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Traditional rain water harvesting techniques and its applicability

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Watershed management in India has been defined as rational utilization of land and water, and water resources for optimurn, and sustained production with minimum hazards to natural resources. It is essentially related to soil and water conservation. Hence, it means proper land use, protecting land from all forms of degradations, building and maintaining soil fertility, conserving water for agricultural use, proper management of water for drainage, flood protection, sediment reduction and increasing the productivity of land use. A major dimension of water shed is the people whom the integrated development is excepted benefit.

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Though India is one of the wettest region in the world with an annual average rainfall of 117 cubic m of rain over the plains water scarcity contains to hunt various parts in India with varying intensify. As it is, India's rainfall is characterized by its diversity, both by the geographical division and season of the year. There is also large variation in each geographical region from one year to another, resulting in flood in some areas and droughts in others. According to an assessment by UNDP, India is among the countries suffering desertification even as water erosion is extensive and severe throughout the Himalayas. On the other hand, the The Energy Research Institute (TERI) says that India's per capital availability of water would touch 496 cubic m by the year 2005. The North-region is characterized with excessive rainfall and high floods during monsoon. Shifting cultivation, cultivation into marginal slopes, over cutting of forests, improper construction activities, massive soil erosion, pollution of agricultural land and water causes the damages of biodiversity in the region. Whenever, there are massive floods in summer season, there is shortage of even water in winter in some parts of the region. It seems there is lack of proper management of water resources in the region. In a high floods state like Assam large and large acres of land lying vacant in winter during to lack of irrigation facilities. If proper and effective water management techniques are evolved sustainable agriculture can be practiced in all dry land of the state which can transformed the state into a richest state in the country. Much of the enormous water bodies in the state are still remained unutilized due to the absence of proper water resource planning.

In Nagaland, despite having a sufficient rain in summer, there is acute shortage of drinking water in the state. Collecting rain winter from the roof is practiced widely is the state. However, there is on proper storage system/facilities are maintained. Moreover, *jhum* cultivation and cutting down or forest is widely practiced in the state which causes ecological imbalances in the. The same is the case of the other hilly states of the region Hence, massive awareness and efficient planning for rain water harvesting, conservation and water shed management is the necessity of the region. The traditional water harvesting system in the region can been modified using appropriate techniques the techniques. The techniques like *Johad, ahar* as described above can also be used in some parts of the region examining the local condition. Moreover, appropriate water resource planning need to be executed for proper use of the huge water bodies of the region. Water shed management in India has been defined as rational utilization of land and water and water resources for optimurn and sustained production with minimum hazards to natural resources. It is essentially related to soil and water conservation. Hence, it means proper land use, protecting land from all forms of degradations, building and maintaining soil fertility, conserving water for agricultural use, proper management of water for drainage, flood protection, sediment reduction and

increasing the productivity of land use. A major dimension of water shed is the people whom the integrated development is excepted benefit.

Though India is one of the wettest regions in the world with an annual average rain fall of 117 cubic m of rain over the plains water scarcity contains to hunt various parts in India with varying intensity. India has 16% of the total population of the world. But the country has only 4% of the water resources present on the earth. Further, it has only 2.5%of the area out of total geographical area of the world. According to an estimate of the Central Ground Water Board, if we continue to exploit our ground water sources indiscriminately, then in the next 20 yrs, 15 states of the country may face acute shortage of underground water. Thus, managing water supplies is one of the critical issues facing humanity and a real challenge of this century. The population of India is expected to stabilize around 1640 m by the year 2050. As a result gross per capita water availability will decline from 1820 cubic m per annum in the year 2001, to as low as 1140m^3 in 2050. Total water requirement of the country for various activities around the year 2050 has been assessed to 1450 km^3/yr. This is significantly more than the current estimate of utilizable water resource potential (1,122 km^3/yr) through conventional development strategies. Therefore, when compared with the availability of 500 km^3/yr at present, the water availability around 2050 needs to be trebled.

As it is, India's rainfall is characterized by its diversity, both by the geographical division and season of the year. There is also large variation in each geographical region from one year to another, resulting in flood in some areas and droughts in others. According to an assessment by UNDP, India is among the countries suffering desertification even as water erosion is "extensive and severe" throughout the Himalayas. On the other hand, the The Energy Research Institute (TERI) says that India's per capita availability of water would touch 496 cubic m by the year 2005. Against this backdrop, water resources experts have stressed on the need to revive the traditional water harvesting techniques to end the nagging water shortage in an economically viable and ecological sustainable fashion. Each region of the country has its own water harvesting, techniques, reflecting the geographical peculiarities and cultural uniqueness of the community. Indians for hundreds of years now have been using a varity of techniques to harvest every possible form of water-rain water, streams, spring, rivers and flood water.

Traditional water harvesting techniques

Rain water harvesting has been practiced in India for centuries and the traditional system of rain water harvesting proved more successful. In Rajasthan, a large part of which is covered by the formidable Thar desert has had a long and unbroken tradition of water conservation. For instance, builders of the famous Chittor and Ranthambore forts had the vision of exploiting the natural catchments in the forts created by the undulating hill tops. Some non-governmental organisations have led to the revival of the age old water harvesting system in Rajasthan called *Johad*. Now, *Johad* is meeting water needs of more than 700 villages in the state without any hassles. Essentially, *Johads* are simple stone and mud barriers built across the contour of slope to arrest rain water. They have high embankments on three sides while the fourth side is left open for rain water to enter. In the villages, where *Johads* have been revived water is shared among the villagers and the farmers are not allowed to grow water intensive crops. A *Johad* prevent rain water from running off, allowing it to percolate into the ground, recharging water aquifers and improve the water balance of the earth. Significantly, the engineering knowledge to make *Johads* was entirely local and no outside expertise was utilized. Yet these *Johads* have stood the test of time and admirably withstood the ravages of rainfall. It is believed that there is not a single village in the country which can not quench the thirst and that of its fields through the revival of traditional water harvesting techniques. Following the efforts of the NGO, Professional Assistance for Development Action (PRADAN), Ratakhurd village in the semi-arid and undulating Alwar district of Rajasthan has change into a sort of green paradise. A series of bunds put up along the hill slops were found to arrest the rain water run off. Each bund has a spillway which passes on the excess water to the rest in the line. Once checked the run–off percolates underground and increases the moisture content of the soil and recharges aquifers effectively. This makes water for irrigation available round the year.

In Gujarat, the traditional water harvesting techniques has been revived and 35 other Villages of Amreli district are known for their hard, rocky terrain on account of their peculiar geological features. These areas could not conserve rain water.

However, the situation has been changed by raising dykes to check rain water along with the putting up of check dams and percolation tanks. Water and famine in these perpetually drought prone rural areas of Gujarat has become a thing of the past with flourishing green farmland fields one from all side. In the high altitude of Himalayan region, water is tapped from hill slops known as *ghuls*. These *ghuls* ranges in length from 1-15 km and carries a discharge of 15-100 L of water/ sec. In the entire region of Western Himalaya comprising Jammu, Himachal Pradesh and Northern Uttaranchal, *guhl* is a standard harvesting technique. A cut is made in the stream, which is further extended by stone embankment, generally made of a pile of stones. Often, it goes on till several kilometers to reach the dammed with the help of trees and branches. In Maharashtra, an earthen or Mosoury dam across a river or a stream is called *Bandhara*. It is generally built in a series across the length of a river, the idea being to lift the water level to a height from which they can be further diversified into irrigation channels. Such systems are seen in Khandesh and Nashik districts, Sholapur, Kolhapur, Satara and Pune areas. Among the *Gond* tribe of Western Orissa, *Kata, Munda* and *Bandha* are commonly adopted water conserving practices. A *Kata* is an ordinary tank constructed by putting in place a stone embankment. It is constructed on either ways, North to South or East to West and is slightly curved in both ends and so constructed to leverage on the natural drainage line. *Munda* is a small embankment built across any kind of drainage channel is it a river let and stream. Designed on a smaller scale, individual farmers could build it for limited use. *Bondha* is four sided tank excavated below a *Kata* from which it receives water by percolation.

In Meghalaya, the traditional water harvesting system of tapping flowing streams and spring water for use in irrigation is popular in the state. Umbir and Mawlyndep and many other villages of Revoi district of Meghalaya collect flowing stream water through bamboo pads for domestic use. In Jowai district, the flowing stream water are stored in small cement plastered pond through bamboo which is used by the whole community, and the overflowing water is used in the catchments areas for farming. In Nagaland, *Zabo* system is practiced in some parts of the state which combines water conservation and forestry. In the *Angami* areas, *Cheo-ozihi* is the techniques of rain water collection. The river/stream water is brought down by long channels through the hill slopes. In Assam, however, there are large water bodies like Brahmaputra and Barak and several other tributaries flowing through the state creating havoc in summer. Rain water are stored itself in the natural lakes, ponds and in the low lying areas. In some parts of the state, the ancient kings constructed big ponds to preserve rain water. In some places, the *garh* is also built to channelise river water to the agricultural field. A *garh* is like big *nala*, where the both sides have big and long embankment and the middle side is left open to flow water. In the paddy field, the whole areas is divided into small pieces in square size, creating small embankment, called *Dara*, where rain water is stored for cultivation. This is also a rain water harvesting techniques practiced in the state from the ancient time. These traditional techniques of rain water harvesting can be used in some other dry land areas in the country. However, to preserve and to stop evaporation planning more trees is necessary, which is termed as natural shed on the water shed projects. In tribal dominated ChotaNagpur belt of Jharkhand, the traditional system of conserving water is *Ahar* or surfaced irrigation tanks. It has been adapted to the gently sloping plains with the help of run-off diversion channel called *pynes*. An *ahar* basically involves an earth filled check dam across the natural drainage joining uplands for harvesting the run–off. In Garhwal region, the *gharat* or water mills continue to meet the water needs of the remote isolated villages.

Working for appropriate techniques

The growing water need of a growing population can be met if excess run off rainwater is properly harnessed. To conserve rain water, the *Chola* kings built a net work of tanks in Tamil Nadu which can still be seen. Such tanks can be seen in Andhra Pradesh and Karnataka. Most of these tanks used for irrigation purposes. Percolation tanks and *nala*–bunds have been constructed in different parts of Maharashtra. All this would show rain-harvesting has been practiced for centuries, but the concept was abandoned after we went in for the big dams. Appropriate or indigenous technology can become handy in collecting and storing rain water. Either roofs or specifically prepared and protected areas on the ground can function as catchments areas. Water loss through infiltration can be countered by covering such areas with plastic sheet, bitumen or linings of

soil or cement mixtures. The primary idea is one of how best we store the rain water. A cover on the storage is indispensable in order to protect the water from evaporation and pollution from outside source. In certain parts of the world such as Mediterranean countries, rain water catchments were built thousand of years ago, sometimes on the ground, sometimes utilizing the roofs of building. In other parts of the world, attempts are being made to adapt indigenous architecture to provide rain water catchments and storage installation, as in the case of village Dagon in the dry Bandigara plateau in Central Mali. The inner walls of the tall granaries are lined with cement or plastic sheets and filled with rain water collected on flat roofs. Other simple constructions for the storage of rainwater have been developed recently in Botswana, Senegal and the Sudan which seem promising and may provide water, where there is no other possibilities to provide water at a low per capita cost. An increasingly utilized means of storing rain water from large catchments areas is the construction of sand and gravel filled dams from which water is extracted through a shallow well in the deepest part of the dam. Such a construction has the advantage providing good filtration. State like Karnataka, Madhya Pradesh, Andhra Pradesh, Tamil Nadu, and Maharashtra is implementing rain water conservation measures in large scale. In Rajasthan, desert areas structures are being developed by Central Arid Zone Research Institute. However, the traditional techniques of water harvesting are proved to be more successful. Hence, efforts need to be taken to use it extensively with little modification.

National Water Policy

Water is prime natural resources, a basic human need and a nature asset. Planning, development and management of water resources need to be governed by national perspectives. The policy, adopted at the meeting of the National Water Resources Council (NWRC), states that water is a scarce and precious national resource to be planned, developed, conserved and managed as such, and on an integrated and environmentally sound basis, keeping in view of the socio-economic aspects and needs of the states. It is one of the most crucial elements in development planning. As the country entered the 21st century, efforts to develop, conserve, utilize and manage this important resource in a sustainable manner, have to be guided by the national perspective. The policy underlines the need to put into practice traditional conservation methods like water harvesting, including roof top rain water harvesting, so as to increase further the utilizable water resources. The policy lays particular emphasis on watershed management through extensive soil conservation, catchments area treatment, preservation of forest, increasing the forest cover and construction of cheek dams.

Objectives of watershed programme

At present, watershed programme has on eye on sustainable improvement and productively of all categories of land and farmers at higher levels and check environmental degradation. The main objectives of all watershed programme implemented in India are promotion of *in-situ* soil and water conservation; optional use of land to minimize risk in dry land farming, increase in productivity of land and better returns to all farmers on sustainable basis through adoption of better technology and cropping patterns and diversification of sources of income; proper management of non-arable land to conserve soil and moisture and store run-off for recharging ground water; production of fodder, fuel, fiber, timber and fruits in the watershed and at the same time help to maintain ecological balance.

National Watershed Development project for rain fed areas (NWDPRA) operates in areas with less than 30% of irrigated areas with no criteria concerning average rainfall. Project sites should be in the upper reaches of the macro-watershed in addition nearer to Revenue Officer/District Officer and close to markets so that farmers from near by areas can assemble and see the process and feel the impact of water shed intervention. Project site should also be located on the main road so that these are easily accessible to environment official visitor, etc. Ministry of Rural Development focuses on small micro-watersheds located in rain fed villages with relatively a little irrigation area varying less than 10% of irrigated area in less than 1,125 mm/year of irrigated area in less than 750 mm rainfall/yr. Emphasis is on soil and water conservation measures. World Bank pilot project operates in large and contiguous areas of about 25,000 ha with at least 750 mm rainfall/yr with a little irrigated area, village in the core watershed area are treated in their entirety. The Non-Governmental Organizations (NGOs) have their own guidelines but they stress on to work in poverty stricken areas often inhabited by SC/ST people. They

operate in remote, unfavourable, scarcity zone of rainfall, degraded, natural resources areas. They treat the programme as rural poverty alleviation programme but based on water shed operated areas basis. Indian Council of Agriculture Research (ICAR) model Watershed Central Research institute for Dry Land Agriculture, Hyderabad and Central Soil and Water Conservation Research & Training Institute Dehradun had 47 model watersheds during 1983-84 to 1989-90. The works undertaken were closely monitored. Though watershed programme has been taken up to improve and maintain natural resources in addition to crop production on water shed basis only the end result was the same i.e. to help people in rural areas of rain fed regions. NGO-Govt Watersheds areas operated by Government and NGOs seek to combine the technical approach of Govt projects with NGOs orientation towards social organization or state.

Applicability in the North East region

The North-region is characterized with excessive rainfall and high floods during monsoon. Shifting cultivation, cultivation into marginal slopes, over–cutting of forests, improper construction activities, massive soil erosion, pollution of agricultural land and water causes the damages of biodiversity in the region. Whenever, there are massive floods in summer season, there is shortage of even drinking water in winter in some parts of the region. It seems there is lack of proper management of water resources in the region. In a high floods state like Assam large and large acres of land lying vacant in winter due to lack of irrigation facilities. If proper and effective water management techniques are evolved sustainable agriculture can be practiced in all dry land of the state, which can transformed the state into a richest state in the country. Much of the enormous water bodies in the state are still remained unutilized due to the absence of proper water resource planning. In Nagaland, despite having a sufficient rain in summer, there is acute shortage of drinking water in the state. Collecting rain water from the roof is practiced widely in the state. However, no proper storage system/facilities are maintained. Moreover, *jhum* cultivation and cutting down of forest is widely practiced in the state which causes ecological imbalances in the state. The same is the case of the other hilly states of the region. Hence, massive awareness and efficient planning for rain water harvesting, conservation and water shed management is the necessity of the region.

In the hill areas of the region, the flowing rain water and stream water can be arrested by putting stone and mud wall in between the hill slopes. Planting more trees in surrounding areas can reduce evaporation of water. This will solve drinking water problem and will lead a multifaceted development in the adjoining areas including agriculture and pesicultnre. The traditional water harvesting system in the region can been modified using appropriate techniques. The techniques like *johad*, *ahar* can also be used in some parts of the region examining the local condition. The technique of *gharat* or the water mills can be used extensively in the entire region to generate current at micro level as mini hydro power project. This will be effective to control flood in the reason. Moreover, appropriate water resource planning need to be executed for proper use of the huge water bodies of the region.

Conclusion

The water resource is a most important issue today. The country is divided into hydro-rich and a poor regime and in both cases local technology has been maintaining all kind of water stress. Development strategies point out that growing interest in traditional water harvesting system will give a big boast to people's empowerment for ending rural poverty and speed up the process of development in all its manifestations. As things stand now, India can hope to end its nagging water famine by investing time, money and energy on reviving the local water harvesting techniques. It is very important to improve and maintain degraded and eroded soils through water harvesting, soil conserving structures in addition to improving environment through better vegetation. Hence, there is need for proper plan on local basis, water basis, for improving and maintaining natural resources for better environment and benefit of people in the region as well as in the country.

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