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Water resources play a vital role in the Indian economy in agriculture. Due to concentration of rain in the four monsoon months in a year, there is a need to store the water during the rainy season for use during dry spells. Unfortunately the facilities for storage is limited and are likely to be scarce in the near future. There is therefore a need for the efficient use of the storage facilities created.

While utilizing the water stored in a reservoir two conflicting priorities emerge. The one is to maximize production per unit of water and the other is to benefit maximum number of people. Such a conflict is all the more pronounced in semi arid regions. This is resolved by situational arrangement. The lower Bhavani project command area is the best example for equitable distribution of water at the same time achieving a higher productivity. The present work is devoted to the study of water distribution and its impact on the economy in the lower Bhavani project command area.

The present work systematically evaluates the available water resources based on secondary sources of
data. The inflow into the reservoir and the water release from the reservoir for the period 1953 to 1986 have been used in the study. Detailed computation of water requirement of crops in the command area have been done and its was compared with the availability of water. The impact of water distribution on the economy was studied through a field survey of 617 households covering aspects of economy through questionnaire. The field survey was carried out in the year 1976 and later in 1988.

Lower Bhavani Project is one of the first major irrigation projects completed in Tamil Nadu after independence. The lower Bhavani dam impounds water in the Bhavani Sagar near Mettupalayam in Periyar district and through a network of canals provide irrigation for about 83,800 hectares of canal in the Gopichettipalayam, Bhavani, Erode and Dharapuram Taluks in Periyar district and Karur Taluk in Tiruchi district. Many alternative schemes were considered for more than 100 years before finalising the dam. The people of the region recognising the importance of irrigation wanted more area to be brought under irrigation. In order to satisfy the genuine demands of the people the command area has been increased in number of times during the planning and execution of the project. Unfortunately sufficient water is not available to irrigate all the area. This has resulted in great difficulties in distributing the
water. However the Lower Bhavani Project canal and the old irrigation system of Kodiveri and Kalingarayan have saved the people of this region from the recurrence of famine and scarcity conditions.

The catchment area of the Bhavani Sagar lies in the Nilgiris district of Tamil Nadu. The Sagar is formed by daming the Bhavani river after its confluence with Moyar. The catchment area is 7144 sq. km. Major part of the catchment is a plateau covered with forest over 50% of the area. 51.5% of area lie above 3000 feet. The bifurcation ratio of tributary basin of Bhavani range from 2.5 to 8.5. That the ratio increases with the order of the stream indicate elongation of the streams and efficient disposal of water. The soils are generally lateritic with moderate clay content. The erosion of the soil is checked by soil conservation measures.

The catchment area receives rainfall in both the monsoon season. The western part receives more than 250 cm. while the eastern part receives around 100 cm. in an year. The coefficient of variation of annual rainfall varies from 17 to 26%.

The copious rainfall combined with efficient runoff generation contribute to a more of less dependable
flow into the reservoir. The water availability in the reservoir is the sum of the inflow and the available storage in the reservoir. The average water availability is 2341 m. cu., meters with inflow at 2107 m. cu. meters on an average. This water is distributed to the riparian and the Lower Bhavani canal system.

The ground water reserves in the command area is estimated at 601.6 million m$^3$, out of which significant recharge comes from canals and irrigated fields.

But the available water is not sufficient to irrigate the entire command area. This storage was visualised even at project planning stage itself. In order to provide irrigation benefits to larger number of farmers as possible various methods of water distribution were attempted since the inception of the project, the intermittent system till 1959, seasonal sluice system till 1964-65 and turn system since 1967. But none of the systems has been able to meet the demands of water and equal distribution of water is still a distant dream.

Another factor which accentuated the water scarcity is the rapid increase of area under paddy. Originally the plan was to stabilize the dry irrigation crops. But the percolation and resultant rise in water table has made the paddy cultivation inevitable. This
increase in area under paddy has put further demand on water. With a view to ensure equitable distribution of water modernisation of the irrigation system has been in progress since 1986. In this modernization, structural changes were made in the distribution of water and 'Varabhandhi' has been introduced in limited area. In spite of technical and administrative improvement, the tail enders still face water scarcity. At the moment 'Varabhandhi' is introduced on a limited scale. Probably when the scheme is extended to the entire command the water situation might improve.

The introduction of irrigation has brought out significant changes in the lower Bhavani Project Command area. The construction of dam and canal network have submerged about 60 sq. km. of forest area, 21 sq. km. of cultivated area. About 145 sq.km. of scattered cultivable waste lands were used for the construction of canals and other purposes. The smaller temporary settlements have been changed into permanent settlements.

The undulating surface covered with shallow red soil to brown colour soil in association with sand and gravel has changed into intensively cultivated land with rocky outcrops. The traditional classification of soil indentify two types of soils in the command area, namely dry soils in the upland and garden-land soil in the areas
depressions and valleys. With the introduction of irrigation the dryland soil areas which where class IV were converted into class II lands supporting double and, in some favourable locations, tripple cropping. The Garden land soils which were class II lands, became class I lands. Due to undulating topography there still exists pockets of land under class VIII.

In the sample villages net sown area, double cropped area and gross cropped area have increased by 20-to 40%. In some villages double cropping became possible. In unirrigated villages, there has been reduction in net sown area. Current fallows have decreased uniformly in all the villages.

The Command area of Lower Bhavani project gets its water mainly from three source namely the water release from the reservoir, the rainfall over the command area and a ground water. The main source, the water release from reservoir, in governed by prior appropriation to the old irrigation system and to Cauvery delta. Therefore the net result is that the command area gets only 35 to 45% of the water release from the reservoir. It amounts to on an average 893 million cubic meter in a year. Variations from year to year is great and the co-efficient of variation of annual water release from to reservoir is as high as 42.11%.
The average annual rainfall over the command area is 728 mm with c.v between 25 to 30%. Although the rainfall amount is low, it is spread over 6 months in both the monsoons. The rain is generally concentrated in few spells which are comparatively more in the north east monsoon than in the south west monsoon.

The Lower Bhavani Project command area is predominantly a semi arid region. The former coimbatore district in which the command area is situated had a stabilized cropping pattern till large scale irrigation was introduced. The dry crops like cholam, cambu and ragi occupied the 45 to 60% of the cropped area. Commercial crops cotton and ground-nut occupied about 20% of the cropped area. Paddy was cultivated in 5-9% of the cropped area only.

At the planning stage of the Lower Bhavani Project it was anticipated that 4050 hectares of land will come under paddy, 50% of the cropped area would be under dry rotation crops and the remaining under cotton.

However due to porous nature of the soil in the command area, cotton could not be cultivated under irrigation condition and it was replaced by paddy.

The percentage of gross cropped area under paddy
increased from 5-9% in 1952 to 53 to 66.35% in 1961-62 and 75.19% in 1972-73.

The next important crop is groundnut. About 17475 hectares of land was under groundnuts. The proportion of area under millets has decreased from 57.35% in 1952-53 to less than 1% in 1972-73. The total cropped area irrigated increased from 2079 to about 70,000 hectares.

In the six sample villages to change in the cropping pattern is in the same pattern as in the command area. In the controlled unirrigated area there is no significant change in the cropping pattern.

In the village Thindal where modernization of irrigation system was done in 1986, the land located near the head of the distributary had higher intensity of cropping and there is larger percentage of area under paddy. In the tail end the intensity of cropping is low as well as proportion of land under paddy is low. It indicates that modernization has not achieved the desired goal of equitable distribution of water.

Water requirements of crops in Lower Bhavani Project Command area is calculated by using the Chrishansen's method from Climotological data.

The climatological data of Coimbatore observatory
are used for finding out the pan evaporation Hargreave's method is used for finding out the irrigation water requirement for each crops.

The above analysis brings out that rice crop grown for 140 days to 190 days require net irrigation requirement of during the Kharif season of 904 mm and while the effective rainfall utilised by the crop is 386 mm of water. In the rabi season the effective rainfall utilised for the crop is 388 mm while the net irrigation requirement is 904 mm.

In the case of cotton, the total water requirement is 1002 mm since cotton cultivation in this area is generally prepared during the south-west monsoon period and the contribution of water for cotton growth from rainfall is 337 mm.

For groundnut, the water requirement of groundnut are met from effective rainfall which is 114 mm and the net irrigation requirement is 896 mm.

In the case of millets, ragi during Kharif season requires the effective rainfall of 181 mm and the Net Irrigation requirement is 504 mm. In the case of Cambu the effective rainfall required is 190 mm and the Net Irrigation requirement is 562 mm. In the case of cholam the effective rainfall is 245 mm and the Net Irrigation requirements is 395 mm.
The economy of the Lower Bhavani Project Command Area has been studied based on a survey in 9 villages. The villages were chosen based on its location to the main canal, are near the head reaches, 2 in the middle reaches and 2 in the tail end of the main canal. Two villages which do not get water from the command are were chosen as controlled villages. In each village 10% of the household were surveyed through questionnaire. Altogether 617 households were surveyed.

The data were tabulated according to the size of holdings. About 83% of the households own land between 3 to 6 acres. About 5% of the households possess land over 21 acres. While majority of surveyed households are farmers owning the land, a more diversification is noticed in villages located near the dam site. Merchants, millowners and officials form about 17% in the total households surveyed but they are concentrated in the villages near to the dam site. Millowners form 21% of the households in the villages located in the middle of the canal. In controlled villages which are dry all are agriculturists.

In this command area cultivators who not only ownly own their land, but also take in land on lease is more than the owner cultivator. The leasing in and leasing out is more in the villages near the dam site. Naturally family
labour predominates. In family labour women workers participate more in agricultural operations both in the command are and unirrigated villages. Outside labourers are also employed. While there is a even distribution between males and females in terms of outside labourer, in the villages located in the middle of the canal more than 75% are female labourers. While in the tail end male workers (90%) predominate. The labourer were paid unevenly. Males generally paid Rs 5-10 per day, where as females were paid between Rs 2.50-5 per day in the year of survey 1976. The children were paid between 1.50 to Rs.3 per day.

In general the farmers are enlightened. They have adapted improved agricultural practices. The agricultural research university through its extension services contributed to the adoption of improved agricultural practices by the farmers. They spend on an average Rs.1000 to 2000 on fertilizers per acre. Majority of them possess necessary agricultural implements.

The average income of the farmers was in the range of Rs. 20,000 to 40,000. they spend most of their savings on agriculture. The farmers do take loans for agricultural operations. More than 90% of the farmer took loan from farm cooperatives, about 6% farmers take loan from money lenders. Majority of farmers have debts ranging from
Rs.10,000 to 20,000. Although seasonal employment is prevalent more than 50% of the household are engaged throughout the year.

Thus the economic conditions indicate a stability and with adequate and assured water supply, the economy will further improve.