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Role of Water Conservation in Combating Scarcity of Water

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Abstract : Water is available in plenty but its misuse is going to cause severe calamities like floods, if not stored properly and droughts, if not conserved. It's raising a lot these days due to its non conservation. Simple solution and effective implementation of the various measures has, of late, been realized. The Central water commission has assessed the total surface runoff and available ground water reserve as 1880 km^3 and 600 km^3, out of which 1140 km^3 is utilizable. It has been projected that the total water consumption for domestic, irrigation, energy and industrial sector will be 1050 km^3 by 2025 A.D. A large number of water conservation techniques are available for us. The thing is one has to practice it in the right place, right time and right spirit. Depending upon the local conditions one can opt for the water saving techniques. Improved household fitting and training of users in water conservation will reduce the demand in domestic sector. Water pricing policy and land use regulation may be additional measures aiding to preservation of water. Besides all the techniques, its time to frame the water conservation act and its strict implementation. The authors have discussed about the various issues relating to the water conservation at length.

INTRODUCTION

All of the five basic constituents of nature viz. land, water and fire etc. have equal importance to the sustainability of life. But if we think judiciously, water is one such element of nature without which we can't survive. If water is available in plenty, it's going to cause threat to life by means of floods and the on the other hand, if scarce, we may have to face droughts. While floods invade rapidly, drought pervades and develops over a period of time.

Drought brings a water deficiency and depends upon a number of factors like rainfall, surface flow, soil moisture and evapotranspiration etc. Broadly, unpredictable precipitation and its shortage is the main cause of drought but at the same time interference of human beings into the nature can't be ignored. Speedy deforestation, intensified use of land cover for cultivation, use of more of water using crops like rice, defective cultivation techniques and overgrazing resulting in loss of vegetation cover are the means by which humans are causing interference to the nature and are directly or indirectly affecting the precipitation. Water audit of the country will help us in exploration of the possible sources of water for meeting the requirements of masses.

WATER CONSERVATION

As per Atharvaved, "water of river, well, ponds etc if used and managed efficiently will reduce the drought and water scarcity." Conservation is the preservation against loss of waste and maximum benefit per unit keeping priorities intact. The over exploitation of the water resources to match the increasing ever growing development activities has further increased the importance of its conservation. The conservation of water is going to help in increase of water availability, reduction in losses, saving of expenditure in creating new infrastructure and saving in energy consumption and overall a green nature in the surroundings.

The Central water commission has assessed the total surface runoff and available ground water reserve as 1880 km^3 and 600 km^3, out of which

1140 km^3 is utilizable. The use of water in turn depends upon the physiographic conditions, socio economic environments and level of the technological advancements. It has been projected that the total water consumption for domestic, irrigation, energy and industrial sector will be 1050 km^3 by 2025 A.D. Over all if we see the scenario it seems that there will not be any shortage of water but while foreseeing the estimation ,we have to keep in mind that the rainfall is not uniformly distributed through out the year and as well as throughout the places. The precipitation is 100mm in western Rajasthan and its going upto the value of 11000 mm at Cherapunji in Meghalaya. The annual runoff per hectare of culturable area in Bark and Brahmputra valley are 53680m^3 and 21000 m^3 respectively, it is 200 m^3 in Saurashtra. These variations in rainfall distribution with respect to time and space are going to be a major factor in creating a flood and draught syndrome and in turn the growing needs of water conservation.

WATER CONSERVATION TECHNIQUES

A large number of water conservation techniques are available for us to implement. The thing is one has to practice it in the right place, right time and right spirit by adopting suitable technologies at a large scale. A few of these technologies are discussed as below:

Surface water conservation

Control of water loss due to evaporation

Large quantities of water are lost due to evaporation. The existing surface area of water bodies is approximately 12000 km^2 which will ultimately increase to 25000 km^2 due to change in the earth's geography. If an annual evaporation loss at present may amount to 27 km^3 it's going to increase almost double fold due to increase in surface area. On an average if we can use some of the methods like using chemical retardants, it's going to help us in reducing the losses due to the chemical interactions. It has been found that if we use chemical retardants, we may reduce the water evaporation by 20-30%.

Inter basin transfer

Regional imbalance in the availability on water resource can be balanced to some extent by interbasin transfers, if technically feasible. Beas Sutlej Link, Sutlej Yamuna link and Rajasthan Canal are a few of the examples of this interbasin transfer. The national water development agency has been working on the national perspective of Himalayan River Development and Peninsular River Development Components and has prepared some of the plans for it.

Micro Catchments

Rainwater Harvesting Tanks

Broadly water harvesting means collection and storage of rain water by some management techniques to make it available for its future uses. Considerable amount of water generally lost in surface flow can be harvested and stored by diverting the stream into pits, furrow and basins etc for reuse as a supplement to the existing irrigation practices. Levees of soil mass constructed along the contours of slope in hilly terrain will conserve water during infrequent rains and may be taken by gravity to irrigate the agricultural lands. At the same time its going to prevent soil erosion. Sukhomajri project is a paradigm of such technique. These techniques are being replicated at a number of places now a day. Further if we use this stored water in irrigating the crops, a substantive amount of increased in yield has been observed

Collection of rainwater from roofs

In this the rainwater is collected through corrugated sheets or tiled roofs in different storage tanks either above or below the ground level. Since these collections are generally free from soil pollution, they can be used even for drinking

purposes with a very minor treatment. This method can be of very much help in particularly heavy rainfall intensity and long spread areas such as North Eastern states.

Collection from inducement of runoff

This technique is suitable for the areas where rainfall is scanty and is for a very limited period, as such unconducive to the recharge of groundwater aquifer. Using chemicals like sodium salts which can reduce the permeability and in turn increase the runoff. Proper grading of the land and removal of obstruction also induces quick runoff. Petroleum products acting as a binder may also help in the process by binding the surface and increasing the runoff and reducing the permeability. The only drawback with this technique is that it is somewhat expansive and may cause the soil erosion. Deterioration of the water quality is another factor that needs to be taken care of while deciding the water usage.

Vegetative Cover Management

In small watersheds, removal of trees, thick bushes and maintaining a good grass cover also increases the surface water yields. This technique has been practiced in Queensland (Australia) and Arizona (U.S.A.). This technique may have some localized use depending upon the topography of the area.

Recycling and Reuse

Almost 75% of the domestic water is not much polluted and it can be recycled and reused in various irrigation uses and industrial uses. Further we can reduce the consumption of water by adapting the latest technologies In India, approx. 300 kl/ton of water is used for preparing paper whereas in USA it requires only about 20 kl/ton for it. So a clear advantage of the latest technologies can be had.

Fixing water conservation regulations and standards may reduce the domestic water consumption. The installation and use of water saving fixtures for the toilets, bathrooms etc. have to be enforced in water scarce areas.

Ground water conservation

Artificial recharge of aquifers

If the ground water is not replenished by rainfall then it has to be recharged by some artificial means. This will depend upon the hydrological condition, topography and available water for the recharge. Artificial ponds/ tanks may be constructed and water can be stored into it, which will percolate to subsoil. In well recharge technique a series of well spaced about 50 m apart are constructed on the banks of river or water body to a depth depending upon the strata. As the water is pumped, it is replenished from the water bodies. These techniques are practiced in the Gujarat, Maharashtra and Andhra Pradesh etc. Further injection techniques from the injection wells are 10 times speedier than by gravity. It has been arrived at by experiments in Ghaggar Basin in Punjab.

Subsurface Dams

Subsurface dams may be constructed across the flow direction of the ground water to impound the water scare periods. It can be of very much help in areas which has profuse rainfall and firm strata are available at low depths to make the dam economical. In Kerala this has been constructed for seed farm in Palaghat.

Water conservation Strategy

Earlier it was perceived that the key to the economic prosperity for our needs lies in having ever increasing water resource developments. But of late it has been accepted that conservation of water is the need of the hour. So some strategy suitable to the present needs has to be evolved out for storing and withdrawing maximum excess runoff which in turn will increase the water supplies in future. It can be attained by raising reservoirs,

groundwater recharge and desalinization etc. Further reduction in demand of water can be achieved by proper education through media, literature etc. in requirement of household, agriculture and industries.

Improved household fitting and training of users in water conservation will reduce the demand in domestic water supply. Depending upon the local conditions one can opt for the water saving techniques like drip and sprinkler irrigation techniques. Lining and proper maintenance of the canals will also reduce the lining losses. Improved technology for less water consumption and recycling and reuse of the waste water discharge will have to be oriented in the industries.

Water pricing policy and land use regulation may be additional measures aiding to preservation of water quality. Polluters should be compelled to pay heavy compensation and at the same time incentives to zero pollution etc. are to be made effective by proper legislation.

COMBATING WITH DROUGHTS

Drought is unpredictable and it's starting and ending can't be foreseen. Owing to such nature the impacts made by it on the all aspects of society may be its social or financial or some other aspects; it's far worse than floods. So one has to be prepared for its impact all the time. It's not the case one has to make measures for it when it occurs; on the other hand one has to think about it and plan suggestive measures regularly keeping supply, demand and management in mind. It should aim at supplementing existing supply system using the latest techniques and plan the resources in such a way that all the demands are met in time without any hue and cry. While planning the legal aspect and standards for the use of water should also be kept in mind

These measures can make use of structural measures and non structural measures. The structural measures can include creation of storage structures, interbasin projects and diversion projects etc. the non structural measures will include proper and efficient water management practices. Depending upon the topography in an area and the meteorology factors in mind, Drip and sprinkler irrigation practices etc may be introduced at a large pace and in have to be enforced so that the drought will be passed on as an interruption in the development rather than as a natural calamity as visualized now a days.

SCOPE AND POTENTIAL OF RAINWATER HARVESTING IN PUNJAB

Punjab is one of the smallest States of India with geographical area of 50362 Sq. Km. It lies between 29-30' to 32-30' N Latitude and 73-55' to 76-55' E Longitude. It is bounded by Pakistan in the west, Jammu and Kashmir in the north, Himachal Pradesh in North and North East, Haryana in the east and South west and Rajasthan in the south west.

Based on soil and climatic parameters, Punjab is divided into the following Agro Climatic regions:-

1. Sub Mountainous undulating region or Kandi region.
2. Undulating plain region.
3. Central plain region.
4. Western plain region.
5. Southern plain region.
6. Flood Plain/Bet Area.

Although the Punjab State has highest production of crops in the country, there are few areas in sub-mountainous region lying in the Shivalik foothills where lands are not intensively cultivated. In Punjab, 5.38 lakh hectare area(nearly 10%) of the total geographical area of the state, comprising of Shivalik foothills also known as Kandi area, water is a precious resource. Although the average rainfall in this area varies from 1000 mm to 1200 mm, but its distribution is erratic and uneven. The irrigated area is far below than the

rest of the state where more than 97-98% of the area is under assured irrigation. In comparison, only about 20% of the cultivated area in Kandi is under assured irrigation. Therefore, the management of rainwater in this region is a key to environmental, economical & social sustainability. The 80% of average annual rainfall of 1000 mm in Kandi region is received within 3 months of monsoon period resulting into severe soil erosion with flash floods and frequent droughts due to erratic rainfall. Therefore, the management of the runoff in the sub-mountainous region known as the Kandi region is crucial for increasing productivity of this region.

KANDI AREA OF PUNJAB

Location

The Kandi area is located in North-Eastern part of Gurdaspur, Hoshiarpur, Nawanshahar, Ropar and Patiala districts lying between 30°21'48" to 32°30" north latitudes and 75°32' 12" to 75°56' east longitudes. The watershed and sub watershed lying in the Kandi area of the Punjab covers 2154 villages of Gurdaspur, Hoshiarpur, Nawanshaher, Ropar and Patiala district. The average height of hills range from 415m to 500m above mean sea level. Fluvial action of choes, erosion and deposition are free geomorphic processes prevalent in the Kandi area of Punjab.

Physiography

There are two major physiographic units :

i) Hills

Hills are observed in the northern fringe of Gurdaspur, North Eastern part of Hoshiarpur and Ropar districts. The hills are composed of sandstones, conglomerates and shales. The attitude varies from 300 to 600 meters above Mean Sea Level. These hills act as a runoff. The number of choes/seasonal rivulets originating in the hills cause severe erosion. Hill shoe dendritic drainage pattern and have thin to moderately dense scrub forests. Ground Water potential of this hilly tract is poor.

ii) Piedmont Plain (Dissected & Rolling Land)

It forma a transitional zone between the Shivalik hills and alluvial terraces. It is 10 to 15km wide and comprises parts of Gurdaspur, Hoshiarpur, Nawanshaher and Ropar districts. The elevation of this zone varies from 300 to 375m above the MSL. The land is badly dissected by seasonal streams popularly called Choes. Many of these choes terminate in the area without joining any major stream/river. The deposits in the alluvial fans and in choes are coarse-textured mainly sand mixed with gravels and or pebbles at places and relatively finer in other area. The deposits are young and highly stratified.

iii) Alluvial Fans

This is undulating are below the hills with general gradient towards southwest direction and has sub parallel drainage. The unit comprises of sediments laid down by choes/ nallahs. Sediments are composed of loose sandy material with some pebbles and boulders.

iv) Table Land

A gently sloping, highly eroded occupied the eastern portion of Bist-Doab area. The drainage is very fine and parallel. The unit comprises of alternate bands of clay, silt and sand of varying grades.

Drainage

Most of the area is drained into rivers Ravi, Beas and Satluj through numerous choes. These rivers along with their tributaries form the main drainage system of the area. The Ravi river rises the northern face of Rohtang Pass in the Kullu hills in Himachal Pradesh. After passing through Chamba and Dalhousie hill ranges, the river emerges from the foothills at Shahpur Kandi in Punjab. The river flows along the western boundary of Gurdaspur district.

The Beas river in Beas Kunj in Pir Panjal range in the south of Rohtang Pass. After traveling through Manali and Kulu valleys, it pierces the Dhanla Dhar range and joins the chakki khad near Mirthal and finally merges with Satluj at Harike (Amritsar District). The area between Ravi and Beas rivers is drained by Sakki Nallah, Kasur Nallah and Palti Nallah. Most of area of Hoshiarpur district and north eastern side of Balachaur tehsil of Nawanshaher district is drained of river Satluj through choes, while the most of area of Garshankar and Hoshiarpur tehsill of district Hoshiarpur partly drain in to East Bein through numerous choes namely Rajni, Chabbewal, Mangrowal and Nasraia choes. The Dasuya tehsil partly drains into the Beas River and West Bein leading to river Satluj and partly into hilly and piedmont area is drained through the langerpur group of choes to the river Beas. The river satluj forms the main drainage in the area of Ropar district. The main tributaries in the area are rivers Soan in the North and Sirsa in the South.

Climate

The annual rainfall varies from 1000 to 1200mm. The southwestern monsoon begins in the first week of July and extends up to September. This is the main rainfall season and constitutes about 80% of the annual rainfall. The temperature precipitation diagram indicates that July, August and September have more rainfall in a year are wet months. The monthly mean temperature is 30°C while the monthly mean minimum temperature is 14°C. The northern part of Gurdaspur district is having rainfall of 1100 to 1500mm.

Rainwater Harvesting in Punjab

The Department of Soil & Water Conservation started the work of rainwater harvesting in the year 1986-87 on the pattern of famous *Sukhomajri* Project. The First Earthen Rainwater Harvesting structure was constructed in village Perch in Ropar district having a catchment area of only 8 hectares. Over the time more than 250 water harvesting structures of different kind have been constructed in Ropar, Nawanshahar and Gurdaspur districts.

Different Types of Water Harvesting Structures

The following types of Water Harvesting Structure have been popularized in the area mainly:

1. Earthen and Masonary Check Dams
2. Micro Lift Irrigation Projects

Earthen and Masonary Check Dams :

The department of Soil and Water conservation of Punjab has constructed about 90 earthen harvesting structures and 11 stone masonry/brick masonry structures. The height of the earthen structures varies from 8-15 meters and of masonry structures 5-8 meters and the catchments area varies between 10 to 200 ha. The earthen embankments have been constructed in Ropar, Nawanshar and Hoshiarpur Districts.

Micro Lift Irrigation Projects :

These type of structures have been constructed where the command area is at a higher level than the water source. It includes the development of the water source through percolation wells and then lifting to centrifugal pumps to irrigate the command area. The average Command Area for such projects is 50 ha. About 60 such structures have been constructed, the majority of them lying in hilly areas of Gurdaspur district.

CONCLUSIONS

Sufficient quantity of water may be available but it's due to its misuse and non awareness, zero inclination for its conservation; the sufficient quantity of potable water is not available to suit to the demands of water. Conservation of water will not only save the precious resource but at the same time it will help in combating of the severity produced by the draughts. It is the

need of the hour to make a water audit in all the possible places where it's being used, like all the financial audits are made in the various organizations.

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