Best Practices of Ground Water Harvesting in Different Parts of India

(Government Research Institutions Initiatives)

Disclaimer: All information in this weblink is based on the information/data gathered from different water harvesting works carried out at various places by different authorities including corporate bodies/NGOs etc. MoWR, RD & GR is not responsible for any errors, mistakes, omissions which might have inadvertently crept in during compilation.

R1	**Kerala**
Title/ Name of work undertaken	Mulching - Mailadumpara - Kerala
Location	Mailadumpara
Organisation/NGO/Persons responsible to undertake the work	Indian Cardamom Research Institute (ICRI)
Description	Any material, usually organic, that is spread on the ground to protect the soil and the roots of plants from the effects of soil crusting, erosion, or freezing is known as a Mulch. A mulch may be made of materials such as straw, sawdust, grass clippings, peat moss, leaves, or paper etc. For large areas under cultivation a tilled layer of soil serves the purpose of a mulch but intensive cultivation of cardamom, ignoring the traditional cultural practices, has resulted in repeated losses. The Indian Cardamom Research Institute (ICRI) studied the soil fertility on a farm and found that the organic carbon/humus content is higher in the farms where this technique is practiced compared to neighbouring plantation. The soil bulk density is also very low. Mulching reduced the acidity of the soil and increased the soil moisture.
Outcome	The studied showed significant achievements like high humus content on farm. It was observed that mulching resulted in several advantages- the plant growth is healthy and the damage due to thrips on capsules and stem borer is negligible; the height of the 17 year old plant is 15 – 20 feet tall and there are about 100 tillers in each clump. Usually cardamom fields are replanted with new suckers in 8-10 years of cultivation. But mulching helped in retaining the plantation successfully for 17 years with compact clumps. There is no need for weeding as the soil is not exposed and self- shade of cardamom clumps discourages weed growth. Source: SELECTED BEST PRACTICES IN WATER MANAGEMENT by Niti Aayog, August 2017
Photographs	

R2	NIH Roorkee
Title/ Name of work undertaken	**Water Conservation through Operation of Reservoirs Using Rule Curves** Storage reservoirs are operated to meet various demands, such as domestic, industrial, environmental flow, irrigation, hydropower etc. Rule curves are followed for operation of reservoirs so that all the demands are met in the best possible manner. In reservoir that aim to control floods, empty space needs to be kept to absorb the likely floods, especially during the monsoon months
Organisation/NGO/Persons responsible to undertake the work	National Institute of Hydrology, Roorkee
Description	software – *NIH_ReSyP* (NIH_Reservoir Systems Package)
Outcome	Some of the important analyses that can be carried out with the software include capacity computation, storage-yield analysis, rule curve derivation, reservoir routing, hydropower analysis, inflow estimation, reservoir sedimentation, and operation of a multipurpose multi-reservoir system for conservation and flood control etc. On-screen forms have been developed for easy preparation of data files. *NIH_ReSyP* software has been used to develop operation policy for many reservoirs. It was applied to study the operation of reservoirs in the Ken-Betwa and Mahanadi-Godavari river interlinking scheme. Training courses have been organized to explain the features of the software to the users
Photographs	

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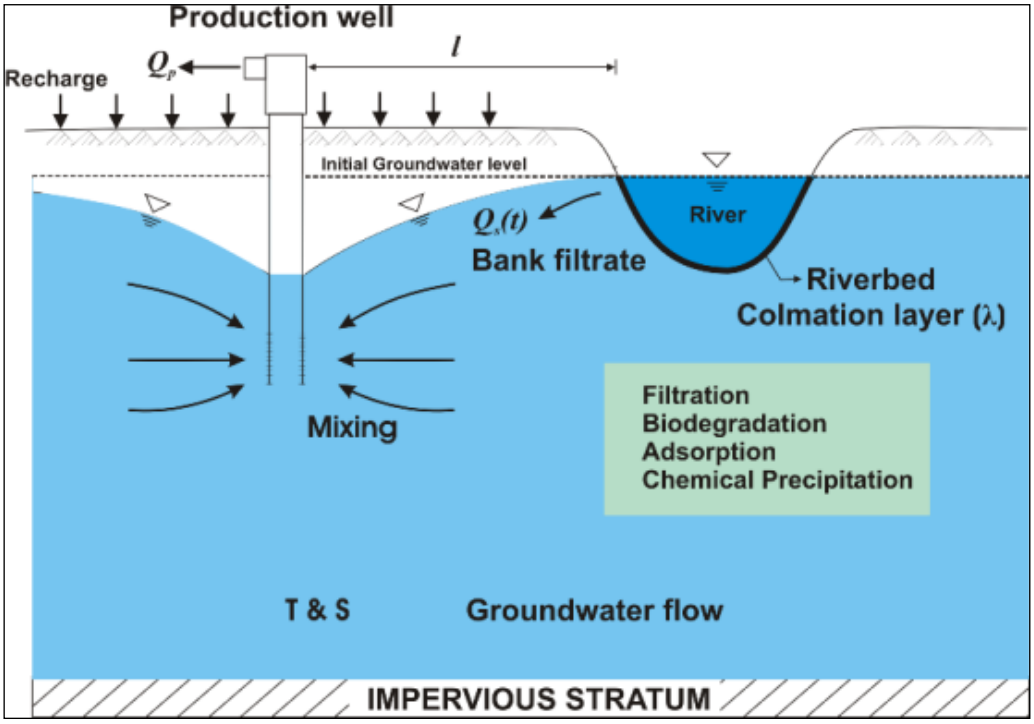
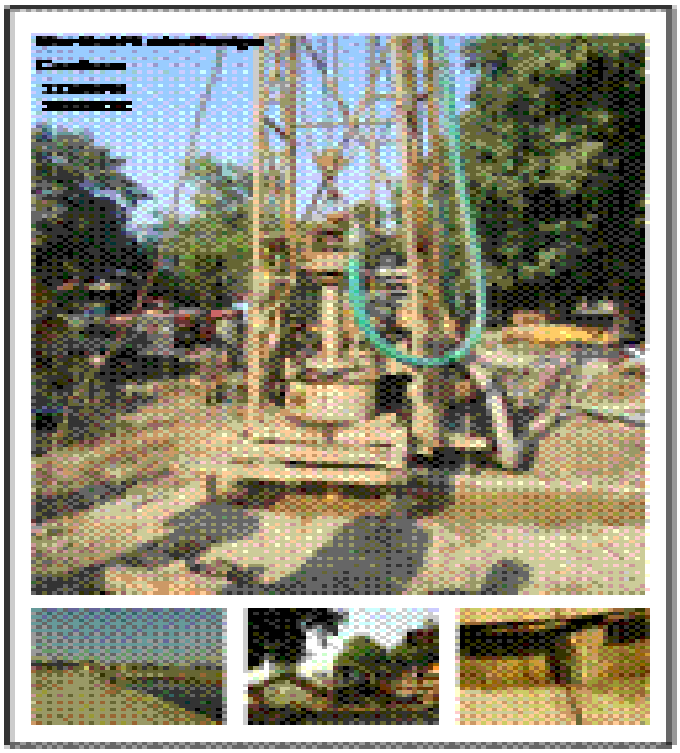
NIH_Reservoir Systems Package
NIH_ReSyP
Inflow Estimation
Reservoir Sedimentation
Capacity Computation
Spillway Regulation
HydroPower Analysis
Flood Operation
Reservoir Routing
Conservation Operation
Developed By :
Water Resources Systems Division
NATIONAL INSTITUTE OF HYDROLOGY
Jalvigyan Bhawan
Roorkee -247667 (Uttaranchal)
India
Start ReSyP
Quit ReSyP

R3	NIH Roorkee
Title/ Name of work undertaken	Riverbank Filtration(RBF) for Sustainable Drinking Water Supply
Organisation/NGO/Persons responsible to undertake the work	National Institute of Hydrology, Roorkee
Description	RBF is a process by which surface water from river, channel and lake is induced by pumping from nearby production wells to flow through the natural porous media before mixing with groundwater and abstraction for direct use or further treatment
Outcome	NIH in association with line State government departments has initiated a few pilot demonstration schemes in different hydrogeological settings, namely, at Mathura and Agra along Yamuna river, in Ara along Ganga river, and Visakhapatnam along Varaha river. In Mathura and Agra area, exploratory drilling and installation of tube wells has been completed in collaboration with U.P. Jal Nigam Sampling and water quality analysis has shown effectiveness of the sites for production of bank filtrate water.
	Photographs

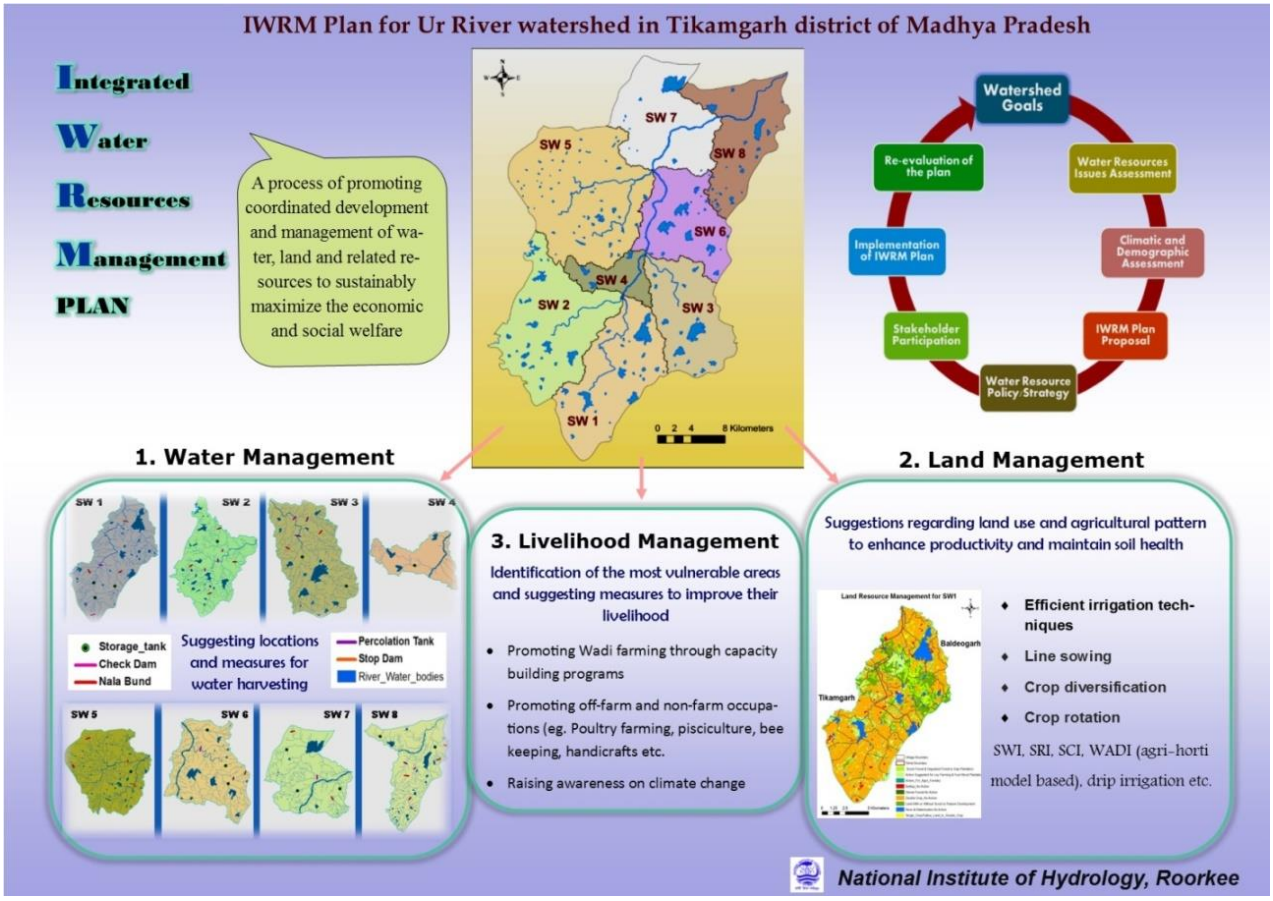




RBF schemes in Agra and Mathura

R4	NIH Roorkee
Title/ Name of work undertaken	Development of Local-IWRM Plan at Watershed Scale for District Level Planning
Location	Ur River Watershed in the Tikamgarh district of Madhya Pradesh
Organisation/NGO/Persons responsible to undertake the work	National Institute of Hydrology, Roorkee
Description	An Integrated Water Resources Management (IWRM) Plan considers effective utilization of land, water and other available natural resources, linked to the vulnerabilities and livelihood opportunities in the geographical area. IWRM Plan at the local level can be successful only if it is prepared in sync with the District Irrigation Plan (DIP) and other development plans At the district level, IWRM addresses almost the complete supply chain of water management (from rainfall inputs to water consumption by different users to wastewater generation and its subsequent handling) and, most importantly, builds on the existing institutions
Outcome	The concepts of "Local" IWRM planning were applied for developing an L-IWRM Plan for the Ur River Watershed in the Tikamgarh district of Madhya Pradesh. The Plan is designed in such a way that it provides useful inputs to the DIP of the Government, both in terms of water supply and demand management synergized with the land management and livelihood improvement. While developing the plan, identification of the needs and priorities of various water users, as well as the threats in terms of land degradation, droughts, contamination of water sources, were deliberated with the local stakeholders during consultations at various stages. The L-IWRM Plan for Ur river watershed provides suggestions on the activities under the following three themes: The best sites for the water harvesting structures, including farm ponds, check dams, percolation tanks etc. were identified based. As part of the technology demonstration, few rooftop water harvesting structures were installed in government schools of selected villages to augment the local groundwater to ensure water availability in hand pumps even during the summer months. Under the land management component, planning is done to create agri-based

	livelihood opportunities, increase in productivity, maintain soil health etc. Suggestions pertaining to the major crops that are grown in the area included System of Crop Intensification, drip irrigation for high value vegetables and fruit crops, Wadi model for fruit and vegetable crops, crop rotations, line sowing, and crop diversification considering the local soil conditions, nutrition value of crops, crop diversification potential, etc.
Photographs	



R5	Uttarakhand
Title/ Name of work undertaken	**Rejuvenation of a Village Pond using Constructed Wetland Technology**
Location	Ibrahimpur-Masahi revenue village in Bhagwanpur Tehsil of Haridwar district
Organisation/NGO/Persons responsible to undertake the work	National Institute of Hydrology, Roorkee
Description	ıtion technology called "Constructed Wetland (CW)". CW is a Natural Wastewater Treatment system. After consultation with the local Gram Panchayat (GP), renovation process started with de-weeding and de-silting of the pond. The removed sludge was used by the farmers as manure. The pond bunds were strengthened, an animal ramp was provided, and fencing was erected to prevent unauthorized entry. A 200 KLD capacity CW was constructed in one corner of the pond, with a bar screen to trap the large solid wastes and a series of grit chambers for settlement of dissolved impurities. Beds of pebbles and brick-bats were made and plants like *canna indica* and reed grass were planted. The combined action of pebbles, brick-bats and plants treats the incoming wastewater
Outcome	After rejuvenation, through the constructed wetland, the pond has become a beautiful sight. The quality of water in the pond, incoming wastewater, and groundwater levels in the hand pumps surrounding the pond was monitored before and after the rejuvenation. As a result of the treatment, the vital water quality parameters have improved: Dissolved Oxygen (0.2 to 5.5mg/l), EC (1619 to 1108mS/cm), alkalinity (578 to 276mg/l), hardness (452 to 323mg/l) leading to an improved trophic status of the pond. The pond water has now become fit for fishery, which shall be a good source of income for the GP. The other benefits include improvement in the local groundwater level (by up to 1.0m) and in the quality of groundwater. Also, the renovated pond with improved aesthetics attracts visitors for morning/evening walk. As a by-product, the size of the pond has increased improved. About 13% enhancement in the area and 58% in volume of the pond was achieved. The maximum depth of pond has increased from 2.36m to 3.29m.
Photographs	

Constructed wetland

Pond after Rejuvenation

R6	Assam
Title/ Name of work undertaken	**Furrow and Raised bed system for water Management**
Location	NERIWALM, Tezpur and different locations in NE India
Organisation/NGO/Persons responsible to undertake the work	Line Departments and farmers
Description	Heavy rain causes water logging and makes growing of crop difficult in Kharif season in North East India. Through this technology crop is grown in raised bed that facilitates easy drainage during Kharif and the furrows serves as irrigation channel during Rabi. North Eastern Region Institute of Water and Land Management has demonstrated this system for capacity building of public.
Outcome	Makes cultivation other than paddy possible in hitherto water logged areas.
Photograph	

R7	Assam
Title/ Name of work undertaken	Soil Moisture Conservation Using mulching
Location	Tezpur and different locations in NE India.
Organisation/NGO/Persons responsible to undertake the work	NERIWALM,-Line Departments and farmers
Description	In existing horticulture based cropping system, plants suffer from moisture stress during Rabi and have to compete with weeds during Kharif in the entire crop across different existing framing system and land holding. Soil loss in slopping land due to water erosion. Plastic mulching results in reduction in irrigation requirement by upto 40%. There is increased yield due to moisture conservation in Rabi and weed control in Kharif irrespective of crop, and agro ecological situation. It also reduces soil loss in slopping land. North Eastern Region Institute of Water and Land Management has demonstrated this practice for capacity building of public.
Outcome	Increase in farmer's income from Rs. 30000-65000 per ha(depending on crop) to upto Rs. 100000 through lower cost of weeding, lesser numbers of irrigation and due to better plant growth from of higher soil temperature during winter.
Photographs	

R8	Assam
Title/ Name of work undertaken	Integration of Rainwater harvesting and Drip Irrigation using Solar pump
Location	NERIWALM, Tezpur and different locations in NE India
Organisation/NGO/Persons responsible to undertake the work	Line Departments and NGO
Description	Traditional homestead agro forestry in North East India were mainly rainfed with low productivity. Flood Irrigation are sometimes applied with wastage of water. Through this intervention rainfall harvested in lined pond is utilized through drip Irrigation using a solar pump for providing lift saving irrigation to high value horticultural crop. North Eastern Region Institute of Water and Land Management has demonstrated this system for capacity building of public.
Outcome	Reduction in irrigation cost by 30% and water saving up to 50%.
Photographs	

R9	Assam
Title/ Name of work undertaken	Increasing water productivity in Hydel Dam Project through better livelihood options
Location	Khuga, Chrichandpur, Manipur.
Organisation/NGO/Persons responsible to undertake the work	NERIWALM, Tezpur, North East India Tribal Development Foundation(NEITDF) Chrichandpur, Manipur.
Description	There are many hydel projects in NE India. The water stored in the Dams of these projects offers immense potential for providing better livelihood options to the people in the nearby areas. In Khuga dam project cage fishery and high value horticulture farming being promoted. North Eastern Region Institute of Water and Land Management has demonstrated this practice for capacity building of public.
Outcome	Increase in nutritional availability in remote border area and better livelihood options.
Photographs	

Cage fishery at Khuga hydel Dam site (Churchandpur, Manipur)

R10	**Gujarat**
Title/ Name of work undertaken	Water conservation and artificial recharge to ground water for Coastal Salinity Prevention and Mitigation in Mandvi and Mundra Taluka of Kachchh District, Gujarat.
Location	12 Villages in Mundra Taluka 1.Moti Bhujpur 2.Nani Bhujpur 3.Navinal 4.Zarapara 5.Dhrab 6.Borana 7.Nana Kapaya 8.Samagogha 9.Siracha 10.Pratapur. 11.Mota Kandagara 12.Moti Khakhar 8 Villages in Mandvi Taluka 1.Gundiyali 2.Nana Bhadiya 3.Tragadi 4.Nani Khakhar 5.Bag 6. Bidada 7.Pipri and 8. Mota Bhadiya
Organisation/NGO/Persons responsible to undertake the work	Vivekanand Research & Training Institute (VRTI),Mandvi, in partnership with Sir Ratan Tata Trust (SRTT), Mumbai
Description	32 check dam, 38 percolation tanks with recharge wells, 1 storage tank
Outcome	The structures constructed for soil moisture conservation and water harvesting created 50,87,600 cubic meters storage capacity. Total ground water recharge from 2005 to 2010 is estimated at 2,99,71,680 cubic meters. Trench irrigation in 8,255 horticultural plants and water saving is 33,000 M^3/ year. Productivity of plants is also increased by 12%. 255 Ha saline soil reclaimed and made it more productive. Drinking water facilities created in 10 Villages to provide safe drinking water to 23,407 people. For water saving : i)Drip irrigation system installed in 90 Ha directly under the project and 142 Ha through motivation and collaboration with Gujarat Green Revolution Company (GGRC) and total water saving is 27,14,400 M^3. ii)Recycled plastic pipe installed in place of open flood channel for 63,710 meters and total water saving is around 82,823 M^3/ year (Loss of seepage, Evaporation etc.)
Photographs	

R11	**Rajasthan**	
Title/ Name of work undertaken	Building resilience to climate change: A watershed approach	
Location	Anjeni watershed , Udaipur district	
Organization/NGO/Persons responsible to undertake the work	Indo-German Watershed Development Programme (IGWDP) by National Bank for Agriculture and Rural Development (NABARD)	
Description	Soil moisture conservation activities: Other than conventional practices, few SMC activities were modified looking at the projections of climate. Interventions like increase cross section of trenches (staggered contour trenches) – by calculating projected rainfall intensity, rainy days etc, Gradonis – Narrow base terrace on small hills, Loose boulder check dams, Grass seeding on Field Bund, fodder tree seedingin barren pasture land by making small balls of organic matter and mud, Micro - basin (Thawla) on existing root stock/plantsetc.	
Outcome	• Gross cropped area - 173 ha • Net cropped area - 82 ha • Irrigated area - 67 ha.	• Gross cropped area - 251 ha, a 10% increase • Net cropped area - 105 ha, a 28% increase. • Irrigated area - 74 ha, a 10% increase
	• Average Groundwater level - 10m • Open wells - 193 & tube wells – 3 • Maize cultivation – 82 ha • Wheat cultivation - 60 ha • Soyabean cultivation – 0 ha • There was no practice of mixed and inter cropping • Wastelands were in a highly degraded condition is no or little	• Groundwater levels have increased by 1.2 m. • New open wells – 223 & tube wells – 20 (for drinking purpose) • Maize cultivation - 98 ha, an increase of 20% • Wheat cultivation - 66 ha, a 10% increase • Soyabean cultivation - 6 ha. • Mixed cropping and intercropping in general practice • Increased vegetative cover with Pasture

	vegetative cover	production of 65 MT fodder which decreased fodder deficit by 15 – 20 %
Photographs		

R12	INDIA
Title/ Name of work undertaken	Water Campaign at various locations
Location	Delhi
Organisation/NGO/Persons responsible to undertake the work	NABARD
Description	NABARD, on the occasion of World Water Day (22-3-2017) launched a major Water Campaign to cover around 1,00,000 villages in vulnerable/water stressed areas where the ground water is over exploited. Dr. Harsh Kumar Bhanwala, Chairman, NABARD launched the campaign in the presence of Senior Officials from State Governments, Banks, NGOs and other stakeholders across the country who joined the launching ceremony through video conference. Major highlights of the campaign include community participation in adopting efficient irrigation methods, ground water recharge and appropriate crop pattern for enhancing agricultural productivity. NABARD would identify Village Volunteers (Krishi Jaldoots) to run the campaign for a localized and more effective approach. These volunteers will increase awareness about various methods of rain water harvesting, efficient water use, groundwater recharge and integrated farming systems. The activities will be coordinated by NABARD's Regional Offices jointly with representatives from the State Governments, State Level Bankers' Committee, Partner NGOs, Agricultural Universities, Water Experts and Farmers' Club Volunteers, among others.
Outcome	With increased awareness, it is expected that the volunteers will be able to mobilize people to adopt water conservation practices and improve water availability. Source : www.nabard.org
	Photographs

R13	Bihar
Title/ Name of work undertaken	Water harvesting through farmer clubs at Purulia district in Bihar
Location	Purulia district
Organisation/NGO/Persons responsible to undertake the work	SAFE with funds from NABARD
Description	Purulia gets ample rain but the district has a very undulating terrain due to this nearly 50% of this water is wasted in run off making the district prone to droughts. But things started changing in some portions of the district over the past 3 years. A Kolkata-based NGO SAFE with funds from NABARD has taken up rain water harvesting through farmers club. At present there are more than 70 such farmers clubs in 5 blocks of the district.
Outcome	Along with rain water harvesting other innovative measures such as 'collective farming', wherein farmers harvest a single crop over several acres of land instead of growing various crops in their fragmented individual farmlands and 'water budgeting' in which the members of the club decide on what crops to grow according to availability of rain leaving some water for daily use and growing fishes have also helped the farmers. With yields increasing more farmers are now showing interest to form farmers clubs. Source : https://www.hindustantimes.com/india-news/collective-farming-water-budgeting-purulia-s-weapons-against-drought/story-jbttY76cUHA3QLIoNSrJzH.html Images have been taken from above web page
Photographs