Managed aquifer recharge as a tool to protect aquifers and help sustainable groundwater management

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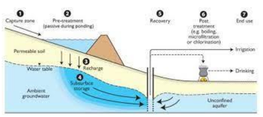
Abstract

Statistics by world bank reveal that more than 60% of agriculture and 85% of drinking water are dependen on groundwater in India.Groundwater levels are declining despite numerous water harvesting techniques. MAR techniques are highly cost effective and help to recover ecosystems that are dependent on it. Overuse of chemical pesticides and climate changes contaminate and increase undue pressure on groundwater resources. Hence managed aquifers are an important tool that enable us to recycle and increase the amount of clean water that is available. Below ground storage of water is maintained for use of water in case of higher demands when groundwater is otherwise depleted. The volume of the managed aquifer is increased so that hydrologic equilibrium may be fulfilled. The water present in a aquifer can be used in many goals like agriculture,drinking etc and one of them is sustenance of groundwater dependent ecosystem .The water percolated is discharged to a groundwater-dependent ecosystem hence providing it replenishment. My research covers all these aspects that involve MAR techniques in context of sustainable ecosystems. MAR is an man-made devised means to restore groundwater. My study accommodates various benefits of MAR Techniques that include the provision of additional natural treatment to enhance water quality,

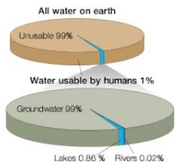
Introduction

In the Indian water policy, Managed Aquifer Recharge (MAR) is considered as one of the best supply side water management options to face groundwater depletion. It is expected to optimize the resource as well as attain environmental sustainability and meet water demands and social justice.

Managed aquifer recharge (MAR), also known as water banking, consists of water management methods that recharge an aquifer using either surface or underground recharge techniques. Artificial recharge can be done through injection of water through wells.
This method often is applied to recharge deep aquifers where application of water to the land surface are not effective at recharging these aquifers



A graphic representation of managed aquifer recharge plant.

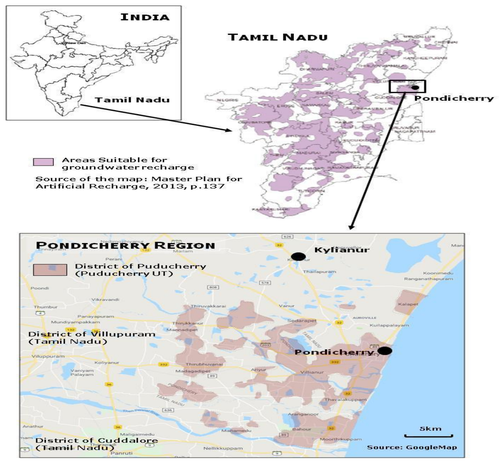


distrubution of usuable water sources

plant managed acquifers provide a valueable way in which unusuable water may be replenshished so that it may be used again for domestic use by villagers in India. it is a highly cost effective solution for water problems in india

Case studies in the Pondicherry Region

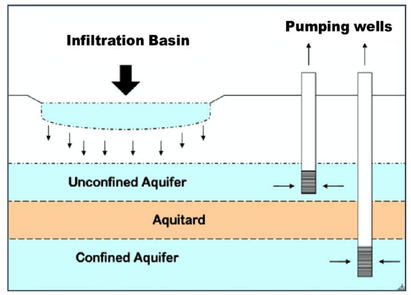
Despite a lack of legal framework, MAR is part of many government programs and a wide set of activities in the Pondicherry Region. For example, in recent years, the Tamil Nadu Government Order Ms.No.198 allocated Rs 5.5 109 (€65M) to the Public Works Department (PWD), Agricultural Engineering Department (AED), Tamil Nadu Water Supply and Drainage Board (TWAD Board), and the Forest Department to create artificial recharge structures under the Master Plan for Artificial Recharge Scheme (MPARS) (2008-2015). More than 12,000 recharge structures were constructed; mainly check dams, a few recharge shafts and percolation ponds. Aiming at boosting groundwater recharge and preventing flood water from draining into the sea, in 2017 the Water Resources Department (WRD) of Tamil Nadu proposed a project to construct nearly 177 recharge structures across the river basins at a cost of Rs 14.45M (€170,000) under the Green Climate Fund, which is a fund established under the United Nation Framework Convention on Climate Change to support developing countries adapt to and mitigate the impact of climate change. In this project, besides structures across the rivers, there are also plans to build recharge wells and recharge shafts in 52 water bodies.



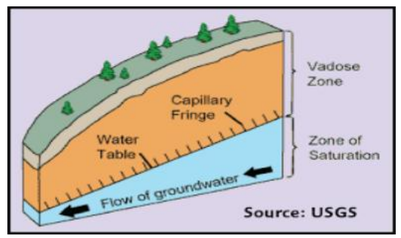
Methodology

MAR techniques have been applied for millennia to manage available water resources. Methodologies range in complexity from simple rainwater harvesting to deep-well injection of reclaimed water into a saline aquifer. Methodologies applied should be appropriate to meet the defi ned objectives which, at the most basic level, will be storage and treatment of water.

structures These schemes are designed with the prime objective of kk These schemes are designed with the prime objective of enhancing recharge (intentional recharge) but aquifers can also be recharged unintentionally (incidental recharge Although simple in principle the effi cient operation of spreading basins and infi ltration schemes needs a good knowledge of the physical, hydraulic, geochemical and microbiological processes in operation and how to manage them for optimum performance. Similar issues need to be addressed in roof top rainwater harvesting.



harvesting An infiltration basin is either excavated in the
ground, or it comprises an area of land surrounded by a bank, which retains the recharge water (e.g. storm water), until it has infiltrated through the floor of the basin..The depth of the basin should be shallow The depth of the basin should be shallow enough, to allow rapid draining in cases
where cleaning of the basin by drying
and scraping is necessary. Water levels
should be managed to prevent growth of
vegetation or accumulations of algae and
consequent resistance to the flfl ow of water.
The area of land available for infifi ltration
basins and the infifi ltration rate determines
the volume of recharge achievable.



conclusion

AjjSettling of fi ne material and subsequent clogging of the aquifer is the main problem encountered in the majority of schemes described above. Clogging can be from suspended sediment load, microbiological growth, chemical precipitation and, in the case of ASR-type well injection, entrained air bubbles blocking pore spaces.The costs of these management and maintenance programmes have to be met and justified against the benefits of the infi ltrated water.

the recharge structure is a communal venture then those who benefi t most need to bear the majority of the costs.MAR is part of the groundwater manager's tools, which may be useful for re-pressurising aquifers subject to declining yields, saline intrusion or land subsidence. On its own it is not a cure for over-exploited aquifers, and could merely enhance rates of abstraction.
Many schemes require low levels of technology and can be (and have been for centuries) implemented with little engineering knowledge. This would include water-harvesting techniques to enhance recharge, fi eld bunding and small bunds across ephemeral streams.Although simple in principle the effi cient operation of spreading basins and infi ltration schemes needs a good knowledge of the physical, hydraulic, geochemical and microbiological processes in operation and how to manage them for optimum performance.

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