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Watershed Management is the Base of sustainable development
(A Case study of Sagarmati Microscopic Watershed)

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Abstract

The concept of watershed Management is defined as a small geo-hydrological Unit draining Surface water to a common point. It could be demarcated on the bases of ridge and gully lines. All lands on the earth are part of one watershed of other watershed. A watershed is thus an area of land from where the surface runoff collects and flows out of the watershed through a single outlet into a larger river or lake. It's for sustainable development of land, soils, vegetation, biodiversity and water resource. This programme was initiated by Shri (Late) Y.P. Bali in 1974 when the ministry of agriculture Govt. of India initiated the programme of soil and water conservation adopting watershed as a Unit. All India soil and land use survey (AIS&LUS) govt. of India has surpass other organization in delineating watershed and through a systematic planned system so that each watershed could be treated as an individual identity without distributing the linkage with the larger Units. In Rajasthan rainfall water are the main source of water. For better utilisation of natural resources we need a systematic study of the river involving river morphology, drainage characteristics etc.

Keywords: Natural Resources, Watershed Management, Vegetation.

Introduction

The conservation of Natural resources and protection of environment for sustainable development is the need of present time. Watershed management is conventional method of preservation and conservation of water, soil, vegetation, biodiversity and economic growth by mean of constructing terraces, storing and restricting water through embankments, check dam, small ponds and dames. It helps to control runoff velocity and slow velocity of water is very useful for natural resources conservation. It helps to retain moisture in the field which is essential for natural vegetation. In all-natural resource water is one of the most significant and essential resources for the survival and sustenance of all organism on the surface of the earth. Without water no life is possible on the earth surface. Under such circumstances water management technique should be adopted of that order which might use water adequately without losses of soil and vegetative cover and increase the biodiversity.

Objectives of the Study

1. To stress upon the significance of the available natural resources and their conservation in the microscopic watershed area.
2. To control the velocity of runoff and protect the fertile top soil and minimizing the sitting up of the reservoirs.
3. To utilize the land on its capability.
4. To manage and utilize the runoff water for useful purpose.
5. To increase in filtration rate of rainwater.
6. To improve and increase the production of timber, fodder, food and wildlife.
7. To moderate the floods peaks at the downstream area.
8. To conserve natural resources and generate employment through agriculture, fishing and industrial development.

Importance of the study

Watershed are important because the surface water runoff within a watershed ultimately drain to other bodies of water. It is essential to consider these downstream impacts when developing and implementing water quality protection and restoration actions. We need to remember that we all live downstream and our everyday activities can affect downstream water. We can improve socio-economic status of farmers

through maximizing income from agriculture, dairy, poultry, sheep and goat farming. It's useful for safe diversion of surface runoff.

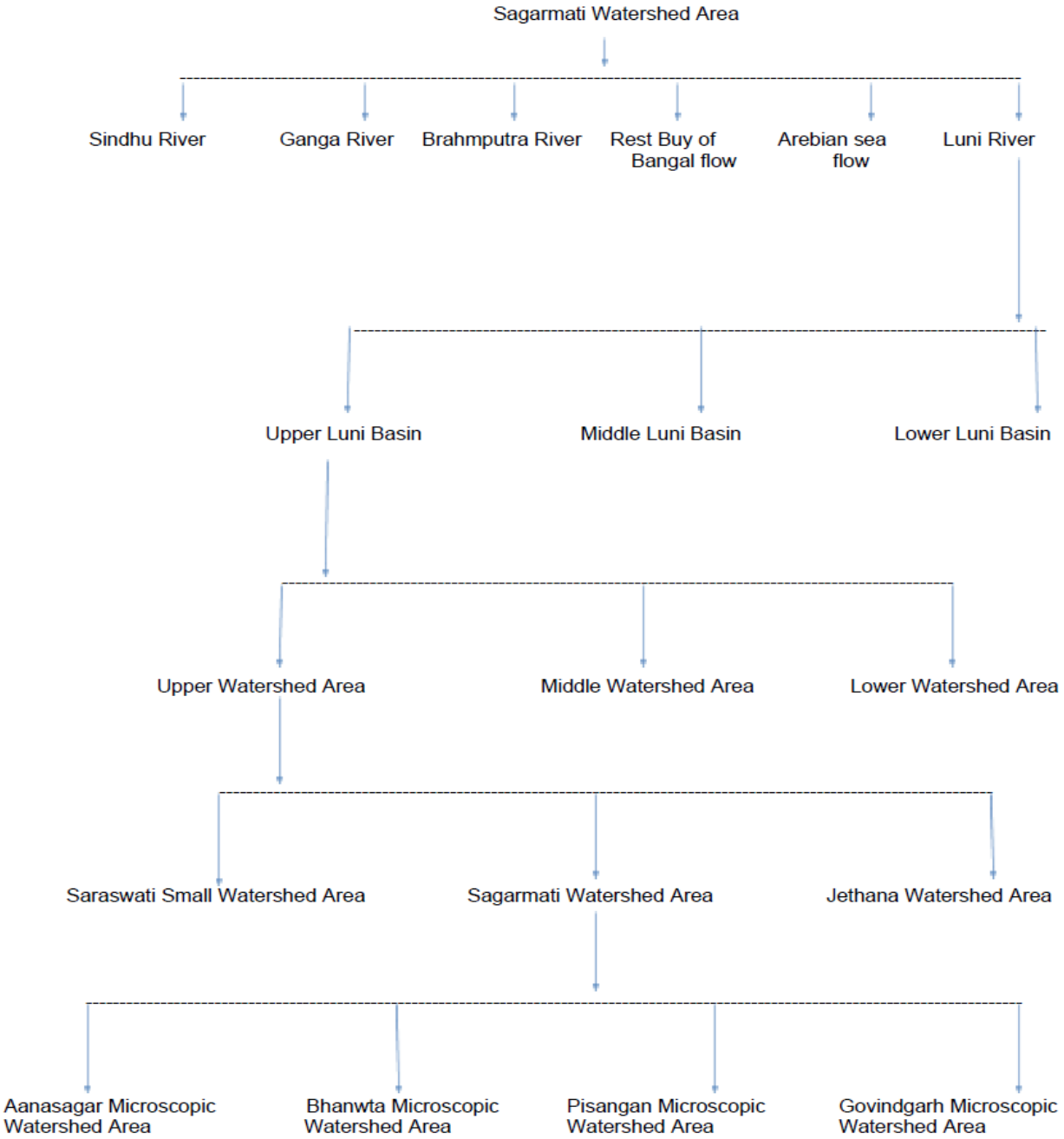
Hypothesis

In present study following hypothesis are formulated: -

1. Increasing in the quantity of rainfall will increase the quantity of water in reservoirs.
2. Construction of artificial reservoirs, embankments, check dam etc. Will facilitate the retaining of the runoff water table would increase.
3. Heavy pumping and high sloping areas will face the problem of lower water table.
4. Industrial development and use of maximum chemical fertilizers will increase the water pollution.

Research Methodology

The present research work "watershed management is the base of sustainable development" has been completed in various stages. The study includes basic stapes of theoretical study collection of data, classification, preparation of table, maps, diagrams, analysis, interpretation of data and report writing. Drainage, slope and relief maps have been prepared on the basis of 1:50000 Topographical sheets. The watershed has been further divided into very small, tiny and mini-watershed area. Karl pearson's correlation method have been use to explain the relation between two phenomena.



Sagarmati Small Watershed Area

Out of the nine principals inter connected lakes, dams, check dam and Anicut of Sagarmati Microscopic watershed the nine wise Foy sagar, Ana sagar, Khanpura, Masiniya, Nuriyawas, Naturhala, Budhwara, Rampura, Pisangan and Govindgarh are directly linked through their overflow. Sagarmati small watershed area is bounded by 26°19'15" to $26^0$29'30" North latitudes and $74^0$20'05" to $74^0$41'11" East longitudes. It is situated in Ajmer and Pisangan Tehsil of Ajmer District. It covers an area of 360.75 sq. km. In the North of the watershed the river Saraswati is flowing while its Southern part is drained by river Lilary basin. The river attains the average elevation of 460.19 metre msl. Its eastern part is high than western that's why water flows from North to South and than east to west. The average slope of the area is 3^0 in east and 2^0 5' in the west. Its Eastern part is hilly and Western part is plain.

The climate of the region is semi-arid and falls under the Koppen's terminology as Bhs. Its summer mean temperature is 42^0 C while in winters it remain around 17^0 C. Rains fall generally in July, August and September and the average is recorded 460 mm. with a minimum in January. It's has the trend of being uncertain, variable, unevenness and breaks.

It structurally, falls under the alluvium category and the watershed area is mostly plain covered by sand with sporadic sand dunes. The dunes are frequently found in north and western parts of the area while its eastern part is covered by the Arawalli ranges.

The region is sandy plain covered by brown sandy soil and possesses the low water content capacity. The soil contain high amount of nitrogen, phosphate, saline minerals and high Ph value ; but it is poor in organic matter . It is fertile where water is available, because the presence of nitrogen and phosphate.

The area under investigation is devoid of reserved forests but here and there trees of Neem, Peepal, Bargad (baniyan), Babool etc. The absence of vegetation is because of water scarcity, growth of population and extension of agriculture.

The watershed region as per census of 2017 has 3270 buffaloes, 6480 cows and bullocks 9385 sheeps and 3860 goats. People are mostly practice animal husbandry because the area suffers with scarcity of minerals and water. The main occupation of animal husbandry too is in the backward state. However, it can be properly developed by watershed management which can improve water-cum–sanitary conditions of animal including available of fodder.

The sagarmati microscopic watershed area is arid rurban countryside where only 1381933 persons are distributed in small hamlets, villages and city. The density of population is 306 persons per Sq. km. Ajmer city has 542321 persons and rest in the village area.

Microscopic watershed unit of sagarmati covers an area of 360.75 sq. km. of which 2.93 sq.km. (0.85%) is hilly and 6.01 sq. km. (3.6%) is barren which is unutilized. The irrigated area covers 54.6 sq. km. or 18.06% of the total watershed and 60.56 sq. km. or 25.06% is unirrigated. The double cropped area constituted only 18.76 sq. km. But it is certain that with the introduction of the watershed management, there would be increase in the irrigated land at least by 56% by converting 12.60 sq. km. unirrigated land under irrigation. This means the two-times increase. The watershed area has only 9.73% of the double cropped area, and if the irrigational facility is available both the double cropped area as well as productivity may be increased. The forests are totally absent in the area and the availability of water would make it possible to convert barren land into green wood by the development of 5.72 sq. km. or 3.6% area into forests.

Surface Water Resources

The significant source of water availability is rainfall. The average rainfall of 460 mm. of the area is liable to make the availability of water only to the extent of 112.25 million cu. Metres. There is scarcity of waterbodies and its tributary-nallas drain the entire water outside the area, the flow-density being 0.55 km. per river-lenth sq. km. The storing devices as well as public awareness about the water-conservation seem to be absent in the area. The storing capacity of the tanks under watershed is decreasing because of sedimentation and thus most of the water is being drained unused outside the area. This problem of water-scarcity in the area may be solved by means of watershed management techniques.

Underground Water Resources

Underground water depends upon aquifer geo-structure of the area, as well as on rainfall velocity of runoff and means of storing water. The alluvium aquifer of the region under study is an important aspect from the point of view of underground source of water. According to Ajmer Underground Water Board, the water-table level during pre-monsoon period is found 18.06 metres. The increase in level shows that it is due to the rains during monsoon period. The surface water and soil humidity are being utilized to complete various activities and underground water is only used for the emergency-work. It is because of this reason that 1.822 meters availability in water table of pre-monsoon and post-monsoon period is visible. On the other hand, the post monsoon water table shows a decline of 2.576 metres. This is because of the scarcity of rainfall and overuse of the underground water. The surface water sources become dry during post-monsoon period. Under these circumstances, domestic, industrial and agricultural activities are compelled to use the underground water, while its refilling is the least in amount. Consequently, the underground water-level goes on decreasing. This is the cause for negative variability in the underground water table level of post monsoon and next year's pre monsoon period.

Source of Underground Water

Underground water sources are mainly by wells, hand pumps, electric power pumps. Sagarmati microscopic watershed area is having only 1206 wells. The number of wells in proportion to seems sufficient the density being 12 wells per sq. km. and 6 wells per each 100 persons for domestic purposes.

Health and Technical Work Dept. has erected hand-pumps at the density of 4 for 1000 persons or 100 sq.km. area. The underground water sources are sufficient in the area, but it is very essential to practice watershed management policy for re-availability of water rate otherwise, the sources would become ineffective and dry.

Demand and supply of water

Total 36.939 million cubic metres water is in demand for domestic purposes as well as for animal husbandry. Agriculture works, need 12.468 MCM. But the supply for aforesaid sectors is less to meet its demand. The rainfall amount in the basin is sufficiently higher than its demand and the basin receives as much as 122.565 MCM. of water. This much of available amount may solve the water problem of the watershed area.

Conclusion

For the conservation of natural resources and protection of environment for sustainable development through Sagarmati microscopic watershed area, the following suggestions may be adopted: -

1. Developments of forests on barren (6.01sq. km.) and hilly terrain (2.93 sq.km.).
2. Bench terracing on the slopes having more than 2-degree (0.92% land) gradient;
3. Contour ploughing on the hillocks in the mid and northern parts of the watershed area;
4. Check-dam should be constructed at places where drainage is very feeble, and big-dams may only be constructed where drainage is of high order.
5. Each of the mini microscopic watershed area may have at least one tank, thus 10 small and one large water- bodies may be constructed in the area.
6. Pasture barrens and fallow-land (5.72 sq. km.) should be developed.
7. Underground water may be conserved for future sources. Its use is permissible only under emergency-circumstances.
8. Rainwater should remain in the same microscopic watershed area.
9. Domestic tank-system should be practiced on house-terrace. The use should be only in emergent need. This may solve the problem to large extent.
10. The aforesaid means if adopted properly by following the principles of the watershed management, at the development of resources in the area would be adequate as well as balanced.

Suggestion

So far development programs were planned and implemented by taking the revenue district as a unit, but this unit was found to be unwieldy and also to a larger extent, heterogeneous in its resource endowments. Therefore, adopting watershed as the unit for integrated planning and implementation. To utilize the rainfall wherever it falls and flows, a watershed is the key element of integrated watershed management. The watershed is claimed to be the most scientific unit for efficient management of land, vegetation and water resources as it is basically an agro-climatic unit with relatively more homogeneity of land and other resources as compared to district. Sagarmati watershed area is a transitional zone where Arawalli end and desert began. According to the survey findings, measurement like forestation, pasture development, livestock management, soil and moisture conservation measures like contour vegetative barriers tillage, mulching, shelterbelts and wind strip, rainfall harvesting techniques are also to be employed for runoff storage and sustainable development.

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