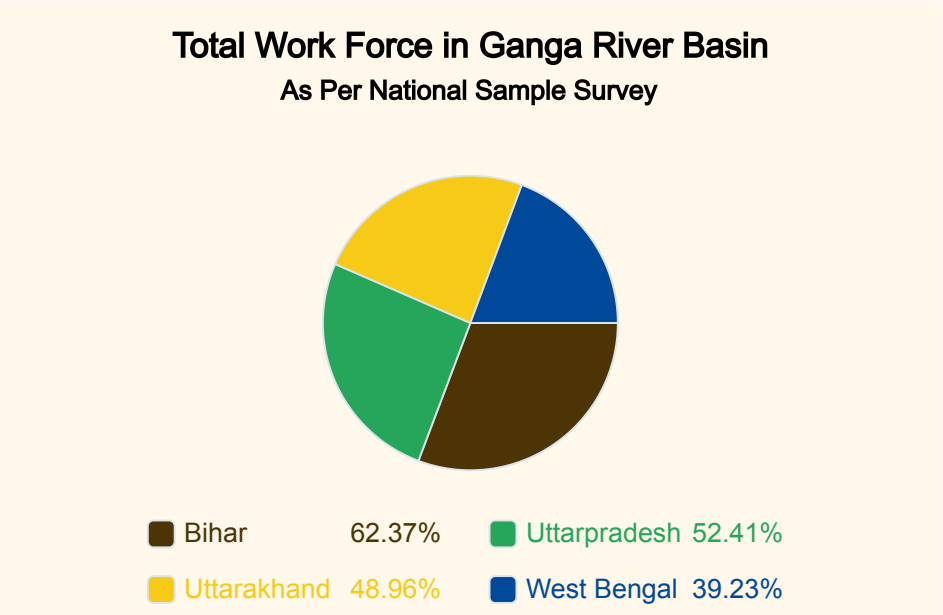


Source: Ipcc World Climate Change Report, National Water Quality Inventory,Wwf Unep

> *If Agriculture fails, everything else will fail*
>
> — *M S SWAMINATHAN*

Agriculture in Ganga Basin

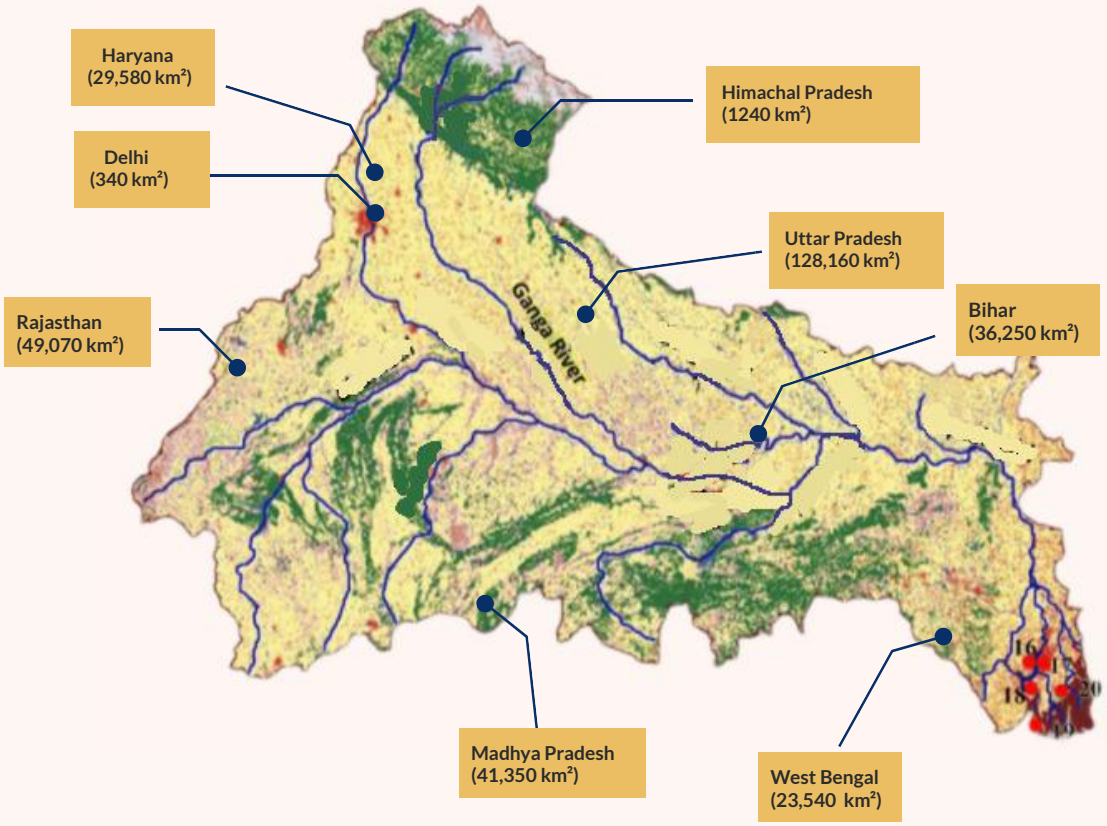
India is a global agricultural powerhouse. It is the world's largest producer of milk, pulses, and spices, and has the world's largest cattle herd (buffaloes), as well as the largest area under wheat, rice, and cotton. It is the second-largest producer of rice, wheat, cotton, sugarcane, farmed fish, sheep & goat meat, fruit, vegetables, and tea. The agriculture sector continues to play a vital role in India's overall economy and employs 55.6% of India's total workforce.



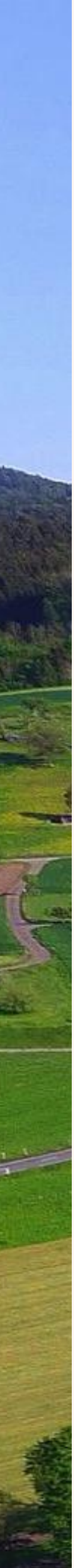
The river Ganga, with over 2,525 km long main-stem, is one resource that sustains multiple functions—pertaining to ecological, socio-cultural and livelihoods. The production of food and other agricultural products takes 70% of the freshwater withdrawals from rivers and groundwater. In India's Agricultural sustainability River Ganga is very critical. The Ganga and its tributaries provide a perennial source of irrigation to a large area. There are about 580,000 km² of arable land, which is almost 29.5% of the cultivable area of India. The Ganga river, being a perennial source of water, facilitates both surface and groundwater irrigation in the basin.

Since, the scope of bringing more area under cultivation is limited due to rising land demand for non-agricultural uses, such as, urbanization and industrialization, the future requirement of agricultural commodities, including food, may be met by intensive use of land, water, and other resources which would have some implications in terms of degradation of soil and water resources.

Irrigated area in River Ganga Basin



The Ganges basin is a part of the composite Ganges-Brahmaputra-Meghna basin draining 1,086,000 square kilometers in China, Nepal, India, and Bangladesh. Its catchment lies in the states of Himachal pradesh, Uttar pradesh, Bihar, Rajasthan, Jharkhand, Delhi and the whole of Bangladesh, Nepal, and Bhutan.



Modern agricultural system have been extensive root of soil deterioration and fertility loss, water pollution and depletion of the natural resource. Though the agricultural based cultivable land is a limited, specifically constraint in Ganga basin, the agricultural growth approximately increased four times in 40 years since the 1960s by adopting high-yield varieties (HYV) crops which necessarily require high fertilizer and water inputs. Soil erosion and degradation have been accelerated by the extensive use of pesticides and fertilizers and high water inputs, blindly tillage of soil, and mono-cropping, depleted nutrients and biodiversity of soil, and polluted its ecosystems. Thus, conservation of natural resources (soil & water) in association with the development of agriculture holds the basic need to meet demand for food in the countryGenerally, the physical or natural resources of a river basin are soil and water, on other hand a collection of minerals and compounds bent in it way. Water as nature wise, is a mobile resource. Deviation from time to time, generally the water in any river basin follows through precipitation and from groundwater inflows and through river and groundwater outflows, evaporation-transpiration, and vice-versa. Soil is formed by the process of weathering of naturally parent rocks, for decomposition and transformation that may take thousands of years.

Therefore, the soil and water both are influenced by each other through many biotic and abiotic operations. One of the objectives of National River Ganga Basin Management in Sustainable Agriculture, to ensure both natural and human resources is of prime importance and the agriculture practice remains environmentally sustainable, i.e. the productivity increases sufficiently and surviving without degrading the physical resources of the river Ganga. Agricultural productivity mainly depends on the quality and availability of physical resources i.e., water and soil. Agricultural growth can be sustained by conservation and sustainable use of constrained natural resources over location-specific processes.

Basin level Agricultural Development Challenges

Current agricultural practices have adversely impacted the Ganga basin soil fertility and water quality. Excessive use of chemical fertilizers and pesticides has polluted both surface and groundwater and become the major non-point source of pollution of river water resources, thus adversely affecting the aquatic lives and livelihood of people. Exponential growth of tube-wells in the basin has caused serious depletion in the ground water level and consequently the quality of water. Groundwater irrigation is preferred on the grounds of equity, efficiency, productivity and to address erratic monsoon and rainfall. But due to the absence of effective regulation, and availability of subsidized electricity and flat rate system of power which encouraged farmers to over-exploit the groundwater, as the marginal cost of drawing water from electrified tube-wells is almost zero, its sustainability has become one of the major concerns in the basin.

Source: https://www.drishtiias.com/daily-updates/daily-news-editorials/agriculture-reforms

The key priorities are how to reduce water consumption and water pollution in agriculture and protect livelihood of small and marginal farmers who constitute more than 90% of total farmers in the basin.

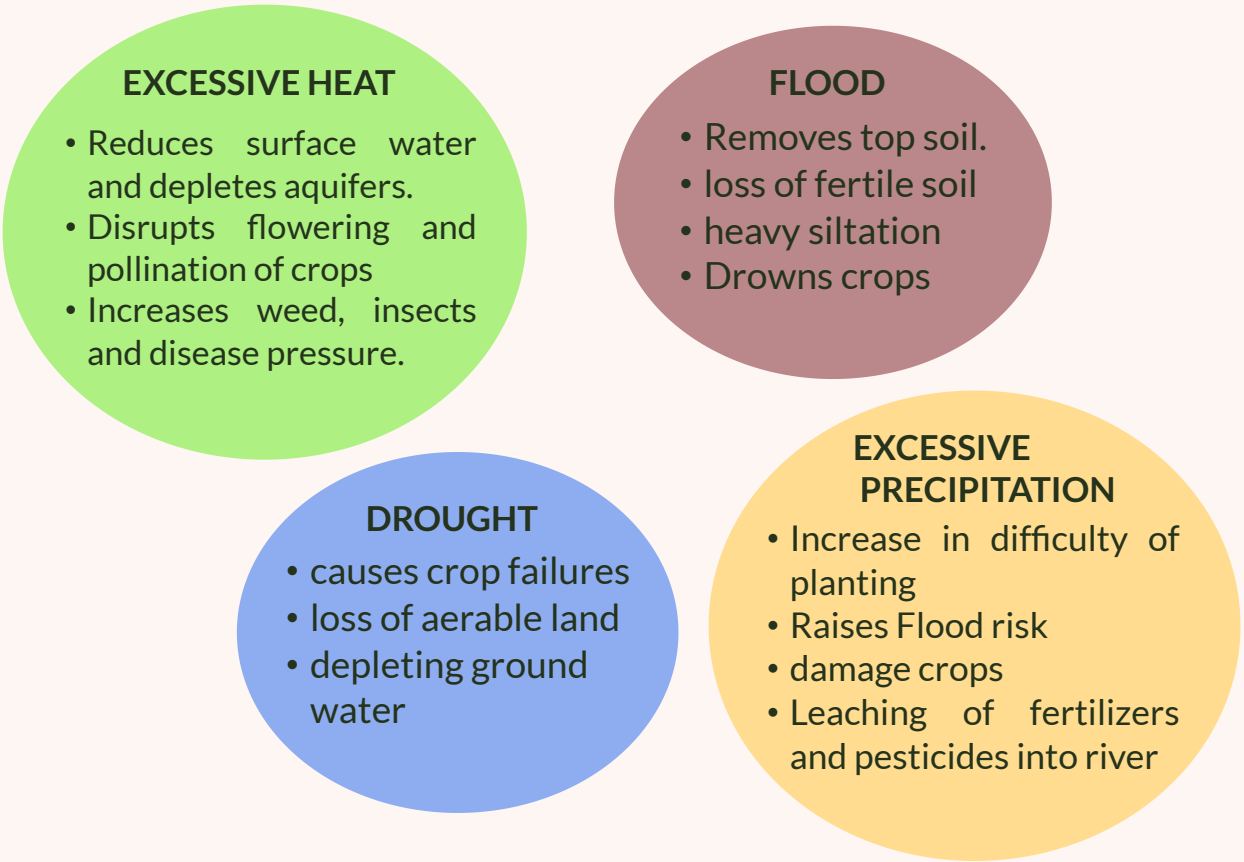
Key Challenges

1. Industrialization along the settlements on the banks of Ganga
2. Marginalization of Agricultural Holdings
3. Changing crop-pattern
4. Climate Change
5. Excessive groundwater exploitation
6. Ever-growing towns into cities and cities into mega-cities on the banks of Ganga
7. Knowledge-Deficit in Agriculture
8. Excessive use of fertilizers

It is recognized that the large-scale irrigation systems on Ganga have contributed immensely to the betterment of the agricultural economy of the region, which has certainly enhanced the socio-economic status of people in the western and central Uttar Pradesh (second state, on the main-stem of Ganga). Besides this, the entire Indo-Gangetic plains have become fertile land with the help of Ganga water and the sediments that flow with this water. On the other hand, during the last half a century, many new challenges have compounded the pressures and stresses onto the Ganga, its water resources, and its aquatic life.

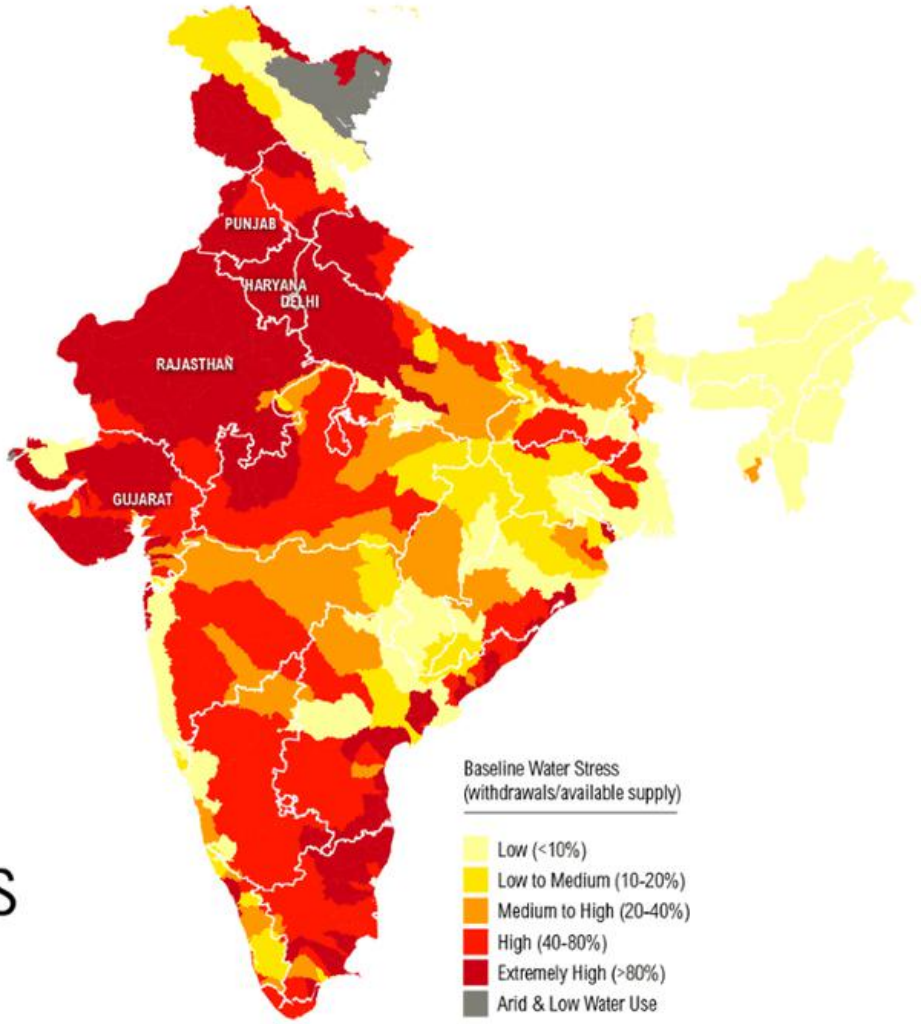
Hydrometeorological Disaster

Climate change causes erratic weather patterns, extreme temperatures, and changes in natural resources, threatening farmer's ability to sustainably produce and maintain crops quality. According to the IPCC (2014), India is likely to suffer from a higher frequency of extreme temperature and precipitation events. The cyclical monsoon system has been identified as one tipping element of the global climate system, which means that strong climate change might drastically change atmospheric circulation patterns globally (Lenton et al., 2008; Steffen et al., 2018). With such a systemic shift, there could be significant impacts on India's agricultural sector..



Impact of Climate Change on Agriculture

54% of India Faces **High** to **Extremely High** Water Stress



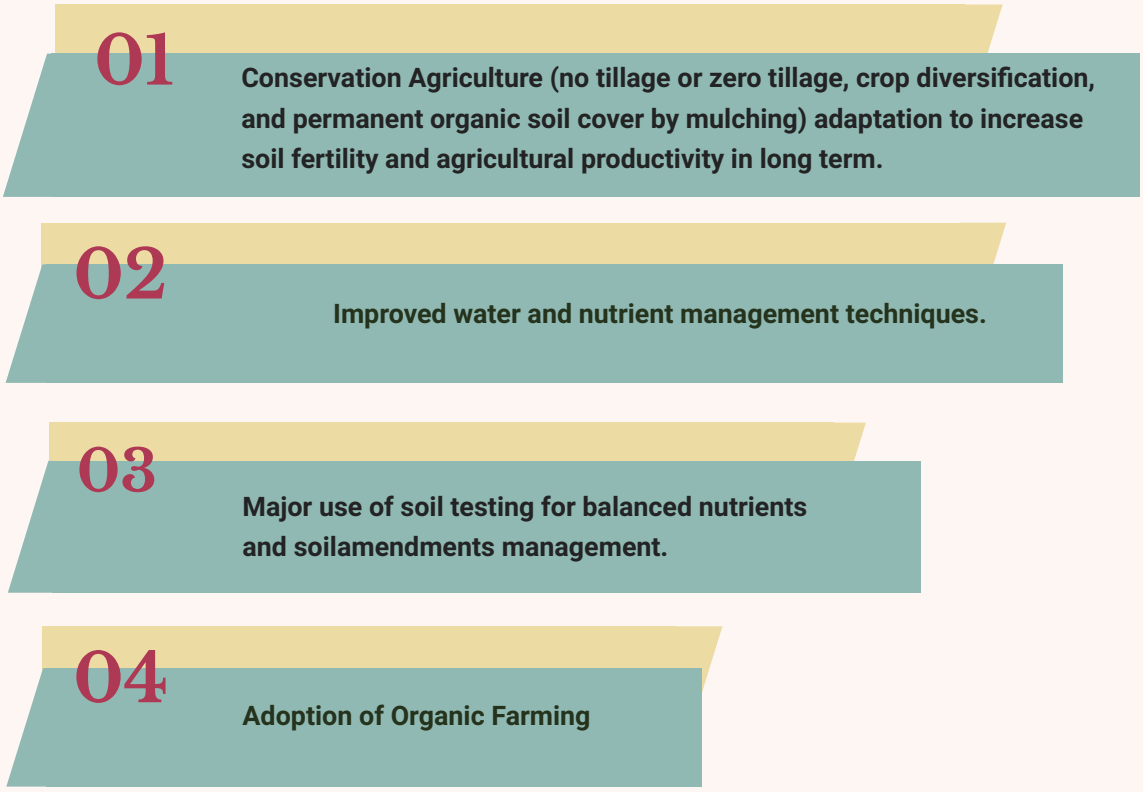
Source: Water stress in India map Photograph: WRI

Few of the questions that needs to be addressed are:

- Can alternative agricultural practices (such as organic farming, drip irrigation) improve river health?
- What kinds of institutional, technological, market and financial support related interventions are required for sustainable agriculture?
- What are the key factors that would determine the shift of farmers towards sustainable agriculture?
- How to address the knowledge-deficit in agriculture management and involve private players in it?

Importance of Sustainable Agriculture

Soil and water are the main physical resources of a river basin that support all life in the basin. Over the last several millennia, human civilization has been increasingly using these resources in agriculture to sustain and expand human communities. As noted by Montgomery [2007], "conventional agriculture has dramatically increased soil erosion around the world. With global agricultural soil erosion outpacing soil production by a wide margin, modern conventional agriculture is literally mining soil to produce food. Soil productivity involves nutrient budgets, not just soil loss. Ecologically productive
soils, those with more soil microorganisms and organic matter, can support greater plant growth." Thus, apart from soil erosion, regular tillage and the extensive use of chemical fertilizers and pesticides have affected soil fertility by debilitating soil's nutrient cycles and leading to progressive soil degradation. In water-constrained areas, increased crop water use has also led to water crises in many parts of the region. While these issues are global, the extreme land and water constraints of NRGB's agriculture have speeded up the degradation of its agricultural lands, with eroded soils and nutrients running into the
Ganga river network and seriously affecting the rivers and other ecosystems. Thus, there is an urgent need to devise and promote appropriate sustainable agricultural practices to protect the basin and its agricultural lands from any further damage.



The main agricultural practices to adopt in Ganga Basin

Sustainable Agricultural Practices in Ganga Basin

Case Study 1

OLAM: Water Use Efficiency Practices in Sugarcane Cultivation

BACKGROUND

Olam International is a prominent seed-to-shelf agribusiness firm with operations in 65 countries and a global client base of over 13,800 customers. Olam International, in collaboration with IFC, Solidaridad, and HUF, launched the “Madhu Shree” programme in Madhya Pradesh in 2013 to promote sustainable sugarcane agriculture. Around 20,000 farmers are covered by the scheme.

OBJECTIVES

The program's major objectives are :

To raise agricultural productivity, save water, promote soil health, encourage economic empowerment, and broaden participation.

To form knowledge collaborations with water institutes such as CII-Triveni Water Institute, Jaipur, Rajasthan, in order to document best practises for enhancing water sustainability in sugarcane production for industry-wide dissemination and experience building.

INTERVENTIONS CARRIED OUT SO FAR ARE:

Training and capacity building:

Better agricultural methods and improved water efficiency in sugarcane agriculture were taught to farmers, project staff, lead farmers, and extension workers.

Implementation of good water management practices:

Water availability and access are major concerns in the Barwani and Hemarus project areas. Trash Mulching, Organic Manure Application, Furrow Irrigation, and Drip Irrigation are four low-cost water-saving strategies that were recommended in front of the agroclimatic and soil conditions.

Community water governance:

A roadmap was conducted in consultation with local NGOs to strengthen community engagement in ongoing activities. In addition to classroom sessions, one-on-one contacts with farmers and extension workers were conducted to increase community engagement and sensitise women on excellent agronomical practises.

Under this programme, the overall adoption of effective agronomical practises and water efficient practises has been considered to be extremely encouraging. For example, practices such as trash mulching and use of compost in fields have shown a positive behavioural change among small and marginal farmers, leading to successful impleme-ntation on the ground.

Case Study 2

People's Action For National Integration (Pani) – Improving Water Use Efficiency In Agriculture In Eastern Uttar Pradesh

BACKGROUND

Since 1989, PANI has been working in Uttar Pradesh to address both social and economic poverty, as well as to change the socio-political landscape in the eastern area of the state. PANI is now active in 19 districts in eastern Uttar Pradesh. The project is reaching out to 26,577 marginal farmers from 103 Gram Panchayats across seven districts in eastern Uttar Pradesh with the aid of eight CSO partners.

OBJECTIVES

PANI, in collaboration with Hindustan Unilever Foundation (HUF), is executing FASAL-2, an agro-based project

To support the life and economic growth of underprivileged farming communities in seven districts.

To incorporate water conservation into agriculture by encouraging farmers to use water-efficient technologies and practises.

FOCUSED ACTIVITIES OF THIS LIVELIHOOD PROJECT

Social development:

Formation and strengthening of farmers collectives and their federations at the gram panchayat level and Farmers' Resource Centres; capacity building of Community Resource Persons in management and leadership; formation of Water Users Groups

Crop improvement:

Training and demonstration lessons should be given to the farmers and resource persons for the cultivation of cereals, pulses, sugarcane, and vegetable.

Soil health improvement:

Composting and water friendly POPs of sugarcane, mentha & vegetables.

Demonstration:

Promotion of pusa hydrogel, drip irrigation, and water efficient agriculture practices like mulching etc

Key Success

- Water savings of 73.51 MCM resulted in diesel savings of Rs. 85 million in the lifting of water from the ground.
- 26577 families have been impacted, contributing indirectly towards sustained use of water.
- 15000 acre area brought under water-efficient techniques.
- Additional production of 28500 tonnes was aided.
- By 2019, the farm incomes of 26577 marginal farmers have increased by 25 to 30 percent.
- Marginal farmers benefitted from access to various government schemes.

Case Study 3

Vermiconpost Practice : Geetaben Kanubhai Rathwa

BACKGROUND

Sinch 3 years, Geetaben has been adopted vermicompost practice in village Dholivav to address both villagers livelihood and water consumption as well as to change the use of fertilisers pattern. she has adopted this modern scientific agricultural practices with Shroffs foundation trust. Trust gave her a platform and opportunity to share her experience with others in Mumbai. Currently she is acting as a Community Resource Person and runs a farm school.

OBJECTIVES

Geetaben adopted this modern scientific agriculture practices with the help of team of Shroffs Foundation Trust

To incorporate water conservation into agriculture by encouraging farmers to use water-efficient technologies and practises.

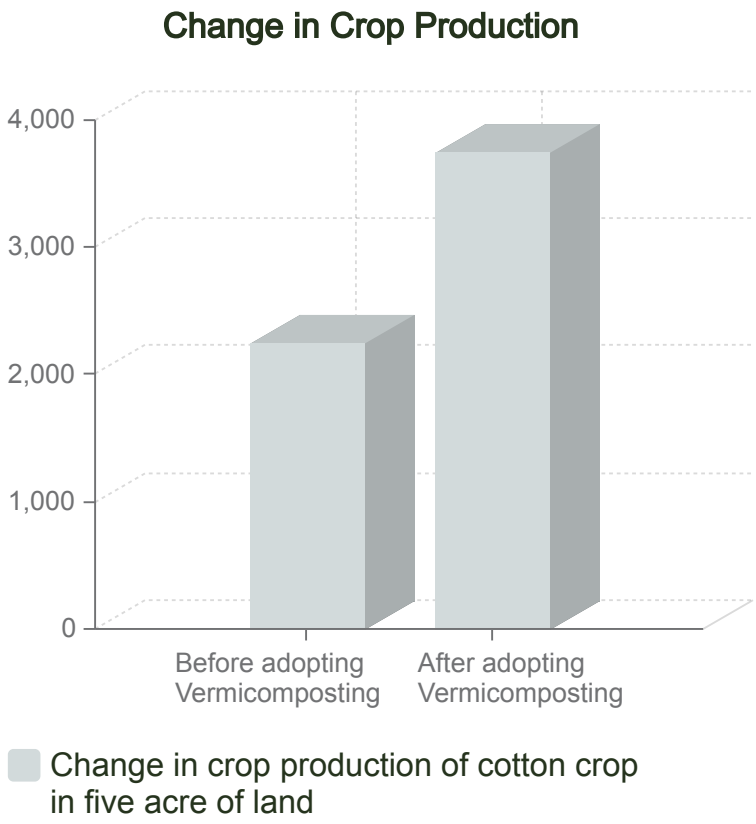
To reduce expenditure on chemical fertilizers on five acre of land.

To engage villagers for adapting scientific agricultural practices to improving soil health and crop productivity

To generate new source of income and improve farmers livelihood

Geetaben is practicing Vermicomposting from last two & half years. The change she experienced in farming was tremendous. Below are some of the results of Vermicomposting practices by Geetaben on her five acre of land.

Indicators	Before adopting vermicompost	After adopting vermicompost
Seeds quantity	1800 g	800 g
Expenditure on chemical fertilizers	INR 5000	INR 700
Vermi compost dosage	NIL	600 Kg
Expenditure on water consumption	INR 1000	INR 550
Soil quality	Hard	Soft
Crop quality	Roots damaged, grey spot on leaves	healthy roots and green leaves
production	700-800 Kg	1600-1800 Kg



NEW INCOME GENERATED

She has created new source of earnings by these practices. Approximately 40 Kgs of earthworms and 75 liters of vermiwash used in the vermicomposting of five acre land area. so that there new source of income generated as 1 ltr of vermiwash cost is INR 30 and 1Kg of earthworms sold at price INR 250.

Major Findings

- Reduction in expenditure on chemical fertilizers up to 86%
- Production increased by 60%
- Expenditure on water decrease by 45%

FRAMEWORK FOR REJUVENATING WATERSHED FOR AGRICULTURAL RESISTANCE

1

ASSESSMENT OF ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

The aim of the ESSA was to review the capacity of existing government systems to plan and implement effective measures for environmental and social impact management and to determine if any measures would be required to strengthen them.

2

IMPLEMENTAION AGENCY

The State Level Nodal Agency (SLNA) for Soil Conservation and Watershed Planning is responsible for overall programme development, budget allocations, technical sanctions, district implementation support, and monitoring. Sanctioning watershed projects is the responsibility of a State Level Sanctioning Committee led by the Chief Secretary.

3

THEORY OF CHANGE

Establishes the linkage between the activities, outputs, outcomes and expected results. These have indicators for determining the change.

4

CAPACITY BUILDING

Strengthening watershed committees, PRIs, and other community institutions is intended to improve public involvement, equitable and inclusive benefit sharing, gender equality, and citizen participation.

01

ASSESSMENT ENVIRONMENTAL AND SOCIAL SYSTEMS ASSESSMENT

This ESSA analyses or considers the extent to which the Program‟s environmental and social management systems are adequate for and consistent with six basic environmental and social principles. The Core Principles are described below

Environmental and Social Management

(a) promote environmental and social sustainability in Program design;
(b) avoid, minimize, or mitigate against adverse impacts;
(c) promote informed decision making related to a Program's environmental and social effects.

Public and Worker Safety

Program procedures ensure adequate measures to protect public and worker safety against the potential risks associated with:
(a)construction and/or operations of facilities or other operational practices developed or promoted under the Program; and
(b) exposure to toxic chemicals, hazardous wastes, and otherwise dangerous materials.

Social Con ict

Avoid exacerbating social conflict, especially in fragile states, post-conflict areas, or areas subject to territorial disputes.

Natural Habitats and Physical Cultural Resources

to avoid, minimize, and mitigate any adverse effects (on natural habitats and physical and cultural resources) resulting from the Program.

Land Acquisition

Land acquisition and loss of access to natural resources are managed in a way that avoids or minimizes displacement, and affected people are assisted in improving, or at least restoring, their livelihoods and living standards

Indigenous Peoples and Vulnerable Groups

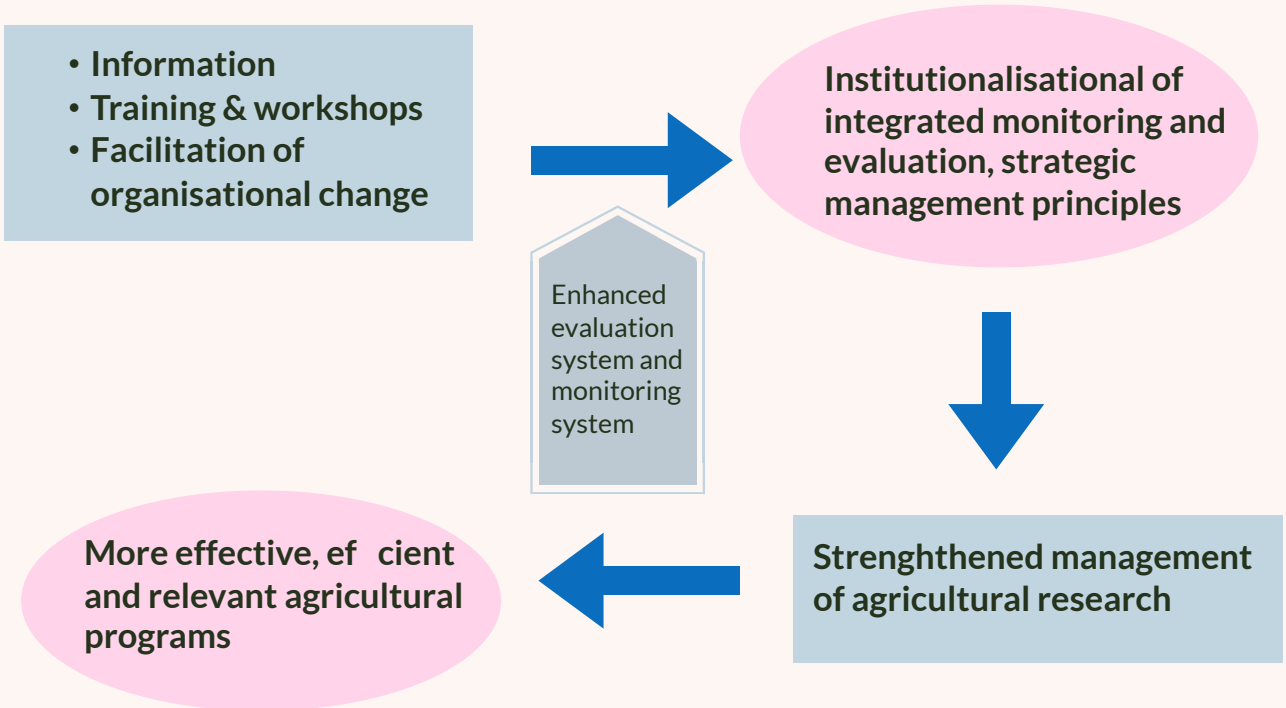
Due consideration is given to cultural appropriateness of, and equitable access to, Program benefits, giving special attention to the rights and interests of indigenous peoples and to the needs or concerns of vulnerable groups.

02 IMPLEMENTATION AGENCY

Watershed programs have been implemented by the Department of Land Resources (DoLR) at the national level and the State Watershed Department (SWD) at the state level since the 1980s.State‟s Agriculture Ministry, is responsible for overall program development, budget allocations, technical sanctions, support to districts in implementation, and monitoring.
The institutional framework for implementing the Program is defined by the national IWMP guidelines (2011) that are to be replaced by the Guidelines for New Generation Watershed Development Projects (2021) once these are finalized and approved. The prescribed guidelines are followed by most states while the actual institutional arrangements differ from state to state, defined by local needs and historic evolution of its institutions.

03 THEORY CHANGE

Theory of Change is a methodology for planning, participation, and evaluation that is used in government sectors to promote social change. Theory of Change defines long-term goals and then maps backward to identify necessary preconditions.



A Theory of Change for capacity in Agriculture Management

04 CAPACITY BUILDING

Capacity-building is the process of developing and strengthening the skills, abilities, processes, and resources that organizations and communities need to survive, adapt and thrive in a fast-changing world. Support of Capacity Building of ULBs should focus on these points.

1. Development of an improved human resources policy
2. Placement of critical human resources
3. Design and delivery of core training modules
4. Equipping and training staff in IT and communication systems

(i) development of an improved human resources policy for attracting and retaining adequate numbers of professionals, including better targeting of women professionals, with necessary skill sets at various levels;
(ii) placement of critical human resources at the state, district, block/sub-block levels, especially to fill gaps in the areas of hydrology, agriculture, institution building, social inclusion and gender;
(iii) design and delivery of core training modules on operationalizing women's consistent representation and decision-making in watershed committees, inclusion and social sustainability measures in watershed development at the state, district, block/subblock levels; and
(iv) equipping and training staff in IT and communication systems to improve planning and management.

Government Initiatives in the Agricultural Sector

Pradhan Mantri Kisan Samman Nidhi Yojna

Pradhan Mantri Kisan Maandhan Yojna

Pradhan Mantri Fasal Bima Yojna

Kisan Credit Card Scheme

Pashu Credit Card Scheme

Paramparagat Krishi Vikas Yojna

Pradhan Mantri Krishi Sinchai Yojna

National Agriculture Market

Dairy Entrepreneurship Development Schemes

National Mission For Sustainable Agriculture

Monitoring and Implementation for Agri-Water Management

STEP 01

SITUATIONAL ANALYSIS

- Stakeholders and Institutional Mapping
- Ganga water resources, allocation and use
- Understand farmer's perspective about Ganga water use and prospects of E-flows in Ganga from their perspective

STEP 02

ENVIRONMENTAL FLOWS ASSESSMENT

- E-Flows management at critical locations on Ganga, i.e,
  i) Downstream of Bhimgoda barrage
  ii) Downstream of Narora Barrage

STEP 03

TRADE OFFS ANALYSIS

Keeping in view i) the E-Flows requirements at identified locations and ii) overall water resources availability based on long-term averages; understand where (location) and when (month/season). Crop diversification for soil fertility.

STEP 04

MANAGEMENT SCENARIOS

a. Social
b. Technical
c. Institutional

Policy ecosystem for sustainable agriculture in India

Sustaining agricultural productivity depends on the quality and availability of natural resources like soil and water. Agricultural growth can be sustained by promoting conservation and sustainable use of these scarce natural resources through appropriate location specific measures. Indian agriculture remains predominantly rainfed covering about 60% of the country's net sown area and accounts for 40% of the total food production. Thus, conservation of natural resources in conjunction with the development of rainfed agriculture holds the key to meet demands for foodgrain in the country. Towards this end, National Mission for Sustainable Agriculture (NMSA) has been formulated for enhancing agricultural productivity especially in rainfed areas focusing on integrated farming, water use efficiency, soil health management, and synergizing resource conservation.

NMSA aims to promote sustainable agriculture through a series of adaptation measures focusing on ten key dimensions encompassing Indian agriculture namely; 'Improved crop seeds, livestock and fish cultures', 'Water Use Efficiency', 'Pest Management', 'Improved Farm Practices', 'Nutrient Management', 'Agricultural insurance', 'Credit support', 'Markets', 'Access to Information' and 'Livelihood diversification'.

NMSA Interventions

National Mission for Sustainable Agriculture has the following four (4) major programmes-

- **Rainfed Area Development (RAD):** RAD is an area-based strategy for the development and conservation of natural resources, as well as agricultural systems. This component has been formulated in a 'watershed plus framework,' i.e., to investigate the possible use of natural resources assets available by watershed development and soil conservation activities under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), National Watershed Development Project for Rainfed Areas (NWDPRA), River Valley Project & Flood Prone River (RVP&FPR), Rashtriya Krishi Vikas Yojana (RKVY), Integrated Watershed Management Programme (IWMP) etc. This component introduced an appropriate agriculture management system by combining sustainable agriculture components such as crops, horticulture, livestock, fisheries, and forestry with agro-based income-generating activities and value addition.

Furthermore. This also supported soil health card based nutrient management approaches, farmland development, resource conservation, and crop selection which is suitable with local agro-climatic conditions.

On Farm Water Management (OFWM): The goal of OFWM was to promote effective on-farm water management methods and equipment in order to improve water use efficiency. OFWM not only focuses on application efficiency but also emphasizes effective rainwater harvesting and management in conjunction with the RAD component. To conserve water on the farm itself, farm ponds may be dug using MGNREGA funds and earth moving heavy equipment (to the extent manual digging under MGNREGA is not feasible).

Soil Health Management (SHM): SHM promoted both location and crop-specific sustainable soil health management, such as residue management, organic farming practices through the creation and linking of soil fertility maps with macro-micro nutrient management, appropriate land use based on land capability, judicious fertilizer application, and soil erosion/degradation. This component will be implemented by the State Government, National Centre of Organic Farming (NCOF), Central Fertilizer Quality Control and Training Institute (CFQC&TI), and Soil and Land Use Survey of India (SLUSI).

Climate Change and Sustainable Agriculture: Monitoring, Modeling, and Networking (CCSAMMN): CCSAMMN provided creation and bidirectional (land/farmers to research/scientific establishments and vice versa) dissemination of climate change related information and knowledge by way of piloting climate change adaptation/mitigation research/model projects in the domain of climate smart sustainable management practices and integrated farming system suitable to local agro-climatic conditions.

NMCG Initiatives in Sustainable and Eco-Agriculture to Rejuvenate River Ganga

The National Mission for Clean Ganga (NMCG) has initiated a project for organic farming in the villages along Ganga right from its source in Gangotri in Uttarakhand till Gangasagar in West Bengal to curb pollution in its water.

SUSTAINABLE AGRICULTURE

- Integrated project for Medicinal Plantation – 10 Districts, 180 Gram Panchayats, 60 clusters, 2500 Ha area for Rs. 35.46 Cr. in Uttar Pradesh
- NMPB to develop 800 Ha corridor of Medicinal Plantation along Ganga
- Special programme of organic farming on 5 Kms stretch along both sides of Ganga
- Rudraksha Plantation in Uttarakhand with INTACH
- Demand Side Management of water in Ganga Basin to increase Water Use Efficiency

AFFORESTATION

- Afforestation along Ganga on the scientific plan of FRI for Natural urban&Agri-riverscape

Recommended Actions

The main recommendations for speedy transition to sustainable agriculture in NRGB are :

Promotion of conservation agriculture practices

Aimed at preventing soil erosion and maintaining soil fertility, by means of “no till” or “minimum tillage” of soils, permanent organic soil cover, and crop diversification, especially in degrading agricultural lands.

Promotion of organic farming

Promotion of organic farming where feasible to reduce damage to soil health and human health by chemical inputs.

Adoption of resource conservation practices

Adoption of resource conservation practices in rice cultivation including System of Rice Intensification and Urea Deep Placement techniques.

Buililding adaptability & exibility

Building adaptability and flexibility in agricultural practices of NRGB through assimilation of new sciences, knowledge exchanges with the outer world, field-level experimentation, and regeneration of traditional knowledge systems.

Resource management

Regional (landscape) level resource management through agroforestry, crop-livestock-fishery-grassland combinations, water harvesting, and buffering of watercourses and water bodies by forests and natural vegetation.

Promotion of resource conservation technologies

Promotion of resource conservation technologies like Laser Land Levelling, Micro-irrigation Systems, Raised Bed Planting, Urea/ Fertilizer Deep Placement, Bio-fortified seeds, etc.

Selection of appropiate policy measures

Selection of appropriate policy measures to implement the above goals, keeping in view the existing social, cultural, economic and institutional strengths and constraints.

Way Forward

Deploying water-efficient technologies:

The water holding capacity of soil can be enhanced by implem--enting a number of cost effective practices and technologies. Furrow irrigation, land-levelling practices and trash mulching are some of the suggested interventions.

Understanding groundwater:

It has to be recognized that the water basin consists of both surface and groundwater. Thus, the use of both surface and groundwater to meet increasing demands should be prioritized.

Involving the Community:

It is critical to undertake capacity building activities for the communities located in the basin. These activities should focus on instilling a sense of responsibility among the communities. There should also be a focus on linking local stakeholders with relevant government officials.

Establishing a common platform for stakeholders:

There are several stakeholders in the Ganga basin, each with its own perceptions and interests. As a result, many interventions have a narrow focus on a particular group of stakeholders, making it difficult to bring about significant changes at the basin level. All stakeholders must be brought together on a common platform so that challenges can be addressed with a long-term perspective.

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