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Watershed Development and Management Saturating Whole Basins Areas:-A Prerequisite of Linking Indian Rivers

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Abstract— *India has quite uneven distribution of fresh water in time and space and to meet the food requirements of its growing population, transfer of all excess water to deficient areas is a must. It ultimately requires to link Indian rivers, but not the way it is planned. In addition to irrigation, our country initiated watershed development programs and planning of Inter Linking Rivers (ILR) in 1980's. These water management programs have been running in sectoral ways having adverse effects towards their sustainability and maintenance of ecosystems. We have experienced water logging, soil salinity, lowering of ground water level and deterioration of water quality due to irrigation development. Watershed development programs have patchy and piecemeal works in only selected watersheds of rainfed areas and lack integration, co-ordination and people's participatation resulting in very little impact on basin level. Inter Linking of Rivers project is still under feasibility study stage indicating inter-state disputes, high costs, low sustainability and efficiency due to high sedimentation and adverse effects on wet lands and biodiversity.*

All the river basin areas have to be developed and managed on the basis of gullies/nalahs' watersheds irrespective of rainfed/irrigated cropped lands, forests, wastelands and residential/ commercial/I ndustrial lands following actual integrated watershed development and management principles with bottoms-up approach. It will include micro level management of rainwater (green water), available surface and ground water (blue waters) and polluted water (grey water), conjunctively. It will give a fair chance to all land owners, villages/towns, districts and states to conserve and manage their shares of water. It will also result in regulated(low flood flow and more base flow) and clean (low sediment and pollution) flows in the rivers ultimately reducing inter-state disputes, structures' costs and increasing life of reservoirs. The clean rivers water can easily be transferred to water deficit areas through ILR projects leaving considerable amount of flow in the rivers at the end for maintaining balanced eco-system.

1. INTRODUCTION

India receives good precipitation and snowmelt amounting about 400 M ha m annually. In addition to this, about 20 M ha m river flows comes from neighboring countries. It is enough to grow two good crops in the entire cultivated areas of our country. But availability of fresh water is quite erratic in time and space causing floods, droughts and soil erosion. About one third of our country's areas in northern regions receives two third of the available water while the rest two third in central and southern regions (peninsular) receives only one third of available water. North and north eastern regions comprising of UP, Bihar, WB, Odisha and Assam are mostly flood prone where as southern regions comprising MP, Rajasthan, Gujrat, AP, Maharashtra, Tamil Nadu and Karnataka are drought prone.

Global warming may increase flow of our snow-fed rivers especially Ganga and Brahmputra up to some extent during current century due to glacier melting and some of our cultivated areas near coasts and islands may come under water. It is also speculated that China may divert upper catchment water before reaching to Indian Himalayan rivers to its country, reducing flow of Ganga and Brahmputra by more than 20 M ha m.

Though sectoral irrigation development projects in the past have increased our food production significantly yet we cannot go now in such sectoral way of irrigation development projects because of their adverse effects like water logging, salinity, lowering ground water table, displacement of people, silting of reservoirs and uneven water distribution. Moreover all good sites of major irrigation projects are built up and available sites are going to face challenging and difficult problems.

Table 1: Irrigation development and food grain production

Years	Five Year Plan	Gross Irrigated Area (Mha m)	Food grain Production (Mt)
1950-55	I	22.5	50
2007-12	XI	90	259

Source: Mehra, Pooja and H.N.Verma, 2015

There is a lot of wastage of irrigation water through conveyance and application systems. The efficiency of our irrigation systems is very low, canal 38% and ground water

wells 60%. In many areas water is available to users at no cost or at very heavily subsidized price. Thus, neither water managers nor users have incentives to conserve water, so water is over used and wasted instead of being treated as a scarce resource. The answer is adequate pricing of water reflecting its true cost. Once it is adequately priced, people will conserve it. There is scope to increase irrigation systems' efficiency by 10-15% which means more than 10 % increase in irrigation command areas with the existing available irrigation water resources.

Effective conjunctive use of rainwater, surface water and ground water is also ignored in almost all the irrigated commands. Multiple use of irrigation water, particularly for fish cultivation, is not followed. Unfortunately, lot of water requiring crop like rice has maximum area under irrigation,i.e.,24.4 M ha m (53% of total rice area) covering more than 65% of the total irrigated area, which should be shifted to pulses and oil seed production.

There is a lot of improvement in rainfed farming and rainfed crops' yields have increased significantly through adoption of improved rainfed farming technology. But there are still many problems in rainfed areas related to soil erosion, moisture stress and crop failure.

In view of above problems related to irrigation development and rainfed farming our country initiated watershed development projects and inter linking of rivers project during 1980s.

2. WEAK POINTS OF WATERSHED DEVELOPMENT PROGRAMS

During 1980s, initially Model Watersheds were developed in few states and after that National Watershed Development Project for Rainfed Areas (NWDPRA) and Integrated Watershed Development Project (IWDP) were started in almost all the states. The lessons learnt from poor responses of the earlier projects like Soil Conservation in the Catchment of River Valley Projects, Drought Prone Area Program, Desert Development Program and Model Watershed Development Project were incorporated in NWDPRA & IWDP projects for holistic development of few selected rainfed watersheds with integrated approach. A common guidelines prepared by different ministries like Ministry of Agriculture, Ministry of Rural Development and Ministry of Environment & Forest, called "*Varsa*" and lateron "*Hariyali*" were applied to develop rainfed watersheds during 1990s & first decade of the current century. A new common guidelines developed by the Department of Land Resources, Ministry of Rural Development in 2008 & revised in 2011 are now applied in almost all the states (Anonymous,2012). Though these projects were designed to develop watersheds in integrated way but these projects are still lacking actual integration & people's participation in fields and thus most of the works have been going on sectoral way (Verma, 1998). Certainly, there are some improvements in these programs but they are not going to fulfill the intended objectives. The weak points observed in these watershed development projects are as follow:

i) Random selection of very few rainfed watersheds in a river basin
ii) Piece meal & patchy works according to available budget iii) Lacks of real integration & peoples participation iv) Common guidelines for works & budgets (not according to individual watershed requirements)
v) Poor adoption of technology after withdrawal of the projects
vi) Irrigated command areas are ignored in the watersheds for rainwater management vii) Non application of perfect hydrological principles at watershed/basin level

3. STATUS OF INTER LINKING RIVERS PROJECT

During seventies two eyes opener proposals of inter-basin water transfer, i.e., 1) Dr.K.L.Rao's National Water Grid Scheme (1972) and ii) Capton Dastur's "Garland Canal Scheme (1977) were not found viable and thus not accepted and the Ministry of Water Resource formulated a National Perspective Plan in 1980 for inter-basin transfer of water from surplus basins to deficit basins. The national perspective plan of ILR has 30 river links (14 in Himalayan component and 16 in peninsular component) and many storage/terminal reservoirs. It is estimated that ILR will generate 34 M kw electricity and will irrigate 35 M ha additional area (25 M ha through surface irrigation system and 10 M ha through ground water based systems) in addition to controlling floods. The total estimated cost of ILR project was Rs.5,60,000 Crores. When the supreme court asked the government in 2002 to expedite the ILR work and complete the project within 10 years (up to 2012), the central government set up a task force in December 2002 to study feasibility of ILR and to provide guidance to the government. The task force on ILR studied the project in depth and conducted many discussions, seminars and workshops on inter linking rivers and the results indicated more inter-state disputes, too high cost, low sustainability, low efficiency, high sedimentation of reservoir resulting less effective life and adverse effects on wet lands and biodiversity. The National Water Development Agency (NWDA) setup in 1982 was given responsibility to study the feasibility of the river links and to prepare Detailed Project Reports(DPR) of interstates and intrastate links. The NWDA has so far completed feasibility reports of 14 peninsular links and two Himalayan links. The field surveys and investigations regarding remaining himalayan links are under progress (Anonymous 2015). So far the DPR's of Ken-Batwa link projects Phase I & II have been prepared and submitted to the governments of UP and MP. The DPR's for priority link of Damanganga - Pinjal has been completed in March 2014 and sent to the Government of Maharashtra and Gujarat and the DPR of Par-Tapi-Narmada link project is under progress and scheduled to be completed by March 2015 (Anonymous 2015).

The ILR Projects implementation involves many steps like preparation of feasibility report, negotiation and consensus among concerned states, agreement with neighboring countries if link projects involve other countries, preparation of DPR's of the projects, clearance by different ministries, techno economic clearance by Technical Advisory Committee, MoWR; Investment clearance by Planning Commission and funding of the project. The Hon'able Supreme Court in the matter of an old writ petition has directed that an appropriate body should be created to plan, construct and implement the inter linking of rivers program for the benefit of nation as a whole and as per the judgment a special committee for inter linking of rivers has been constituted by Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD and GR) vide Gazette notification dated 23.09.2014. Two meetings of the special committee have been already conducted so far.

4. WATERSHED DEVELOPMENT: A PRE-REQUISITE OF ILR PROJECT

Review of ILR project as mentioned above indicates very slow progress because there are many problems in finalization & implementation of the project. Under present situations of the rivers' basins & rivers' flows it's very difficult to reach up to implementation stage in cases of many important links. If all the rivers basins are treated & manage following watershed development & management principles most of the problems related to the finalization & implementation of the project will be solved (Mehra et al, 2015). The steps suggested for development of rivers basins & rainwater management are given below:

4.1. Steps to develop rivers basins

i) First select all outer watersheds near ridge line of the basin for their development & management and then come down to middle then lower watersheds.
ii) In a watershed, development & management works should be started firs with first order streams 'sub-watershed wise and then we should start working for second & then third order streams.
iii) Entire lands (rained cropped, irrigated cropped, forest, horticulture, waste), gullies/nallas of the sub-watersheds should be developed & managed with improved technology.

4.2. Bottom-up steps of rain water management

i) Maximum rainwater should be conserved where it falls in the individual fields using in-situ rainwater conservation technology.
ii) Excess runoff should be harvested in the lower parts of the fields through intra-plot water harvesting techniques for rice/fish/irrigation uses.
iii) If still excess runoff is there, it should be stored in tanks/reservoirs along gullies/nallas/rivulets for fish production /irrigation, first at village level, then block/district level and then state level.
iv) Over irrigation and wastage of water should be avoided using piped conveyance & micro-irrigation systems (drips & sprinklers)

Above steps, having bottom-up approach (individual farmers to rivers) will give chance of maximum water conservation by farmers, villages, blocks/districts and states reducing intra-state & inter-states disputes. The rivulets/rivers flow will be regulated reducing peak/flood flows during monsoon and increasing base flows during lean period reducing height/cost of structures, river bank erosion and meandering of rivers. Sediment flow in the rivers will also be reduced increasing life of reservoirs. Dredging and straightening of rivers and developing waste lands of river sides will also be possible. Clean excess water can easily be diverted to other water deficit basins and enough water can be left at the end of rivers for balanced ecosystem. It proves that for the complete success of the ILR project, watershed development saturating whole basins of the rivers is a pre-requisite.

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