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ENVIRONMENTAL IMPACT OF ARTIFICIAL RECHARGE OF GROUNDWATER WITH SPECIAL REFERENCE TO AREAS IN AND AROUND DALTONGANJ BLOCK, DISTRICT PALAMU

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ABSTRACT

Water on the earth is in motion through the hydrological cycle. The utilization of water for most of the users i.e. human, animal or plant involves movement of water. The dynamic and renewable nature of the water resources and the recurrent need for its utilization requires that water resources are measured in terms of its flow rates.

Post-independent India has witnessed a phenomenal development of its groundwater resources, which, has resulted in deleterious effect in terms of steep decline in groundwater levels, dwindling yield, dying up of wells, and water quality deterioration. Ground water development has shown phenomenal progress in our country during the past three decades. There has been a vast improvement in the perception, outlook and significance of ground water resource. The importance of groundwater for domestic, industrial and agricultural uses and its readily and locally available characteristics has lead to indiscriminate extraction of this precious natural resource.

Groundwater is an integral part of the environment, and hence cannot be looked upon in isolation. There has been a lack of adequate attention to water conservation, efficiency in water use, water re-use, groundwater recharge, and ecosystem sustainability. The causes of low water availability in many regions are also directly linked to the reducing forest cover and soil degradation. Overexploitation of groundwater and intensive irrigation in major canal commands has posed serious problems for groundwater managers in India. Depletion of water tables, saltwater encroachment, drying of aquifers, groundwater pollution, water logging and salinity, etc. are major consequences of overexploitation and intensive irrigation.

STUDY AREA

The State of Jharkhand covers a total area of about 79714 sq km has 24 districts and a population of about 26.9 million [Urban-5.9 million (21%), Rural 20.9 million (79%)]. The state has 152 towns and 32615 villages. The average rainfall here is about 1400mm.

The district of Palamu is covered by three major geological formations viz, the Precambrian crystallines, the Vindhyans and the Gondwanas. Besides, the tertiary laterite and alluvium also cover part of the district. The study area is covered by Granitoid Gneiss as Precambrian Basement and Shales and Sandstones as a part of the representation of the Gondwanas. The Alluvium cover of considerable thickness occurs in the northern part of the district along the Sone and North Koel rivers. Ground water occurs mostly under phreatic condition in all the lithological units and locally under semi confined and confined condition.

ARTIFICIAL RECHARGE

Artificial recharge of groundwater is achieved by putting surface water in basins, furrows, ditches, or other facilities where it infiltrates into the soil and moves downwards to recharge aquifers. Artificial recharge is increasingly used for short or long term underground storage, where it has several advantages over surface storage, and in water reuse. Artificial recharge requires permeable surface soils, where these are not available, trenches or shafts in the unsaturated zone can be used, or water can be directly injected into aquifers through wells. To design a system for artificial recharge of ground water, infiltration rates of the soil must be determined and the unsaturated zone between land surface and the aquifer must be checked for adequate permeability and absence of polluted areas.

SUSTAINABLE NATURAL RESOURCE MANAGEMENT

The concept of sustainable natural resource management is essentially integration of three factors -first, human beings have a common destiny of interdependence with other living creatures on the earth; second, the main concern of development is not growth at all costs but to render the lives of majority of the people easier and more harmonious; and third, there are thresholds of irreversibility which traditional economics does not take into account.

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In Indian context it may be further explained as a means to meet the basic nutritional requirements of present and future generations, providing employment with sufficient income and quality living conditions for rural people; maintaining the productive capacity of the natural resources while protecting the environment and reducing the vulnerability of the agricultural sector to adverse natural and socio-economic factors and other risks as well as strengthening self-reliance.

In recent years the notion of sustainable development has emerged as a reaction to the highly technological and centralized processes that have governed thinking on development, the green revolution being a classic example. The process of sustainable development envisages that people should not merely participate, but be in charge of their own development.

The Cyclic System of Development or Chakriya Vikas Pranali (CVP) in Jharkhand state is one live example that is based on sharing of benefits in a continuous 1:3:3:3 sharing system.

The concept of Cyclic System of Development was originally conceived Dr. P. R. Mishra and implemented at village Sukhomajri near Chandigarh in the hills of Shivalik range, and further replicated successfully in Palamu. The concept revolves around the age old principal of optimal utilization of basic ingredients of nature i.e. land, water, air, and sun with the involvement of the communities, which not only create economic wealth but also bring these components of the nature back into their pristine condition, even if they are in degraded condition. What is more important is the changes brought in by this concept for ensuring social cohesiveness.

Thus this concept, not only creates the economic wealth but also an environmental and social wealth for ensuring long-term sustainable development This is achieved through the involvement of the local community and by creating institutional mechanism within which it works in a totally transparent manner. The features like thrift, transparency, equity are the inherent characteristics of this concept. The CVP creates a common pool of degraded land. The soil and water conservation techniques are applied and the whole community is involved irrespective of their economic or the social status with the produce being shared in an equitable manner. The sharing system has built an equity for each individual, the community and also the future, so important for sustainability of the development. The gains are shared as, 30% share to the students(participants working on the pool), 30% to the land owner who pool their land, 30% share to Gram Kosh (Village fund) for social and economic development of the village and 10% share to Kalyan Kosh.

The core features of CVP are:

(a) conversion of private fallow lands into common-pool resources;

(b) the maximum utilization of rainfall through water conservation -in situ and in small tanks and ponds -and its concentrated use through introduction of a new, intensive, multi-layered land use systems with very high potential income yield;

(c) mobilization of villagers' organization for management of regeneration of natural resources, and

(d) distribution of benefits on a 1:1:1 basis -one share to the landowner; one share to be divided equally among all village workers as family income; and one share to the village society for the development of social infrastructure: school, health centers, etc.

The pooled land includes the marginal fragmented land and the land owners, who willingly give their degraded land as the system ensures that the land remain their property. The students are generally the landless idle human resources as also the committed supporters of the concept. Multi-tiered and multi-rooted planting system is adopted. The selection of plant species is based on the soil quality, water availability and local demand and is decided by the Community.

ENVIRONMENTAL IMPACT OF ARTIFICIAL RECHARGING

Environmental effects of groundwater recharge vary from site to site, and these can have both beneficial and harmful effects. In general, however, the types of environmental effects that should be considered when planning recharge facilities range from ecological effects on soil, hydrologic, and aquatic eco -systems, to effects on species dependant on riparian habitats, and to possible effects on people’s use of the water resources for recreation.

All the surface methods are susceptible to clogging by suspended solids, biological activity or chemical impurities. Clogged top layer reduces the infiltration rate drastically. Experiments conducted to increase the infiltration capacity by scarping the top soil indicate that the infiltration capacity of the untreated recharge facilities has reached 20.3 % of the original values in a season and that scraping the top sediment layer and 15 cm of top soil could restore 68.3 % of the initial infiltration capacity. Aquifers sometime contain clay lenses; if the recharge water has a low TDS and/or a higher sodium concentration, then this clay lenses could become dispersed and move with groundwater through coarse layers of the aquifer, causing the water pumped from wells to be “muddy.” Water quality issues assume greater significance depending on the use to which the recharged water is intended for.

Clogging of soil matrix is a major operation problem of infiltration systems for artificial recharge of groundwater. Clogging can be of even greater importance in waste water lagoons or constructed wetlands where injection wells used are much more vulnerable to clogging than surface infiltration systems because the infiltration rates into the aquifer around the bore hole are much higher than in infiltration basins. In addition, remediation of clogging in wells is much more difficult than in surface infiltration systems. In the case of dry wells, it is impossible to remediate soil clogging by pumping or redeveloping because the dry well is in the unsaturated (vadose) zone and the groundwater cannot flow into it.

Artificial recharging through surface infiltration system is not feasible where permeable surface soils are not available, land is too costly, unsaturated zones have restricting layers or undesirable natural or synthetic chemicals that can leach out, or aquifers have poor quality water at the top or are confined. However, surface infiltration methods have relatively low construction costs and are easy tooperate and maintain. Field studies of direct surface recharge techniques have shown that of the many factors governing the amount of water that will enter the aquifer, the amount of sediment in the recharge water, the area of recharge and length of time that water is in contact with soil are the most important. Direct subsurface recharge methods access deeper aquifers and require less land than the direct surface recharge methods, but are more expensive to construct and maintain. Recharge wells, commonly called injection wells, are generally used to replenish groundwater when aquifers are deep and are generally separated from the land surface by materials of low permeability. In all the methods of subsurface recharge, the quality of recharged water is of primary concern.

In areas where the base flow of streams is supported by groundwater discharge, additions to storage and flow of groundwater by recharge may result in higher sustained stream flows during low flow or drought conditions. The flow of springs might also be sustained at higher levels through dry periods by the higher groundwater heads that would result from artificial recharge. Through artificial recharge, groundwater heads can be restored to or maintained at levels that can help prevent or reduce subsidence. On the other hand, surface water bodies whose water quality has been altered by low quality water emanating from the recharged aquifer could also be damaging to the ecology of the receiving surface water body.

In Palamu monsoonal rains are between June and September. It is therefore necessary to harvest the monsoon runoff into small percolation ponds in mini-catchments by constructing earthen or masonry bunds called check dams on small streams and allowing the stored water to percolate and recharge the groundwater body. The residence time of water in the pond behind the check dam is increased and it is possible for the farmers to dig wells to capture the recharged water and irrigate crops in their small farm plots. The efficiency of the percolation ponds is hampered by silt that accumulates in the pond bed, year after year. It is therefore necessary for the beneficiary farmers to desilt the pond bed when the pond dries. Otherwise, the efficacy of recharge decreases considerably.

Cultural considerations often enter into the selection of a recharge method and site for locating recharge structure. The availability of land, land uses in adjacent areas, public attitudes, and legal requirements play a role in defining the acceptability of artificial recharge in a given setting. In urban areas, injection wells with controlled water supplies are preferable whereas surface recharge facilities requires continuous surveillance and regular maintenance for public acceptance.

CONCLUSION

Watershed projects can gain a lot by paying attention to the revival of traditional water harvesting structures. Not only is this less costly, community's contribution and participation is easily accomplished in such initiatives. Furthermore, reviving community structures leads to rebirth of community spirit and community management –an aspect on which substantial time and resources are spent in watershed projects.

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