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GROWTH - INFLATION DYNAMICS

It is indeed pleasing to learn from the recent report of Ernst & Young, the renowned global services consultancy organization that India would grow faster than China by 2013. E&Y while lowering its previous assessment of India's GDP growth rate for 2011 from 8% to 7.2%, forecasts our growth to be 8% in 2012 and 9.5% in 2013. In comparison the GDP growth of China would be less than 9% in 2013 and 8.6% in 2013. At the same time taking note of the 9% plus inflation in India, E&Y cautions that unless India takes right policy measures to control prices the portended growth would not be possible.

There is no second opinion on the prime problem of Indian economy today. Inflation is the major concern of everyone, both the policy makers and the common people. Talks of Repo Rate variations are no more confined to the bankers and the economics classroom. Everyone seems to look for a hike in it whenever the Reserve Bank of India announces the periodic monetary prescriptions; RBI Governor doesn't disappoint us!! In the last eighteen months the Repo Rate has been increased thirteen times. Over the period it has gone up from 5% to 8.5% (350bps); consequentially the Reverse Repo Rate is also increased to 7.5% (RBI maintains a difference of 1% between the two rates). The obvious goal is to contain the bank loans on the one hand and also encourage banks to hold larger short term funds with RBI; text book solution of demand management to control inflation.

The RBI move to deregulate the savings bank account has received mixed response from economists. Now banks are at liberty to offer differential rate on S/B deposits above Rs. one lakh. An increase in S/B interest rate is expected to ensure small depositors to earn an equitable interest. There is likely increase in house hold savings or lesser withdrawals from S/

B accounts leading to greater financial inclusion. YES bank has already hiked interest rates for S/B deposits by 200bps to 6% on the hopes of strong 'savings – multiplier' effect. Other banks may follow suit to attract S/B deposits. But a simple calculation reveals a different perspective. The approximate S/B deposit amount in the banking system by March 2011 is Rs. 1446900 Crores. Assuming a 100 bps hike by banks, the additional interest outflow could be Rs. 14469 Crores definitely not helpful in containing demand. Bankers say they are compelled to cut transaction costs to absorb possible increase in rates.

Optimism over the efficacy of the initiatives apart, the RBI Governor is also a worried man like everyone over the intractable and persistent inflation. The RBI defense that Monetary Policy operates with lags and there is still an element of suppressed inflation in the economy hardly convinces the common man. While growth seems to be extremely sensitive to interest rate hikes in interest rate inflation is no way affected by RBI measures. Slowdown in growth is apparent. Corporate India says that RBI has done more to slow growth than to tame inflation.

Chief Economic Advisor to finance Ministry, Kausik Basu views monetary tightening as not working and wants some out of the box thinking to address the inflation problems. The RBI Deputy Governors say 'Inflation is structural, emanating from high fiscal deficit, high global energy & commodity prices'. Fiscal slippage is an inevitable cause with the centre planning to increase its borrowings by over Rs.53000 Crores. Hardly 5% of the expected proceeds from targeted disinvestment of Rs. 40,000 Crores has materialised so far; limiting fiscal deficit to the targeted 4.6% of GDP for this financial year is but a dream. Falling rupee and costly imports do add to inflationary pressure. It is said that 10% depreciation is equivalent to a 50bps cut in interest rates. However, RBI is categorical that it won't use exchange rates as an instrument to control inflation. Exporters faced with gloomy prospects of overseas, demand a separate credit policy for exports as they fear the possible rise in interest on loans would undermine their competitiveness.

Finance Minister Pranab Mukherjee considers the current inflation is the outcome of supply constraints. Observing that food inflation has reached double digit levels Pranab Mukherjee differs with RBI pursuing tight money policy. He wants the supply constraints to be tackled. A look at the prevailing situation shows a diverse picture. But for coal there seems to be no shortage of commodities, fuel, and manufactured goods. There has been a record food grain output and comfortable stocks in the granaries. The stocks with Centre at the beginning of October 2011 stand at 51.78 million tons. RBI also recognises structural imbalances impacting food prices. The issue seems to more of accessibility of food items at reasonable prices rather than their availability. Management inertia appears to be the cause of the supply constraints.

Recently the support price for wheat has been increased by 14.75% and for rap seed & mustard the increase is 35%. Some observers link it with Uttar Pradesh elections in 2012. How to explain the higher inflation in Rural India? Is the wage - Price spiral in rural areas is more due to income rise from MGNREGS without any rise in production? Are higher income & dietary preferences a perceptible cause for increase in demand? Certainly there is a need to study the causes beyond support prices.

In this context Subba Rao's assurance that inflation will fall by December 2011 and soften at 7% by March 2012 looks skeptical. One would only wish the wisdom of the RBI Governor proves to be not wrong. There is certainly need for an inventive change in policy to ward of a recession leave alone surpassing the growth rate of China.



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We are indeed fortunate to be present at the several Conferences of the Association of the Economists of Tamil Nadu, especially this XXXII Annual Conference here at Gobi Arts and Science College, Gobichettipalayam. We are also proud at the release of the XXIII volume of our Journal, 'Peninsular Economist'. I observe scholars, young and experienced, deeming it an honour to be and to become an AET member as this affords each one of us an occasion for meeting of minds – of various age-groups and from every known part of our state of Tamil Nadu. True to a healthy practice, initiated and implemented at the AET, we are able to meet one another every year in a new centre of learning. Permit me to recollect now that an extraordinary Executive Committee Meeting took place at this venue on October 01, 2011, to chalk out details relating to the conduct of our Annual Conference this year. The EC members experienced that day, the generosity and magnanimity of the management of Gobi Arts and Science College, Gobichettipalayam. Relishing the refreshing treatment meted out to every AET Member attending the Annual Conferences, I am certain, every participant will appreciate an additional quality of the organizers, viz., and impartiality at this year's Conference.

The XXIII issue of 'Peninsular Economist' being released in this Conference is a proud moment for all of us. The ever growing number of articles year after year is satisfying to us as scholars come forward in

large numbers to articulate their views on the Conference themes. I congratulate the members for enrolling more life members under the fold of AET. Our life members' strength has crossed the landmark number of 500 at the last Conference in Tiruchendur; presently we have 522 life members. I appreciate the teacher members for successfully motivating their research scholars to write articles on specific Conference themes. The overall enthusiasm shown by our young scholars in presenting papers and interacting on the themes deserve special appreciation.

The editorial team has done a splendid job in collecting the articles from members and bringing out the journal on time. I am sure the new format of the 'Peninsular Economist' will be refreshing change relished by all.

RELEVANCE OF GANDHIAN ECONOMICS TO-DAY

Dr.M.P.GURUSAMY, Chairman,
Kumarappa Research Institution,Thayanbagam, Dindigul.

At present the global economy and the India economy are in crisis. Michel chossudovsky and Andrew Gavin Marshall observe, "In all major regions of the world, the economic recession is deep - seated, resulting in mass unemployment, the collapse of state social programs and the impoverishment of millions of people... Humanity is at the crossroads of the most serious economic and social crisis in modern history... The process of economic decline is cumulative... The global political economy is a system that enriches the very few at the expense of the vast majority. The global economic crisis has contributed to widening social inequalities both within and between countries.

After 63 years of Independence and planned economic development, we have achievements in certain areas such as communication, road and air transport, improvement in science and technology especially in large scale industries, education in general and technical, growth of infrastructure facilities such as banks and finance, industries, commerce, trade and services. We are successful in raising the standard of living of upper class and a few sections of the middle class. But there is another side of our development.

Most of the problems which we had during the British rule such as poverty, unemployment, illiteracy, inequality, backwardness of agriculture, decline of rural and village industries and exploitation of mass by few are still persisting. More than these problems we are facing new problems such as political corruption and scam, black-money, inflation, driving of rural people and tribal people from their source of livelihood, growing indebtedness, inequilibrium in regional development and more dependency on other nations.

All our efforts of economic development are hampered by the continuing economic and political problems, which are deep rooted in our soil. Our academicians are not able to find and suggest solutions to the ever increasing problems. It is observed, "The economics profession, particularly in the universities, rarely addresses the actual "real world" functioning of markets. Theoretical constructs centered on mathematical models serve to represent an abstract, fictional world in which individuals are equal.... By failing to examine the interplay of powerful economic actors in the real life economy, the process of market rigging manipulation and fraud are overlooked. The concentration and centralization of economic decision-making, the role of the financial elites, the economic think tanks, the corporate boardrooms: none of these issues are examined in the universities economic programme. The theoretical construct is dysfunctional: it cannot be used to provide and untangling of economic crisis" The 2G Spectrum scam is the best example for this.

The Gandhian economics is an alternative approach to find solutions to the modern economic problems. Our academicians are not seriously considering Gandhian economics as they are following the western economics or Marxian economics. So here is an attempt to present the nature and significance of Gandhian economics and point out its relevance to the present day.

Nature and significance of Gandhian Economics

Mahatma Gandhi may not be considered as an economist in the strict academic sense of the word. He was a social revolutionary and social scientist who aimed at creation of a new society, namely sarvodaya, with equality and justice and without any kind of exploitation and violence. In a way, he was more practical than J.M.Keynes as far as our country is concerned and more revolutionary than Karl Marx as he stood for the welfare of all.

Gandhiji had an integrated and holistic approach to life and society. His philosophy does not divide life into water tight compartments as social philosophy, political philosophy, economic philosophy and religious philosophy. So his social philosophy includes the ideas and values of politics, economics and religion.

While the modern economics based on Keynesian ideas and the Marxian economics is more and more divorced from ethical and spiritual values, the essence and basis of Gandhian economics is ethics. It is not neutral between ends. It stands for right means and right ends.

In order to have a clear understanding of Gandhian economics and appreciate its relevance today, we may point out the significant features of Gandhian economics.

1. Truth and non violence

The Gandhian economics is based on the principle of truth and non-violence. Dr.J.C.Kumarappa rightly says, "Only two life principles govern all Gandhiji's economics, social, political and other considerations, viz., Truth and non - violence. Anything that cannot be satisfactorily tested on these touchstones as it cannot be regarded as Gandhian."

2. Man centered

Gandhiji's says, "The supreme consideration is man" Gandhian economics studies man in his natural settings. E.F.Schumacher calls it meta-economics. He says, "As economics deals with man in his environment, we may expect that meta-economics consists of two parts-one dealing with man and the other dealing with the environment". While the modern economics is wealth centered, Gandhian economics is man centered and concerned with human resource development.

3.Simplicity

Gandhian economics stands for simplicity. It is for the voluntary restriction of wants. It aims at a standard of life. But the Western economics studies ever-increasing wants i.e.multiplicity of wants and aims at high standard of living.

4. Sanctity of Labour

Gandhiji values labour as an essential aspect of life. So he develops the concept of bread-labour. The Western economics advocates capital intensive techniques of production which leads to sophisticated technology and results in the creation of an army of unemployed persons.

5. Human values

Gandhian economics considers human values and welfare more important than material values. Money will not be the measuring rod. Social welfare will be the index of growth. But the Western economist sacrifices human welfare for the sake of material progress. For example, drinking and smoking will be patronized to get more revenue for the Government.

6. Welfare of All

One of the cardinal principles of Gandhian economics is welfare of all i.e. Sarvodaya. The capitalism aims at the welfare of a few. The communism tries to ensure the welfare of a large number of people.

7. Self - sufficiency

It aims at the creation of self - sufficient village community. The principle of swadeshi is inherent in it.

8. Economy of permanence

One of the objectives of Gandhian economics is to establish an economy of permanence. As only nature is permanent, it is based on nature.

9. Rural Approach

The Gandhian approach is rural as required in our nation. Gandhiji says, "We are inheritors of rural civilisation. The vastness of our country, the vastness of the population, the situation and climate of the country have in my opinion, destined it for rural civilisation"

The Western economics favours the growth of cities and urbanisation. The industrialisation i.e, growth of large - scale industries and the development of science and technology, will help urbanization.

10. Normative science

Gandhian economic is a normative science which tries to tell what it ought to be. It is not satisfied simply with analysing the existing situation and telling what it is. It is practical in its approach. It is concerned with policies for implementation rather than theories of discussion.

11. Decentralisation

One of the most important principles of Gandhian economics is decentralisation. The Gandhian concept of decentralisation is related to rural economy, self - sufficiency and swadeshi. Gandhiji advocates khadi and village industries basing on the principle of decentralisation.

12. Micro-Level Planning

Gandhian economics advocates Micro-level planning and planning from bottom for the development of the nation. So it starts with village plan and proceeds to block plan, district plan, state plan and national plan. our Five Year Plans are macro - level plans and also plans from the top.

13. Holistic approach

It adopts holistic approach. It looks whole life as one and it has integrated approach.

14. Service Economy

Gandhian economics aims to create service economy. Dr.J.C.Kumarappa, The eminent

Gandhian economist points out the five stages of human development, namely (i) Parasitic Stage - Ex. Life of a tiger : (ii) Predatory Stage - Ex. Life of a monkey: (iii) Economy of Enterprise - Ex. Life of a bee : (iv) Economy of gregation - Ex. Collective life of a family and (v) Economy of Service - Ex. Life of a mother.⁶ Service Economy is the highest form of development in which all will lead happy life.

ITS RELEVANCE TO-DAY

Gandhiji had developed his economic philosophy in the beginning of the twentieth century when India was under the foreign rule. So some people have doubt whether his theory is applicable to modern period. We present here certain facts and figures to reveal that how his theory is appropriate even to-day.

1. Rural Economy : India is still rural in its nature and content. Even now nearly 70% of our people are living in villages. Therefore Gandhiji says, "If the village perishes, India will perish too. It will be no more India. Her own mission in the world will get lost"⁷ now our villages are at the verge of destruction. This is the result of our deviation from Gandhian economics.

The conditions prevailing in India are favourable for the development of agriculture. According to the available data while only 11% of the world is arable, in India 51.5% of the total land is cultivable India has irrigation potential of 178 million hectares which is nearly 1.84 times of the cultivated area of China. We have more than adequate human resources.

In spite of the fact that India has all these advantages, it is backward in agriculture due to neglect of agriculture in our plans and budgets. The results are that nearly 20% of the total cultivated land remains uncultivated and our farmers are leaving the villages in search of employment in far away places. The black and corrupted money has been invested in land and gold. The rural people have been deprived of the very source of their livelihood. A few farmers commit suicide due to their inability to repay the loan.

Once our agriculture was self-reliant in seeds and fertilisers, But after independence, in the name of improved agriculture, chemical fertilizers and hybrid seeds were given. The farmers have been tempted to shift from food grains and vegetable cultivation to cash crops. There is no self-sufficiency in food or in any essential items. Now we are reaping its consequences, Mohan Dharja rightly says, "Chemical fertilizers and pesticides have done great harm to the soil texture. It has been revealed that more than 20 million, million ha of land under perennial irrigation, has lost its producing capacity following the use of chemical fertilizers, pesticides and excessive amounts of water. This has made such land saline or water logged."⁸

The organic (nature) farming and scientific micro-watershed programme in all the six lakh villages are insisted at present to save agriculture. These methods have been emphasised by Gandhians for a long time.

Now all cry about food crisis. All agree that elimination of hunger should be a top national priority. Why is there so much scarcity of food grains? It is due to the neglect of agriculture. We are paying heavily for this. Prof. M.S. Swaminathan, the agricultural scientist, rightly says, "The goal of food for all can be achieved only through greater and integrated attention to production, procurement, preservation and public distribution." He also points out, "Unless we realise that agri-

culture in India is not just a food producing machine, but is the backbone of the livelihood of over 60 per cent of our population, rural deprivation and suffering will not only continue to persist, but will get worse leading to severe social unrest."¹⁰

The MGNREGP (The Mahatma Gandhi National Rural Employment Guarantee Programme) is the monument for our failure in the implementation of rural development programmes under our five year plans. The National Rural Employment Guarantee Act (NREGA) promised a revolutionary demand-driven, people centered development programme. It is expected that planning, implementation and social audit by gram sabha and gram panchayats can engender millions of sustainable livelihoods following initial rounds of wage employment. As Milhir Shah says, "But the first three years of the programme have also shown that NREGA suffers from ills - leakages and delays in wage payments, non-payment of statutory minimum wages, work only for an average of 50 days per annum as against the promised 100 days, fudged muster rolls, few durable assets and even few sustainable livelihoods."¹¹

Unless the Gandhian idea of village swaraj is implemented with due emphasis on agriculture, animal husbandry, khadi and village industries with decentralised Panchayat Raj, the rural economy will not have sustainable growth.

2. Poverty and Unemployment

The twin problem of poverty and under employment are the complex problems deep rooted in the systems of our economy. They are inter related and interdependent. One may be the cause for another. So we may deal both the problems simultaneously.

The problem of poverty is more complex than the problem of unemployment as it is the product of our socio, political, economic and religious practices we followed from time immemorial. So far much has been written about the causes and miseries of poverty in India. Gandhiji told in 1926 itself, "A starving man thinks first of satisfying his hunger before anything else. He will sell his liberty and all for the sake of getting a morsel of food. Such is the position of millions of people in India. For them liberty, God and all such words are merely letters put together without the slightest meaning"¹²

It is told that China which accounted for 38% of the world's poor in 1990, saw its share fall to 12 per cent by 2005. India on the other hand, saw its share rise from 22 to 30 per cent. A small increase in the poverty line from \$1.25 a day to \$1.45 a day increase the number of people below the poverty line in India by 30 percent from 456 million to 590 million."¹³ The vicious circle of poverty has become the oceanic circle of poverty.

One of the basic reasons for the ever increasing poverty is the rapid growth of population in spite of our efforts of family planning. Since we were not able to increase our production to meet the increasing demand and achieve full employment level, we are not able to increase our production to meet the increasing demand and achieve full employment level. We are not able to eradicate poverty.

Another important reason for this chronic poverty is the maldistribution of income and wealth. The major share of the increased income and wealth has been pocketed by the top 15 per cent of the people. After independence the rich has become richer and the poor has become poorer.

The unemployment which was the result of the decline of rural industries due to the British Economic Policy, continued to grow under our popular government. It is reported that in 1960-61, 1.7 million were seeking employment. This figure had increased to 17.8 million in 1980-81 and 32.7 million in 1988-89. Recently, we have produced many technical people due to the growth self-financing Educational system. It has added new dimension to the problem of unemployment. Due to global financial crisis and economic slow down, the job losses are increasing.

We realise that there is not much scope for establishing large-scale industries in an unlimited way due to shortage of capital and intermatinal marketing problems, Our corporate sectors are interested to invest in the capital intensive service oriented enterprises where they could reap high profit. So we have to follow our own methods of increasing employment opportunities with the initiative of people and with their own resources.

We have to develop micro-enterprises small scale, village and agro-industries. The village panchayats have to plan and create jobs. The MGNREGP has to be reshaped to create source of employment. The self-help groups have to be provided with opportunities to establish micro-enterprises. If gandhian methods are followed in rural areas to achieve self-sufficiency in the basic needs of the people, we may be able to achieve the objective of full employment.

3. Inflation

Another important problem which India faces is inflation. The prices of more or less all kinds of goods including necessities are going up and up beyond the reach of common man. Ashwani kumar, the union minister of state for industry, says, "The steep rise in inflation, triggered by an unprecedented rise in the international price of crude oil and global food shortage, present and extraordinary challenge before India"¹⁴.

The important reasons for inflation are the fast increasing expenditure on our Five Year Plans, the widening public expenditure, uncontrolled public borrowings, foreign debts, low productivity and defective foreign trade.

The inflation could have been controlled if we have adopted Gandhian methods. The public expenditure should be reduced by avoiding free gifts, grants and subsidies and avoiding undue remuneration to Government staff. There should be decentralisation of public works. The local bodies have to be encouraged to undertake more activities with their own funds. The production of goods and services has to be increased to meet the demand. The decentralisation of industries is needed.

4. Consumerism

The growing consumerism due to modernisation, urbanization and globalisation is a great danger to the growth and welfare of the country. It is told the modern civilisation consists of 7Cs namely 1. cell phone, 2. computer, 3. car, 4. confeteria, 5. cinema, 6. camera and 7. credit card. In addition to this, they spend a lot for their habits as smoking, drinking, and seeing films. Unless consumerism is controlled the welfare of the people may not be protected.

The Gandhian principle of simplicity has to be followed by all. The capitalism and market economy try to multiply the wants of the people.

5. Growing Black money

Another evil of our economy is the accumulation of black money. It runs a parallel Government. It is the source of many socio - economic problems. It spoils the system of democracy.

A few years back the Committee of the Associated Chamber of Commerce and Industry on Black money, headed by Ramakrishna Bajaj, said that the widespread generation of black money accounted for 21 per cent of the gross domestic product (G.N.P) and it was estimated about Rs.80,000 crores per annum. Now it would be a few lakh crores.

The serious problem of this black money is that most of this money is not available for our economic development. This money is going away from our nation illegally to nations which are tax havens such as Switzerland. The size of the illegal money transfers is amazing. Estimates have varied between Rs.30 Lakh crore and 70 Lakh crore, According to Dr. Vidyanathan, over the 60 years since Independence, the country could have lost as much as \$ 1.5 trillion.

Unless ethics are followed in economics this problem will continue. Most stringent action is necessary to enforce ethics in all economic dealings.

6. Exploitation and Corruption

In our country exploitation and corruption have reached their zenith. Over enthusiasm to accumulate wealth motivates the people amass wealth without bothering about the means. The stronger will exploit the weaker. In our capitalistic system, most of the industrialists, business men, doctors lawyers, cine-stars and cricket players are doing it legally.

The corruption has grown any limit. The Government officials in collaboration with the politicians have nourished corruption. Now people have lost faith in the executive, legislative and judiciary. The Commonwealth Game scam and the 2G spectrum scam will elaborate the extent of political corruption. Most of the gains and benefits of our development are eroded by corruption and exploitation.

As the cancer of corruption seems all pervasive we will not establish welfare state without eradicating corruption. Gandhiji says, "Accumulation of wealth without work is a social sin." The theories of economic growth forgetting corruption and exploitation will not serve their purpose.

7. Alternative to capitalism

Gandhiji was not satisfied with the working of capitalism. As its evils were multiplied he wanted to bring revolutionary changes in the structure of the economy. He was not able to accept communism as it is not bothered about the means. In order to bring transformation in the modern society, he formulated his unique theory of Trusteeship. Through trusteeship, he wanted to practice the principle of sharing, Gandhiji expected the capitalists to be the trustees of wealth. If necessary, he advocated the regulation of capitalism. He insisted on the principles of equality and social justice.

As globalisation with its methods of privatisation and liberalisation has strengthened capitalism. We have to seriously think about an alternative system to it. The Gandhian economic thought will guide us.

8. Global economic crisis

This era of globalisation has faced the problem of global financial crisis in the year 2008. India has also been affected by this.

The answer to globalisation and global crisis is swadeshi. As per the swadesi principle, we have to decide our own course of development according to our needs and availability of resources. The swadeshi philosophy has to direct and guide the national economy. Gandhian economic thought teaches to think globally and act locally.

Conclusion

If we understand the Gandhian economics in the context of the present Indian economic situation, we will agree that it is relevant today. So far we have not tried Gandhian methods in our nation. As now we are facing with more problems and in the stage frustration, we have to find solution to them. If we adopt Gandhian economics firmly with a strong will power, we will definitely succeed and be model to the entire world.

Foot - Notes

1. Michel Chossudovsky and Andrew Gavin Marshall, 'The Global Economic Crisis', Global Research 2010, pp.xv to xix
2. Ibid. p.xviii
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13. C.P.Chandrasekar, 'New Light on Global Poverty', The Hindu 2-9-2008.
14. Aswani Kumar, 'Domestic Inflation, Result of Imported Inflation' The Hindu, 23-6-2008.

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Foot-Notes

1. Michel Chossudovsky and Andrew Gavin Marshall, "The Global Economic Crisis," Global Research 2010, pp. 1-10.
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13. P. S. Chandra, "New Light on Global Poverty," The Hindu 2-9-2008.
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A STUDY ON LAND RESOURCE MANAGEMENT IN ALLITHURAI VILLAGE – TIRUCHIRAPALLI DISTRICT

INTRODUCTION:

The physical characteristics of land, the institutional and other resources frame- work like labour and capital availability determine economic development. The reporting land – the land for which the data on classification of land use available amounted to 93%. The area separated as “cultivable waste” has remained stationary at 6.4%. A part of the land that is not utilized at present is classified as waste land which includes baked and rocky deserts. Population expansion on the one hand and advanced standard of living on the other hand resulted in ever increasing demand for residential land – both in village and towns apart from establishment of more number of industries, development of commerce, transport, communication and recreational facilities.

In this context, the present paper on “Land Resource Management in Allithurai Village-Tiruchirapalli District” aims to know the trend in land use pattern and the need and scope for a planned shift in it. The need to plan and manage all uses of land in an integrated manner is very urgent today to avoid social, economic and environmental problems.

OBJECTIVES:

- To know the trend in land utilization.
- To find out the causes and effects of change in land use pattern.
- To analyze the area under cultivation of different crops.
- To study the change in cropping pattern.
- To give suggestions for a planned shift.

METHODOLOGY:

Both primary and secondary data have been used. The secondary data have been collected from Allithurai Panchayat Union, Department of Agriculture, Taluk Office -Srirangam and from reputed Journals. The primary data have been collected from the households and agriculturists of the Allithurai Village.

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TABLE NO: 1
TRENDS IN CROPPING PATTERN

SL	CROPS CULTIVATED	TREND IN AREA
1.	PADDY	-VE
2.	COCONUT	+VE
3.	SUGARCANE	+VE
4.	BANANA	-VE
5.	TAMARIND	-VE
6.	TEAK	+VE
7.	MANGO	+VE
8.	JASMINE	+VE
9.	CUMBU	+VE

Source: Primary data

SIZE OF LAND HOLDINGS:

The size of land holding decisively affects the income from agriculture. Farming of certain size under certain conditions yields the best results and gives the maximum return to the cultivators. The crop failure, unfavorable agricultural price policy, increasing cost of cultivation makes the farmers to withdraw themselves from the tedious agricultural operation slowly, so that the agricultural lands are gradually coming under the ownership of flat promoters.

TABLE NO: 2
CROP CULTIVATION DURING THE YEARS 2004-2010 (IN HECTARES)

S.No	CROP CULTIVATED	2004-05	2009-10
1.	PADDY	398.8	360.92
2.	COCONUT	23.89	23.13
3.	SUGARCANE	11.97	14.03
4.	BANANA	7.23	6.97
5.	TAMARIND	8.4	7.76
6.	TEAK	-	0.20
7.	MANGO	-	0.18
8.	JASMINE	3.26	4.32

Source: Official Records of Panchayat Union

IRRIGATION FACILITY:

Land resources conversion take place at Allithurai village due to the problems related to assured water supply. Nowadays undependable river water supply and failure of monsoon have resulted in dry land farming. The profitability from dry farming not being attractive has resulted in land conversion. After 2003 the dry crops like Cumbu are cultivated by the farmers.

SUGGESTIONS:

- ✓ To improve the area under agricultural crops and thereby to retain the land for agriculture operation, there is need for improved agricultural technology, irrigation, timely supply of electricity, live stock sector and literacy.
- ✓ To improve the efficiency of delivery systems of agricultural development, the elected institutions can be empowered.
- ✓ To avoid irrigation problems and depletion of ground water to protect land quality and reduce environment problems, diversification can be adopted.
- ✓ To enhance the growth and development introduction of water – saving technologies, establishment of secure water right to users, decentralization of water management, pricing reforms can be followed.

CONCLUSION:

Effective conservation of non irrigated areas into irrigated areas by ensuring irrigation facilities as it was found that non-irrigated areas form a substantial part but contributing very little to production.

NATURAL RESOURCE MANAGEMENT – LAND AND WATER

Introduction

Natural resources include are those things which have been best used by nature and upon which man works to produce goods for the satisfaction of his wants. The process of development implies a better and more efficient use of these resources by; man with the help and aid of those resources which he has created himself for facilitating his work. Lack of natural resources does affect the growth process adversely unless the parity of local based resources is compensated by obtaining them from abroad. Among the important natural resources which country needs to process of obtain are the land resources, the forest worth, the water sources. The land resources, the forest wealth, the water resources, The mineral resources, The marine resources, etc., apart from the proper climatic conditions and the topographical location. The extent of amount of resources is not limited to only increase which are known or discovered. It also includes undiscovered resources, which may come to be found out only with the process of development of knowledge and skill and may thus contribute to the future course of the growth of an economy.

A natural resource may be defined as component of the environment that can be utilized by man to support life on the earth. These resources are available in atmosphere hydrosphere and lithosphere in the form of air, water, soil minerals, forests, food, animals, plants, energy as well as human beings. Thus any material may be termed as a resource provided a technology is available to transform that into a more valuable product.

Management of Land Resource and Control of Land Degradation

Soil is considered as a non-renewable resources a the process of land degradation is very important. Some of he measures taken are:

Afforestation and reforestation

Afforestation is growing forest in an area where no forest existed before, while reforestation means replanting forest at a place where forest has been destroyed and natural regeneration is not possible. Restoration of forest helps to check soil erosion, floods and water logging.

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Better agricultural practices

- (a) Terracing
- (b) Regular cultivation
- (c) Crop rotation
- (d) Fallowing

Planting wind breaks and shelter belts

To check wind velocity, and provide wind breaks and control soil erosion two or more rows of tall trees are planted at right angles to the direction of prevailing winds.

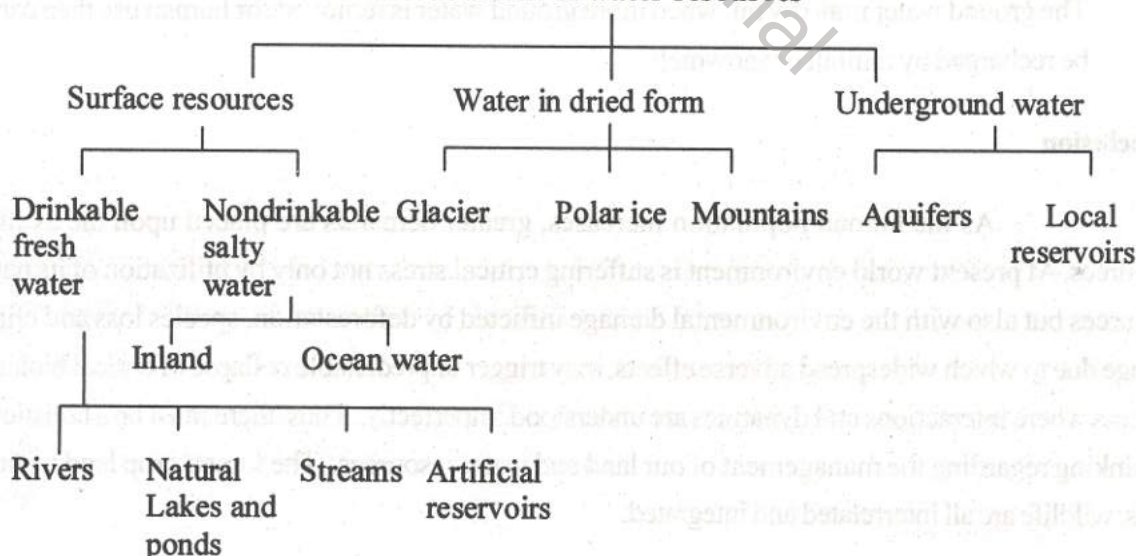
Water Resources

If earth were smooth, the ocean would be sufficient to submerge the entire world to a depth of 800 feet. At global scale about 71% of earth surface is covered with water. Hydrosphere is estimated to have a water volume of 1.4 billion km^3 , of which 97% to 98% is ocean water and the rest 2 to 3% is available as fresh water. Out of the 3 to 2% fresh water 1.77% occurs as polar ice, 0.5% as ground water, 0.02% in lakes and rivers, 0.0% as soil water and 0.001% as moisture in the air.

Water on the earth is regulated by; water cycle where 84% of global evaporation occurs from ocean surface and 16% from the land surface 77% of the rain falls on the sea surface while 23% falls on land. A net gain of 7% rainfall water on land maintains fresh water reserves.

The annual evaporation is equal to the annual basis total rainfall and the excess water is returned to the ocean by surface run off through rivers and subsurface water flow.

Various forms of water resources



Use of Water Resources

Population explosion, expansion of industries and agriculture have increased the demand for water manifold. 70% of water is used for agriculture, 1.1% for domestic and municipal supplies and the rest is used by various industries such as cement, mining, detergents, textile, leather and pharmaceutical industries etc. Water is the basic necessity of life for all on this earth. With growing population water is subjected to considerable use and abuse. Even rain water is not pure, it absorbs many atmosphere pollutants which might enter the ground. Acid rains are also examples of polluted rain waters damaging plants and animals. Fresh water is a finite source, through it is supported by hydrological cycle in which oceans maintain a perennial flow of water. Over exploitation of water resource is resulting in many problems.

- i. To fulfill the needs of increasing human population, ponds, rivers and lakes are over drawn.
- ii. Excessive irrigation in the arid and semi arid regions causes accumulation of salts in the soil reducing crop productivity.
- iii. The wetlands are drying up, More and more ground water is being polled for human use, which has lowered water table alarmingly.
- iv. The continuous depletion of ground water in the coastal regions often lead to the movement of sea water into fresh water wells, spoiling water quality.
- v. Heavy rainfall on exposed soils results in rapid run off causing soil erosion. It puts low land areas at extreme risk of destruction due to flooding. Soil erosion also results in sedimentation of water-ways that can harm aquatic life.
- vi. The ground water may dry out when more ground water is removed for human use then can be recharged by rainfall or snowmelt.

Conclusion

As the human population increases, greater demands are placed upon the available resources. At present world environment is suffering critical stress not only by utilization of its natural resources but also with the environmental damage inflicted by deforestation, species loss and climate change due to which widespread adverse effects, may trigger unpredictable collapse of critical biological systems where interactions and dynamics are understood imperfectly. Thus, there must be a holistic way of thinking regarding the management of our land and water resources. The forests, crop lands, grazing lands, wildlife are all interrelated and integrated.

ROLE OF VOLUNTARY COLLECTIVE ACTION IN THE MANAGEMENT OF COMMON PROPERTY RESOURCES



Introduction

The concept of common property (also referred to as “collective goods”, “common goods”, “public goods”, “the commons”, “collective resources”, “common pool resources”, etc.) refers to something that is used as if it belonged to all members of a group. The group may be large or small. An essential aspect of common property is that no member can be excluded from the use of the resource. In other words, CPRs are resources that are common to and jointly used by the members of an Identified community or group. Such group-specific resources may include village pastures, village forests, Irrigation facilities and other resources commonly used by a community.

Decline of CPRs

Another aspect which has drawn the attention of researchers on CPRs is the decline of these resources. It is estimated that the CPR area in India has declined by about 26 to 63 per cent. In addition to this quantitative decline, qualitative decline of CPRs in terms of their reduced productivity have also been oral reported, based mainly on information drawn from history and scattered village records.

Studies have attributed the decline at CPRs to population growth, increasing commercialization, privatization, public policies, technological and environmental stress like droughts or changes floods. It is also reported that the degradation of CPRs is an outcome of their over-exploitation and poor up keeping, brought on by a slackening or complete abolition of traditional formal and informal management practices and, thereby, limiting local control over the resources.

It has been pointed out that the rural rich and the poor contribute differently to the decline of CPRs. The main tendency among the rural rich is to withdraw from CPRs as product-users since the labour costs for appropriating and using them is higher than the value of the products appropriated. They rely more on alternative options like own supplies of biomass and a switch from using renewable CPR products to non-renewable and/or outside (Jodha, 1986; Stewart, 1989). They also tend products to grab CPR lands for

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private use (Jodha, 1986; Brara, 1997; Iyengar, 1989). Studies have shown that, due to the lower returns from depleting CPRs, the rural rich are often indifferent towards the maintenance of these resources.

The poor households, on the other hand, utilize the CPRs as a vital source of sustenance, overexploiting them due to non-availability of alternative options. Another factor, which some studies have noted as a cause for CPR degradation, is the practice of open grazing.

Management of CPRs

Generally common property resources are faced with the familiar free rider problem. The conventional solution to free rider problem is the government intervention (public action) with penalties and incentives to regulate the behavior of individuals. The other option is voluntary collective action or an action by more than one agent for providing a public or collective good. So this paper has made an attempt to obtain the sustainable management of CPRs through voluntary collective action.

Collective action

Collective action can be understood as an action taken by a group of individuals to achieve common interests (Marshall 1998). Collective action can be voluntary or obligatory for specific persons, e.g. in water users associations where all land owners in an irrigation scheme are obliged to join an association for collective action. Members can act directly on their own or through an organization. Collective action itself can be of several types, depending on the type of work and type of action.

Types of work:

- Group work - all members are required to do the work together (e.g. clean a common irrigation canal).
- Organized work - all members are required to do the work, but not together. Their work may be organized in rotation (e.g. patrolling a community forest).
- Independent work - all members are required to do the work, but they can work independently (e.g. maintaining the irrigation canals that cross one's own fields).

Type of action:

- Physical - members do physical work
- Contribution - by cash or in kind instead of physically
- Regulation - members prohibit something, supervise or enforce regulations

The degradation of open access resources that is predominantly observed in many developing countries may be therefore attributable to the presence of limits to voluntary collective action in the local village economies. Therefore, an outside agency or government can play an enabling role to promote collective action. For example, government can give either a subsidy or a loan to village communities for creating community assets that are complementary to preservation. It can undertake land reforms to reduce the skewness in the distribution of land in a village community. Government can also provide alternative employment for populations in excess of threshold levels in the village communities. In all these cases, government plays an enabling role, and there is no coercion or infringement of individual rights in the appropriation of benefits.

Conclusion

There are two options for the management of commons: (a) Governmental regulation and (b) Voluntary collective action. The market failure in the management of commons is well recognized and so is inefficiency of governmental regulation. The limits to voluntary collective actions are the people's capabilities to harness the preserved commons and the fairness in the appropriation of benefits. If an outside agency or government plays an enabling role in removing these impediments, voluntary collective action is possible. The role of government in this case does not involve any coercion or encroachment on individual rights. The government acts only as a catalyst to collective action. Hence this paper mainly highlights the catalytic role of government in promoting the voluntary participation of people in the common property resources management.

AGRICULTURE, LAND DEGRADATION AND FOOD SECURITY ... WHAT WE ARE GOING TO LEAVE FOR FUTURE ?

INTRODUCTION :

Land and water are God's gift. These natural resources provide everything for us. But what we are doing ? Through our activities by spoiling the environment, we are destroying these natural resources. If land is degraded and water is contaminated, it will affect the agriculture sector and the Human life. Even though it is a known factor to us, still we are not thinking about the food security and the prices of the commodities.

SUSTAINABLE DEVELOPMENT IN AGRICULTURE :

Sustainable development emerged as an important theme of development in 1987.

Sustainable agriculture refers to the ability of a farming system to produce food, without causing severe and irreversible damage to the ecosystem. Generally, sustainable agriculture integrates three things – environmental health, economic profitability and social and economic equity, it desires that all the sectors including farmers, farm labourers, credit providers, policy makers, scientists, researchers and consumers at large must act coherently towards this goal. Although it is difficult in the current scenario, yet it is desirable for the betterment of the future.

The Green Revolution has been the corner stone of India's agriculture development, transforming the country from one of food deficiency to self sufficiency country. Further, the so called, "Rainbow Revolution", enabled the nation in livestock, vegetables, fruits and pulses. Although India has made significant progress in the agriculture and allied activities, but in comparison to developed countries and some of the developing countries even the picture is not so sanguine.

The Vision 2020 document of the National Planning Commission has also reiterated. India needs to sustain an agricultural growth rate of 4.0 to 4.5 percent in order to reduce food insecurity and poverty.

MEANING OF FOOD SECURITY :

The concept of food security relates to a condition, when each and every individual is able to get a nutritionally adequate diet in quality as well as quantity and the food consumed is efficiently being utilized biologically for a healthy productive living. But this concept is very far from our country where even after fifty seven years of independence, under nutrition, malnutrition and silent hunger prevail in the different sections of the society. Declining per capita availability of pulses and low intake of fruits and vegetables, milk, egg and other animal products. It is otherwise defined having access at all time to enough food for an

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active healthy life style. This implies that safe and nutritious food is available and that household resources are sufficient to meet the cost. Hence the issue of the food security is more concerned with access to food supply rather than availability and stability of food supply.

CHANGES IN THE CROPPING PATTERN :

Nowadays people doesn't like to wait for long period of cultivation and they do not like to leave the land as ideal in between the cropping production. One of the fears expressed relates to the possibility of intensification of commercialized agriculture and shifts of interest from low priced grain cultivation to relatively more remuneration crops where there is better scope for value addition. As the area under food grains tend to decline in the recent years and if more area is converted for fruits and vegetables and the present land of yield gap continues, food security under severe pressure causing, severe starvation in future.

PROBLEM OF HUNGER – STARVATION :

Since the early 1990s food production in developing countries has tripled, more than keeping up with population growth. If all the food producers were distributors equally every persons would be able to consume 2760 calorie a day addressing hunger means ensuring that people have command over the resource needs to acquire food.

Hunger is more than just a lack of available food. It is a problem of definition in food entitlement and deprivation in related essential services (healthcare, education, safe drinking water, adequate sanitation). Food entitlement differs from food availability with income and then consume, rather than what is available in the markets.

Everyday 799 million people in developing countries about 18% of the world's population go hunger. The hunger situations in developing countries can be tackled through distribution system and increasing production.

More than three quarters of hungry people are in rural areas of developing countries. About half life in farm households an marginal lands, where environmental degradation threatens agricultural production. Moreover, landlessness is rising in most rural region because of higher farming density and unequal land distribution. Trend in the shift of malnutrition to urban cities also notices in developing countries recently,

WHAT IS THE PRESENT SITUATION OF FOOD GRAINS PRICE ? INDIAN FOOD PRICE CRISIS – INFLATION ?

No doubt, technology will bring about an improvement in agricultural productivity and competitiveness, but more important is how the technology is driven by market demands? India invests a substantial amount of money in the agricultural sector but a large share goes to subsidies for fertilizer, electricity, water and Minimum Support Price and so on. The spending on subsidies is about 4 times greater than the spending on investments. Hence agricultural scenario is dominated by features having short term impact rather than lasting and long term. This needs to be reversed. A highly regulated market discourages private investment in rural areas. Since agricultural sector is becoming more responsive to market demands, public-private partnership have an opportunity to play a larger role. This is likely to improve agriculture productivity, competitiveness and supply response and will be critical in responding to the new challenges of the agriculture sector.

CONCLUSION :

Sustainable agriculture and food security are two important aspects of ensuring “food for all and food guarantee for all”. The future of agriculture will be in jeopardy if the Natural resources like water and land are over exploited. The depletion of ground water will not only raise cost of production, but also create severe environmental crisis. The excessive use of fertilizers and pesticide will retard soil fertility.

We should take these problems in our mind, and by changing our life pattern, giving importance for our own life and for future generation, Let us join and form an unity to protect the Natural Resources.

CLIMATE CHANGE - IMPACT ON SUSTAINABLE DEVELOPMENT

Water scarcity is expected to become an ever-increasing problem in the future, for various reasons. First, the distribution of precipitation in space and time is very uneven, leading to tremendous temporal variability in water resources worldwide (Oki et al, 2006). For example, the Atacama Desert in Chile, the driest place on earth, receives imperceptible annual quantities of rainfall each year. On the other hand, Mawsynram, Assam, India receives over 450 inches annually. If all the freshwater on the planet were divided equally among the global population, there would be 5,000 to 6,000 m³ of water available for everyone, every year (Vorosmarty 2000). Second, the rate of evaporation varies a great deal, depending on temperature and relative humidity, which impacts the amount of water available to replenish groundwater supplies. The combination of shorter duration but more intense rainfall (meaning more runoff and less infiltration) combined with increased evapotranspiration (the sum of evaporation and plant transpiration from the earth's land surface to atmosphere) and increased irrigation is expected to lead to groundwater depletion (Konikow and Kendy 2005).

Water use has been growing far faster than the number of people. During the 20th century the world population increased fourfold, but the amount of freshwater that it used increased nine times over. Already 2.8 billion people live in areas of high water stress, the report calculates, and this will rise to 3.9 billion – more than half the expected population of the world – by 2030. By that time, water scarcity could cut world harvests by 30 per cent – equivalent to all the grain grown in the US and India – even as human numbers and appetites increase.

There are four main factors aggravating water scarcity according to the IPCC:

1. The growth of world population in the last century has tripled. It is expected to rise from the present 6.5 billion to 8.9 billion by 2050. Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water.
2. Increased urbanization will focus on the demand for water among a more concentrated population. Asian cities alone are expected to grow by 1 billion people in the next 20 years.
3. High level of consumption as the world becomes more developed; the amount of domestic water used by each person is expected to rise significantly.
4. Climate change will shrink the resources of freshwater.

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Changes in Precipitation and Drought Patterns

Projections of changes in total annual precipitation indicate that increases are likely in the tropics and at high latitudes, while decreases are likely in the sub-tropics, especially along its poleward edge. Thus, latitudinal variation is likely to affect the distribution of water resources. In general, there has been a decrease in precipitation between 10°S and 30°N since the 1980s (IPCC 2007). With the population of these sub-tropical regions increasing, water resources are likely to become more stressed in these areas, especially as climate change intensifies. While some areas will likely experience a decrease in precipitation, others (such as the tropics and high latitudes) are expected to see increasing amounts of precipitation. More precipitation will increase a region's susceptibility to a variety of factors, including:

1. Flooding
2. Rate of soil erosion
3. Mass movement of land
4. Soil moisture availability

These factors are likely to affect key economic components of the GDP such as agricultural productivity, land values, and an area's habitability (IPCC 2007). In addition, warming accelerates the rate of surface drying, leaving less water moving in near-surface layers of soil. Less soil moisture leads to reduced downward movement of water and so less replenishment of groundwater supplies (Nearing et al 2005).

Melting Glacial Ice

Water supplies can also be affected by warmer winter temperatures that cause a decrease in the volume of snowpack. The result is diminished water resources during the summer months. This water supply is particularly important at the midlatitudes and in mountainous regions that depend upon glacial runoff to replenish river systems and groundwater supplies. Consequently, these areas will become increasingly susceptible to water shortages with time, because increased temperatures will initially result in a rapid rise in glacial meltwater during the summer months, followed by a decrease in melt as the size of glaciers continue to shrink. This reduction in glacial runoff water is projected to affect approximately one-sixth of the world's population (IPCC 2007).

Water Quality

A decline in water quality can result from the increase in runoff and precipitation- and while One of the most significant sources of water degradation results from an increase in water temperature. The increase in water temperatures can lead to a bloom in microbial populations, which can have a negative impact on human health. Additionally, the rise in water temperature can adversely affect different inhabitants of the ecosystem due to a species sensitivity to temperature. The health of a body of water, such as a river, is dependent upon its ability to effectively self-purify through biodegradation, which is hindered when there

is a reduced amount of dissolved oxygen. This occurs when water warms and its ability to hold oxygen decreases. Consequently, when precipitation events do occur, the contaminants are flushed into waterways and drinking reservoirs, leading to significant health implications (IPCC 2007).

Effects on Coastal Populations

For coastal populations, water quality is likely to be affected by salinization, or increased quantities of salt in water supplies. This will result from a rise in sea levels, which will increase salt concentrations in groundwater and estuaries. Sea-level rise will not only extend areas of salinity, but will also decrease freshwater availability in coastal areas. Saline intrusion is also a result of increased demand due in part to growing coastal populations that leave groundwater reserves increasingly vulnerable to contamination and diminishing water reserves (IPCC 2007).

Economic Water Scarcity

On the other hand, economic water scarcity occurs when water resources are abundant relative to water use, but insufficient infrastructure or financial capacity prevents people from accessing the water they need. This dilemma plagues an additional 1.6 billion people worldwide, predominantly the rural poor and particularly in Africa. For this reason, additional investment in the water sectors of developing countries could play a transformative role in poverty alleviation. Slum dwellers, for example, typically pay five to 10 times more per unit of water than do people with piped water, and in rural households, women and children may spend the majority of their day fetching water from distant, and often unsafe, sources. The majority of the world's poorest people are smallholder farmers, most of whom rely on low-yield, rain-fed agriculture, and their livelihoods are constantly threatened by inconsistent precipitation and drought.

Poverty and water

The poor are the ones who suffer most. Water shortages can mean long walks to fetch water, high prices to buy it, food insecurity and disease from drinking dirty water. But the very thing needed to raise funds to tackle water problems in poor countries - economic development - requires yet more water to supply the agriculture and industries which drive it. The UN-backed World Commission on Water estimated in 2000 that an additional \$100bn a year would be needed to tackle water scarcity worldwide. Even if the money can be found, spending it wisely is a further challenge. Dams and other large-scale projects now affect 60% of the world's largest rivers and provide millions with water. The World Water Forum, which will be attended by 20,000 people in Istanbul, will hear stark warnings of how half the world's population will be affected by water shortages in just 20 years' time, with millions dying and increasing conflicts over dwindling resources.

Pollution and disease

Global water consumption rose sixfold between 1900 and 1995 - more than double the rate of population growth - and goes on growing as farming, industry and domestic demand all increase. As

important as quantity is quality - with pollution increasing in some areas, the amount of useable water declines. More than five million people die from waterborne diseases each year - 10 times the number killed in wars around the globe. And the wider effects of water shortages are just as chilling as the prospect of having too little to drink. Seventy percent of the water used worldwide is used for agriculture. Much more will be needed if we are to feed the world's growing population - predicted to rise from about six billion today to 8.9 billion by 2050. And consumption will soar further as more people expect Western-style lifestyles and diets - one kilogram of grain-fed beef needs at least 15 cubic metres of water, while a kilo of cereals needs only up to three cubic metres.

Technical solutions

New technology can help, however, especially by cleaning up pollution and so making more water useable, and in agriculture, where water use can be made far more efficient. Drought-resistant plants can also help. Drip irrigation drastically cuts the amount of water needed, low-pressure sprinklers are an improvement, and even building simple earth walls to trap rainfall is helpful. Some countries are now treating waste water so that it can be used - and drunk - several times over. Desalinisation makes sea water available, but takes huge quantities of energy and leaves vast amounts of brine. The optimists say "virtual water" may save the day - the water contained in crops which can be exported from water-rich countries to arid ones. But the amounts involved would be immense, and the energy needed to transport them gargantuan. And affordable, useable energy will probably soon be a bigger problem than water itself.

In any case, it is not just us who need water, but every other species that shares the planet with us - as well all the ecosystems on which we, and they, rely. Climate change will also have an impact. Some areas will probably benefit from increased rainfall, but others are likely to be losers. We have to rethink how much water we really need if we are to learn how to share the Earth's supply. While dams and other large-scale schemes play a big role worldwide, there is also a growing recognition of the value of using the water we already have more efficiently rather than harvesting ever more from our rivers and aquifers. For millions of people around the world, getting it right is a matter of life and death.

The Influence Of Tank Silt And Coirpith On Soil Physical Properties In The Reclamation Of Theri Soil

Introduction

Theri-soils are located in southern districts of Tamilnadu particularly along the coastal areas of Tuticorin, Tirunelveli and Kannyakumari districts. It situated in the land area of about 20000 hectares. It occupies about 11000 hectares only in Tuticorin district. Its area is equal to 70% of paddy cultivating area in this district. If these theri lands are converted into cultivation lands we can considerably increase the food production of the district. The main drawback of the soil are their low in nutrient status, water holding capacity, organic carbon content and are also affected by wind erosion. But below 20 feet, these soils have quality ground water. Tank silt and coirpith mixed in equal proportions was added to the soil to improve its quality.

Materials And Methods

Theri-soil (TH) samples are collected from an area located at a distance 15 Km from Tiruchendur in Tuticorin district of Tamilnadu. The study area has semi-arid tropical climate. The average annual rainfall is 630 mm. The soil samples were taken upto a depth of 30 cm from the top surface. For amendments, the coirpith (C) was collected from the nearby coir factory. Pleurotus sojarcaju mushrooms were used to compost coirpith. The tank silts of nearby tanks were collected, dried and powdered and mixed with dried. Before using it, all the powdered tank silt was passed through 2 mm sieve for ensuring uniformity in size. The tank silts and the coirpith are mixed in equal proportions (CS) Ten different combinations viz., TH+ 10% of CS, TH+ 20% of CS, TH+ 30% of CS,

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Table 1. Effect of various mixtures of coir pith and tank silt on the physical properties of theri – soil

PERCENT	pH	EC	BULK DENS	POROSITY	W.H.CAP	ORG.CARB	HYD.CON	VOL.EXP
10.00	8.06	0.12	1.73	42.70	26.13	0.15	185.00	5.21
20.00	7.98	0.13	1.68	42.00	27.44	0.22	176.00	6.14
30.00	7.90	0.15	1.64	40.90	28.59	0.36	165.00	6.83
40.00	7.85	0.16	1.62	40.00	30.01	0.38	145.00	7.57
50.00	7.90	0.18	1.56	39.00	31.12	0.42	135.00	8.36
60.00	7.73	0.19	1.52	38.40	32.50	0.51	115.00	9.13
70.00	7.67	0.20	1.48	37.50	33.60	0.57	100.00	9.98
80.00	7.61	0.23	1.43	36.70	34.90	0.63	85.00	10.79
90.00	7.55	0.24	1.39	35.60	36.13	0.71	69.00	11.57
100.00	6.95	0.26	1.35	35.00	37.52	0.74	56.00	12.47
theri soil 0%	8.5	0.14	1.7	48.2	17.4	0.09	210.6	1.26

TH+ 40% of CS, TH+ 50% of CS, TH+ 60% of CS, TH+ 70% of CS, TH+ 80% of CS, TH+ 90% of CS, TH+ 100% of CS on volume basis were made.

EC – Electrical Conductivity, HYD.CON -Hydraulic conductivity, ORG.CARB -Organic carbon , VOL.EXP -Volume expansion, W.H.CAP -Water holding capacity.

Stepwise multiple regressions showing the influence of the different variables considering them in pairs at each stage were worked out. Water holding capacity is taken as the dependent variable. In the first stage, the independent variables pH, EC, bulk density, particle density, porosity , volume expansion , organic carbon and hydraulic conductivity were used pair wise.

The set of equations obtained in the first stage were

- (i) When pH and EC were combined pair wise, EC was selected and the equation arrived at is

$$y = 16.887 + 80.143^{**}x ; R^2 = 0.990^{**} ; x = EC .$$
- (ii) When Bulk density and particle density were combined pair wise, the particle density was selected and the equation resulted is

$$y = 77.370 - 19.150^{**}x ; R^2 = 0.996^{**} ; x = \text{particle density}$$

- (iii) When Porosity and volume expansion were paired, it led to the deletion of porosity and the equation formed is

$$y = 17.902 + 1.578x; R^2=0.999; x=\text{volume expansion}$$

- (iv) Finally in the first stage, when organic carbon and hydraulic conductivity were combined, the hydraulic conductivity was selected and the equation reached is

$$y = 42.094 - 0.0837x; R^2=0.996; x=\text{hydraulic conductivity}$$

Thus, in the first stage, the EC, particle density, volume expansion and hydraulic conductivity were selected. Here in the second stage, when EC and particle density were combined, the EC is driven out in the equation and the resulting equation is with particle density as the independent variable. Similarly when the volume expansion and the hydraulic conductivity were combined, the hydraulic conductivity gets eliminated.

Finally, in the third stage, the particle density was combined with volume expansion, the volume expansion was selected. Thus it shows that volume expansion was an important factor for the water holding capacity. The result shows that in the case of the water holding capacity, the volume expansion is the crucial variable.

Conclusion

The desired level of the various parameters can be achieved by proper choices of the proportions of coirpith and tank silt mixture to their soils. Of the selected eight variables, the volume expansion seems to be the most important variable deciding the water holding capacity. The relationship between the volume expansion and the proportion of amendments is

In the case of volume expansion the best regression equation fitted is

$$y = 4.3531 + 0.0795x;$$

Which indicates the additional proportion of coir pith and tank silt mixture will improve the volume expansion

NATURAL RESOURCES MANAGEMENT

Introduction

The National's strength, be it social, economic or political depends mostly on the available resources and their proper utilization. But what is a resource? In simple terms, resource is the matter or substance which satisfies human wants at a given time and space. Before any element can be designed as resource three basic pre-conditions must be satisfied. They are the knowledge, technical skills and demand for the material or service produced. If one of the conditions is not satisfied the particular substance remains unutilized. Let us explain it through one example. From time immemorial, water is present on the earth. But it becomes a source of energy when people gained the knowledge and technical skills for hydel power generation. It is therefore human ability and need which create resource values not their sheer physical presence. So the basic concept of resource is also related to human well being.

India has rich endowment of resources. An integrated effort is now being made by our country to make the best use of the existing resource potential. It helps to meet the demands of growing population and also provide opportunities for employment. Simultaneously, it acts as indicator for the levels of development.

Objectives:

1. Recognize the significance of land as a resource.
2. Identify the main land.
3. Explain some problems of land resource.
4. Problems created as a result of soil erosion
5. Significance of soil resource.

Soil Resource

Soil is defined as upper layer of the earth composed of loose surface material. It is a mixture of many substances including endless variety of minerals, planets and animals water an air. It is the end product of continuing interaction between the parent material local climate, plant and animal organisms and elevation of land. Since each of the elements varies a really, soils also differ from place to place soil is a very valuable resource plant growth and buildings to stand shiftily.

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Soil Erosion

Soil Erosion is described as the carrying away of soil. It is the theft of the soil by natural elements like, water, wind, glacier and wave. The present shape of land has been carved. Through thousands of years. Soil erosion has become now one of the major environmental problems and a serious constraint for agricultural production. The important social factor are deforestation, over grazing, nature of land use and methods of cultivation. Ravines, gullies and land slides are most serious and highly visible forms of land erosion.

The occurrence of landslides is common in earthquake sensitive belt, particularly the siwaliks. Heavy rainfall and cutting of slopes for roads, building and mining activities.

Soil erosion and soil exhausting are due to loss of soil nutrients pose serious threats to our efforts of increasing the productivity of soil faster than the population growth.

Soil conservation

The most important step of soil conservation is to hold the soil in place. This is possible by improved agricultural practices in different regions. Contour ploughing and terracing are generally practiced on the hill slopes. They are the simplest conservation methods. Rows of trees (or) shelter belts are planted to protect the fields in desert regions from wind erosion. Afforestation of the catchment areas and sloped in the Himalayas, the upper damodar valley in Bihar and the Nilgiri hills in south has been implemented. Major forms of soil erosion are ravines, gullies, land slides and sheet erosion.

CONCLUSION

Land is our basic resource. It has different roles like productive economic factor, foundation for social prestige and is the basis of health and political power. India has rich cultivating land, Land use is dynamic process. It changes over time due to a number of factors including increasing population and changes in cropping pattern and technology. Bulk of land continues to be used for raising crops. India faces a lot of problems related to land. They are land degradation, tenure (or) ownership of land and deforestation. India has adopted two broad measures, land reclamation and land reforms to solve these problems. Soil is defined as upper layer of the earth composed of loose surface material. Like land, soil erosion and soil exhaustion. Various soil conservation methods like contour plough terracing, shelter belt formation and forestation are adopted in India.

Both land and soil should be conserved for our use and for our generation. We have to give our world as it is to our youngsters. It is a duty to each citizen to save our precious land resource. Save our world. **CLEAN LAND GREEN WORLD.**

WATER RESOURCE MANAGEMENT –ISSUES AND OPTIONS

INTRODUCTION

Water is God's gift to every living thing. Water plays a key role in the biological processes. Water is the key factor in Environmental problem. Water is the vital input in Ecological regeneration. Water is a finite resource. Water is indispensable for the existence and survival of life on earth.

Water is needed in almost every sphere of human activity. Water is required for direct consumption for washing, cleaning, cooling, waste disposal and transportation. Water is essential for the Irrigation, Industries, Livestock Management, Thermal power generation, Domestic requirements, Hydro-electric generation, and various human activities.

Water is the most important natural resource. It is manageable resource because of its capability of diversion, transport, storage and recycling. Water Resource Management refers to economics applied in the usage of water be it ground water or surface and ensures a judicious distribution of water to as many uses as possible. In Asia, 86% of fresh water use is for agriculture, 8% for industry and 6% for domestic purposes. According to a United Nations estimate, by the year 2025 two-thirds of humanity will face shortage of fresh water. In this back drop an attempt was made to highlight different issues relevant to water resource management in India.

MAJOR ISSUES

1. Overdraft mainly for irrigation.
2. Maximum utilization of surface water and groundwater.
3. Over irrigation of certain crops like wheat, paddy etc.
4. Competition among private well owners.
5. Loss of water through evaporation, run off and base flow.
6. Industrial pollution to ground water.

CONSEQUENTIAL EFFECTS

1. Fall in water table forcing farmers to deepening of wells. Reduced area under irrigation. Charges in cropping pattern and abandoning agriculture.
2. Mining of ground water. Land subsidence and Intrusion of sea water in coastal areas.
3. Inefficiency in available water use and inequality in distribution.
4. Over exploitation of ground water threatening the long term sustainability of agriculture. Drinking water problems. Failure of wells and increase in the cost of pumping and social efficiency in water use.
5. Acute drinking water scarcity.
6. Health problems like skin and infectious diseases and contamination.

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The irrigation and water related acts passed both before and after independence are unable to effectively tackle the current requirements for sustainable use and management of water and water related resources. Without correcting the fundamental incentive gap through a radical transformation of the existing water laws and institutions, it is certainly not possible to ensure ecological security nor economic efficiency nor social equity in water resources. Clear cut water rights system is indispensable for the sustainability of our irrigated agriculture. The present regulatory policies such as well spacing, well siting, licensing norms and power tariff norms are inadequate and ineffective. The local institutions at the village levels have lost their teeth and they are no more effective under the changing scenario.

SUSTAINABLE STRATEGIES FOR WATER RESOURCES

The following points can be stressed for better management of water resources>

- Need for environmental and social management in using water resources.
- Special emphasis has to be laid on the conservation of quantity of water from the sources to the points of consumption by making use of different techniques such as efficient use, reuse, waste water treatment, setting priorities.
- Revival of local and traditional water storage structures and integrated watershed development programmes.
- Better involvement of stakeholders in the planning and implementation of water resource programmes is a must.
- They must adopt water saving techniques like sprinkle or drip irrigation against flood irrigation.
- The farmers must invariably follow the instruction of the agricultural/ Ground water management departments of the Government and avoid excessive use of water.
- Central and state governments should assess the ground water resource potential.
- Attention should be paid by the researchers and extension personnel in increasing the production per unit area/per unit of water in agriculture.
- Waste water recycling
- Design, installation and use of information in the water resources.
- Modernization of old irrigation systems and re-establishing of tanks.
- Training the farmers as well as officials in modern irrigation and agriculture development.
- For effective water resource management there should be more horizontal co-ordination than in vertical in delivering duties water management programmes should be implemented in a systematic way with integrated co-ordination of all relevant government departments at state and central level.
- Watershed management strategies are addressing rural development through restoration of the natural environment. The beneficiaries' role should be modified from passive recipients to active participants.

It is concluded that public awareness, sense of ownership and women's participation have to be encouraged by governmental organizations with the help of government in managing water resource successfully.

Drought Prone Areas Programme in Tamilnadu: A Long Way To Go

Introduction

Most watershed projects in India are implemented with the twin objectives of soil and water conservation and enhancing the livelihoods of the rural poor (Sharma and Scott, 2005). Programmes to make better use of land and water resource have been introduced to many parts of rural India in recent years. These often improve natural resources management, but the extent to which they benefit poor people is not clear. For example, improvements to land quality only help people with access to land, watershed development is important in rural livelihoods areas, but require further planning to improve livelihood of the rural poor.

The under-productive use of natural resources is one of the major contributors to poverty in India. A vast majority of the rural poor depends on these natural resources for their livelihood. These areas are characterized by a large human and cattle population, which are continuously exerting heavy pressure on the already fragile natural resource base for food, fodder, and fuel. Some of the important activities are carried out in a watershed such as ridge area treatment, drainage line treatment, development of water harvesting structures viz., low cost farm ponds, check dams, percolation tanks, ground water recharge through wells and bore wells, nursery rising for fodder, timber and horticultural species. Besides, different types activities are also included like land development, crop demonstrations to popularize new crops and pasture development.

The benefits were highest from the watersheds where people's participation was high (Joshi, *et.al.* & 2005). The factors determining households participation in watershed management reveal that the number of workers in the family and number of wells owned found to significantly and positively influence the household's contribution towards watershed development (Suresh Kumar and Palanisami, 2009).

Objectives

The specific objectives of the study are:

- (1) To study the DPAP in Tamilnadu between the period 1995-1996 to 2005-2006.
- (2) To know the people's participation in DPAP watershed activities, role of PIA and the activities of user group in the study area.
- (3) To suggest policy measures for effective implementation of the programme.

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Methodology

To investigate the DPAP activities, this study was carried out in Poolathur watershed in Dindigul district of Tamilnadu. The random sampling procedure was employed for selecting the sample of 30 respondents. For the purpose of the study, initial information details were collected through project implementing agency. (DRDA/ JDA, Dindigul) and watershed functionaries. Then personal interviews were conducted with the sample respondents through structured questionnaires regarding people's participation in DPAP watershed activities, role of PIA and the activities of user group. Discussions were also made with the members of watershed committee and watershed association to collect information with regards to the watershed development activities under DPAP in the study area. The data were collected during the month of November 2010. The data were pertaining to the year June 2009-May 2010.

Results and Discussions

Table 1: Respondents' Participation in DPAP Watersheds Activities

Sl No.	Activity	No. of Respondents	Percentage
1.	Planning (Pre- implementation)	11	36.67
2.	Implementation	17	56.67
3.	Maintenance (Post – implementation)	2	06.66
	Total	30	100.00

Source: Primary data.

It was found that the sample respondents (56.67 per cent) participation is high in implementation of watershed activities (See Table 1). Participation (36.67 per cent) was low during the pre-implantation stage of watershed works. There was a very low level participation (06.66 per cent) in maintenance of watershed works.

Table 2: Respondents' Opinion with regard to the Role of PIA

Sl No.	Role	Very good	Good	Average	Poor	Total
1.	Technical support of PIA	- (0.0)	22 (73.3)	3 (10.0)	5 (16.7)	30 (100.00)
2.	Accessibility to PIA	2 (6.7)	21 (70.0)	4 (13.3)	3 (10.0)	30 (100.00)
3.	Problem solving capacity of PIA	2 (6.7)	25 (83.3)	3 (10.0)	-	30 (100.00)
4.	Cancelling and guidance of PIA	2 (6.7)	22 (73.3)	6 (20.0)	-	30 (100.00)
5.	Frequency of visit to WS Area	-	26 (86.7)	4 (13.3)	-	30 (100.00)
6.	Supply of Inputs	-	5 (16.6)	20 (66.8)	5 (16.6)	30 (100.00)
7.	Decision making	-	22 (73.3)	6 (20.0)	2 (6.7)	30 (100.00)

Note: Figures in Parentheses indicate percentage to total

Source: Primary data.

The opinion of the respondents' about the role of Project Implementing Agency (PIA) is shown in Table 2. Of the total respondents, 73.3 per cent of respondents reported that the role of PIA regarding technical support is good. This is followed by the opinion poor by 16.7 per cent and average by 10.0 per cent of the respondents. 70 per cent of the respondents opined that the accessibility of PIA is good.

Table 3: Respondents' Opinion About the Activities of User Group

Sl. No.	Activities	Very good	Good	Average	Poor	Total
1	Functioning of UG	3 (10.0)	25 (83.3)	-	2 (6.7)	30 (100.0)
2.	Interaction among the members of UG	2 (6.7)	23 (76.6)	2 (6.7)	3 (10.0)	30 (100.0)
3.	Site selection for activity/ treatment	4 (13.3)	26 (86.7)	-	-	30 (100.00)
4.	People participation in UG meeting	3 (10.0)	25 (83.3)	-	2 (6.7)	30 (100.00)
5.	UG member interaction with WA / WC	-	21 (70.0)	2 (6.7)	7 (23.3)	30 (100.0)
6	Group activity – participation	2 (6.7)	19 (63.3)	-	9 (30.0)	30 (100.0)
7	Interaction with PIA officials	4 (13.3)	23 (76.7)	-	3 (10.0)	30 (100.0)
8.	Participation in Common activity	-	25 (83.3)	-	5 (16.7)	30 (100.0)

Note: Figures in parentheses indicate percentage to total

Source: Primary data.

Table 3 shows that 83.3 per cent of the respondents expressed that functioning of user group is good. Only 10 per cent of respondents expressed as very good. 6.7 per cent of respondents opined that the user group function is poor. 76.6 per cent of the respondents reported that the interaction among the members of user group is good. Of the total respondents, 6.7 per cent of the respondents expressed as very good interaction. 10 percentage of respondents reported that the interaction among the member is poor. Regarding site selection for activity, 86.7 per cent of the respondents opined good. This is followed by the opinion very good by 13.3 per cent respondents. 83.3 per cent of respondents expressed that the people participation in user group meeting is good.

Conclusions and Policy implications

The supply of inputs should be increased. The activities of user groups with watershed association /watershed committee is poor. The beneficiaries should be strengthen and take part in the discussion with the members of implementing authority. People of the project area should be brought into the confidence and responsibility /commitments should be specified.

RAIN WATER HARVESTING – A SUSTAINABLE USE OF WATER RESOURCES

Introduction :

Water plays a complex and multi functional role. It is one of the renewable natural resources which makes life possible in our planet. Most resources have substitutes, but water does not has any substitute. Its availability is largely dictated by climate. It varies in quality and availability and fluctuates from season to season.

Two - third of the planet is covered by water. About 97% of water is stored in a sea and remaining 3% of the water is fresh water. In this fresh water 75% of the water is stored as ice in the polar regions which is unavailable. Thus 1% of water is free flowing fresh water. In which 98.8% of water is over exploited. The growing water needs of growing population be met up with excess run off water ,which is to be properly harvested.

Rain water is the grey clean water and it should be conceived properly. To fulfill the present drinking water needs of the people, systematic way of catchments and storage is essential. For this rain water harvesting is essential. Hence in this paper an attempt has been made to study the Rain Water Harvesting - a sustainable use of water resources.

Objectives :

1. To analyze the availability of water in India and in Tamil Nadu.
2. To study the need for rain water harvesting.
3. To study the techniques of rain water harvesting.
4. To study the advantages of rain water harvesting.
5. To find out the problems of rain water harvesting.

Methodology:

The study is based on secondary data. The informations are collected from Books, Journals, News paper and several websites.

Component s of Rain water Harvesting system :

A rainwater harvesting system comprises components of various stage – transporting water through pipes or drains, filtration, and storage in tanks for reuse or recharge. The common components of a rain water harvesting system involved in these stage are illustrated here.

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Catchment : The catchment of a water harvesting system is the surface which directly receives the rain fall and provides water to the system.

Gutters : Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank, gutters can be semi – circular and rectangular in shape.

Conduit : Conduit are pipelines or drains that carry rainwater from the catchment or rooftop area to the harvesting system.

The following table shows the diameter of pipe required for draining out rainwater based on rainfall intensity and roof area.

Diameter of Pipe required for drawing out Rain water

	Diameter of pipe (mm)		Average rate of rainfall in mm/h (mm) millimeters per hour			
	50	75	100	125	150	200
50	13.4	8.9	6.6	5.3	4.4	3.3
65	24.1	16.0	12.0	9.6	8.0	6.0
75	40.8	27.0	20.4	16.3	13.6	10.2
100	85.4	57.0	42.7	34.2	28.5	21.3
125	-	-	80.5	64.3	53.5	40.0
150	-	-	-	-	83.6	62.7

Source : Secondary data

Advantages of Rainwater harvesting :

The important advantages of rainwater harvesting are.

1. Rainwater is a relatively clean and free source of water
2. Rainwater water harvesting system collects and stores water within users reach.
3. It assures a more continuous access to water.
4. Rainwater harvesting also conserves energy as the energy in put needed to operate a centralized water system is by passed.
5. It provides an alternative source of good quality water in the area where ground or surface water is chemically contaminated.
6. Rainwater is one of the purest sources of water available and does not get polluted.

Problems:

Rain water harvesting system has some limitations

1. The success of rain water harvesting depends upon the quantity and frequency of rainfall. Thus, it may fail during dry weather.
2. Low storage capacities limit the water harvesting benefits and large capacities may not be economical.
3. Storage tanks can be breeding ground for mosquitoes or unsafe for small children.
4. Leakage from tanks can cause the deterioration of load bearing slopes.
5. Domestic RHW systems increase construction cost of a building.

Remedial Measures for problems of Rain water harvesting:

impurities and allowed to enter the casing of the bore well directly

- ❖ The yield of some bore wells has declined dramatically and can no longer be pumped in a sustainable manner.
- ❖ Clean storm water can be filtered thoroughly through a recharge pit filled with materials such as stone, charcoal and sand and then allowed bore wells.
- ❖ Many rooftop rainwater filters are available in the market, including the rainy filter and the pop – up filter. They can be used while recharging the borewells.

Conclusion:

It is every body's business to save and properly use the available water. It means a role for every household and community have to involve themselves in protecting water resources. The demand for water for household, industry and irrigation is increasing due to the growth of population, large scale industrialization and producing food needed for the uncontrolled population. To meet the supply demand gap. The available water should be managed effectively and efficiently. So water harvesting is a vital necessity to meet the growing demand. The greatest natural resources of a country or not gold not even black gold or petroleum but water.. Rain water harvesting is as old as civilization and is practiced in many countries including India from time immemorial. But government and people remember this only when water is not available even for drinking purposes. There is no use in spending huge sum of money when we notice the water scarcity even for drinking industry and agriculture purpose.

LAND USAGE AND LAND REFORM IN INDIA

Introduction

Land is one of the basic and viable resources for human existence. It provides man with the basic necessities of life. With the development of civilization the needs of human society have multiplied and diversified. Accordingly the various uses to which the land is put have also diversified. Land is a finite resource, with the explosive growth and spread of population it is progressively becoming a scarce resource. Consequently it has become inevitable to have a sound land use management for the sustained use of this increasingly scarce resource. This has led to a systematic study of land use pattern to assess the potentiality of available land in a given region. Land use is the way in which, and the purposes for which, human beings employ the land and its resources: for example, farming, mining, or lumbering. Land use can be defined as "man's activities and various uses which carried on land (Clawson and Stewart, 1965). Land cover describes the physical state of the land surface: as in cropland, mountains, or forests. The term land cover originally referred to the kind and state of vegetation (such as forest or grass cover), but it has broadened in subsequent usage to include human structures such as buildings or pavement and other aspects of the natural environment, such as soil type, biodiversity, and surface and groundwater.

Changes in Land and Resource use:

During the last 100 years, a better health care delivery system and an improved nutritional status has led to rapid population growth, especially in the developing countries. This phenomenal rise in human numbers has, in the recent past, placed great demands on the earth's natural resources. Large stretches of land such as forests, grasslands and wetlands have been converted into intensive agriculture.

Land has been taken for industry and the urban sectors. These changes have brought about dramatic alterations in land-use patterns and rapid disappearance of valuable natural ecosystems.

During the last few decades, several small urban centers have become large cities, some have even become giant mega-cities. This has increased the disparity between what the surrounding land can produce and what the large number of increasingly consumer-oriented people in these areas of high population density consume. Urban centers cannot exist without resources such as water from rivers and lakes, food from agricultural areas, domestic animals from pasture lands and timber, fuel wood, construction material and other resources from forests. Rural agricultural systems are dependent on forests, wetlands, grasslands, rivers and lakes. The result is a movement of natural resources from the wilderness ecosystems and agricultural sector to the urban user. The magnitude of the shift of resources has been increasing in parallel with the growth of industry and urbanisation, and has changed natural landscapes all over the world. In many cases, this has led to the rapid development of the urban economy, but to a far slower

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economic development for rural people and serious impoverishment of the lives of wilderness dwellers. The result is a serious inequality in the distribution of resources among human beings, which is both unfair and unsustainable.

Land Problems

Out of the total land area, as many as 175 million hectares suffer from degradation. Land degradation is caused largely by soil erosion, but also by water logging and excessive salinity. The most serious threat to the soil is posed by deforestation. Heavy rainfall during monsoon damages the soils. Steep slopes encourage rapid run off leading to soil erosion especially on the southern slopes of the Himalayas and the western slopes of the Western Ghats. Major portions of the Himalayas are prone to landslides and erosion. Wind erosion is prevalent in Rajasthan, gully erosion in the Chambal Valley, Chotanagpur, Gujarat, submontane Punjab Himalaya. Water logging and salinisation which constitute the second major threat to soil have already claimed 13 million hectares and threaten many more. The lands affected are mostly situated in canal irrigated areas. They have suffered because of the absence of adequate drainage. Land is also degraded due to mining operations in many parts of the country. The total land area affected is about 80 thousand hectares by mining. Urban encroachment on good quality agricultural land is another problem by which the amount of land used for agriculture is steadily declining. In other words, there is a tough competition between agriculture, urban and industrial development. There are social conflicts that arising out of the rights to occupy and transfer land. The tenant cultivators face major disincentives such as the fear of eviction, the insecurity of tenure, high rents and inadequate surplus to invest. Land ceiling laws have not been implemented with adequate strictness.

Solution for Land Problems

The country has adopted a two-fold approach- physical and social, as they are complementary to each other. Physical reclamation of land is achieved through chemical treatment of water logged soils and is followed with scientific rotation of crops. Similarly land rendered useless by river action and river floods are also reclaimed after necessary treatment to restore their fertility and texture etc. physical reclamation of desert lands calls for more sustained efforts. It requires introduction of suitable natural vegetation and canal or well irrigation or even both. Social approach on the other hand is reflected through state legislation aiming at overall rural reconstruction, promoting agriculture and its productivity in particular. Consolidation of land holdings is one measure among many. It provides necessary motivation and empowerment of a tiller by confirming on him the rights of land tenure/ ownership etc. Elements of social exploitation are promptly removed e.g. absentee landlords. Thus legislation is used to ensure social justice. The Government of India constituted the National Wasteland Development Board in 1985 with a view to enhancing the productivity of wastelands. It includes the programme afforestation of 5 million hectares per year.

Equitable Use of Resources for Sustainable Lifestyles

Reduction of the unsustainable and unequal use of resources and control of our population growth are essential for the survival of our nation and indeed of human kind everywhere. Our environment provides us with a variety of goods and services necessary for our day-to-day lives, but the soil, water, climate and solar energy which form the 'abiotic' support that we derive from nature, are in themselves not distributed evenly throughout the world or within countries.

A new economic order at the global and at national levels must be based on the ability to distribute benefits of natural resources by sharing them more equally among the countries as well as among communities within countries such as our own. It is at the local level where people subsist by the sale of locally collected resources, that the disparity is greatest. 'Development' has not reached them and they are often unjustly accused of 'exploiting' natural resources. They must be adequately compensated for the removal of the sources to distant regions and thus develop a greater stake in protecting natural resources.

A National Food Security Requirement

For a country the size and population of India, food security is an especially crucial component of national security, and, until recently, it was on an upswing due to technological breakthroughs in rice and wheat production, a price policy ensuring minimum support prices, agricultural subsidies providing cheaper modern inputs, and a closed market. However, with economic liberalization has come the entry of cheaper foreign agricultural goods into the country and the removal of agricultural subsidies for Indian farmers, which will threaten food security in the future. With a reduction in the role of the state to ensure food security and the eventual takeover by market forces, there is sure to be a decrease in the access to food for the poorest Indian citizens.

Conclusion

Land itself is a major resource, needed for food production, animal husbandry, industry, and for our growing human settlements. Land as a resource is now under serious pressure due to an increasing 'land hunger' - to produce sufficient quantities of food for an exploding human population. It is also affected by degradation due to misuse. Land and water resources are polluted by industrial waste and rural and urban sewage. They are increasingly being diverted for short-term economic gains to agriculture and industry. Natural wetlands of great value are being drained for agriculture and other purposes. In order to be effective, land reform must be seen as part of a wider agenda of systemic restructuring that undertakes simultaneous reforms in the sectors of energy and water. Deeper structural reforms will ensure that the exercise of land redistribution actually becomes meaningful, enabling small farmers to turn their plots into productive assets.

ENVIRONMENTAL IMPACTS OF WATER POLLUTION: A CASE EXPERIENCE FROM WAY SIDE VILLAGES OF NOYYAL RIVER BASIN

Introduction:

Water pollution has emerged as a major public health concern because of fabricated and environmental changes at local and global scales. Increasing population, geological factors, rapid urbanization, agricultural developments, global markets, industrial development, and poor wastewater regulation have affected the quantity and the quality of water. The ground reality is that small-scale units through production processing and manufacturing generate pollution and create a heavy damage to the environment. Consequently, which may lead negative externalities on Human Health, Animal Health, and Plants. This paper is an attempt to examine the socio economic benefits and environmental impacts of the rapid industrial growth in Tiruppur, a major textile industrial cluster in South India.

This section reviews the previous studies which focused on various impacts of water pollution on human health. Ratna Reddy.V et al (2002) Studies the effects of various diseases arising out water pollution. However it was observed that most of the diseases are water borne, such as skin infection, teeth corrosion, joint pains, and diarrhea general muscular weakness in the villages. Tholkappian S (2005) "Environmental Regulation" used a primary survey data on textile bleaching and dyeing units in the Karur industrial cluster, analyzed the impact of environmental regulation on the production cost of the firm. Pandey .S (2006) "water pollution and health" he point out that water is the important constituent of life support system. No one can live and even dream to live without water.

Material and Methods:

The Environmental impact of industrial pollution with respect to depletion of ground water resource, degradation of water quality and the health impacts thereof. Tiruppur, Coimbatore and Erode districts in the state of Tamil Nadu were chosen. The criteria adopted to stratify the five selected villages (problem acute villages) in order to choose 264 households is based on proximity distance from industrial location along with river basin and its implications. The five villages were selected for the way side villages Noyyal River and 10 % of the sample household are being selected for investigation. The sample households were being selected based on landholding and community wise to understand intensity of impacts. Statistical tools such as Analysis of Variance, "t" test, hypothesis testing, and Regression have been used to analyze the nature of the data.

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ANALYSIS AND DISCUSSION

This paper intends to analysis the primary data for understanding the various aspects in impacts of industrial pollution and its toxic effects on human, animal, and plants.

ESTIMATION OF AGRICULTURAL LOSS:

The damage function links to the functional relationship between industrial pollution and its impact on agricultural yield. The agricultural damage functions were being estimated the degree of damage as caused by industrial pollution. Following table shows the details of land holding pattern of the respondents according to the wet and dry land.

Table 1: Detail of Landholding

Land Holding pattern	Statistics	Family Size	Wet Landholding acres	Dry Landholding acres	Total Landholding acres
Land less	Mean Sum % of T. S S. D	6 228 3.5 9.15	-	-	-
Marginal Landholders (0.1 to 2.47 acre)	Mean Sum % of T. S S. D	36.21 3803 58.5 24.89	1.11 117.50 28.6 0.85	1.06 112 27.7 0.59	1.2143 127.50 18.7 0.41
Small Landholders (2.48 to 9.88 acre)	Mean Sum % of T. S S. D	23.11 2404 37 22.29	1.47 153.75 37.4 1.63	2.03 212 52.4 2.24	3.18 330.75 48.6 2.54
Medium Landholders (9.89 & above)	Mean Sum % of T. S S. D	3.64 62 1.0 1.22	8.23 140 34 5.78	4.73 80.50 19.9 4.70	13.11 223 32.7 3.68
Total	Mean Sum % of T. S S. D	24.60 6497 100 24.18	1.55 411.25 100 2.58	1.53 404.50 100 2.15	2.58 681.25 100 3.52

Source: Primary Survey, 2010

From this table1 land holding pattern which varies among the different landholders are being specified. The total land holding of the respondents about 2.58 acres among which the marginal land holders got 1.21 acres; small land holders hold 3.18 acres and the medium land holders are having 13.11 acres of land respectively. The medium landholders are holding more wet land 8.23 acres. And the small and marginal land holders are holding more of dry land.

Table2: Land values escalation in Polluted and Non-polluted Areas

Land Holding pattern	Statistics	Land Holding		Area under cultivation		Land Value	
		Before pollution	After pollution	Before pollution	After pollution	Before pollution	After pollution
Marginal Landholders (0.1 to 2.47 acre)	Mean	4.53	2.27	2.38	3.99	38561	381142
	Sum	238.50	476	250.40	419.25	4049000	40020010
	% of T. S	31	50.6	34	90.5	58.4	75.9
Small Landholders (2.48 to 9.88 acre)	Mean	2.95	2.76	2.83	0.33	21903	95288
	Sum	307	287.25	294.50	34.50	2278000	9910000
	% of T. S	39.8	30.5	40	7.4	32.8	18.8
Medium Landholders (9.89 & above)	Mean	13.23	10.47	11.26	0.55	35764	162647
	Sum	225	178	191.50	9.50	608000	2765000
	% of T. S	29.2	18.9	26	2.1	8.8	5.2
Total	Mean	3.56	2.91	2.78	1.75	26268	199602
	Sum	770.50	941.25	736	463.25	6935000	52695010
	% of T. S	100	100	100	100	100	100

Source: Primary survey, 2010

The above shown table 2 gives us the detailed understanding of land holding pattern area under cultivation and the land value before and after the impact of pollution. In a given reality the cultivated area and land holding pattern being reduced after pollution. The land value is being increased about Rs. 199602 after pollution, than before pollution area land value about Rs. 26268. This is not as equal to rate of changes in the land value in Non- polluted region. After pollution land holding pattern came down from 2.78 acre, to 1.75 cent. A paired 't' test is used to find out any significant difference between the before and after pollution in the respect to land value. The Correlation value is 86% result shows that there is positive relationship between the land value escalation before and after pollution.

Table 3: Agricultural Productivity in Before and After Pollution (in Acre)

Land Holding pattern	Statistics	Paddy (in bags)	Turmeric (in bags)		Corn (in bags)		Sugarcane (in tons)	Cotton (in tons)	Ragi (in tons)		Brinjal (in pages)		Chilli (in pages)
		BP	BP	AP	BP	AP	BP	BP	BP	AP	BP	AP	BP
Marginal Landholders (0.1 to 2.47acre)	Mean	33.67	32.33	-	12.14	-	54.75	52.89	9.08	0.03	3.26	0.10	0.96
	Sum	2391	646	-	255	-	43	1481	954.40	4	343	11	101
	% of T. S	81.8	73.7	-	29.6	-	61.8	71	74.6	40	47.7	100	19.8
Small Landholders (2.48 to 9.88 acre)	Mean	24.00	29	-	12.24	3.16	36.83	10.53	2.34	0.05	2.44	-	2.44
	Sum	432	145	-	428.50	19.	221	453	244.20	6	254	-	254
	% of T. S	14.8	16.5	-	49.8	100	31.2	21.7	19.1	60	35.3	-	49.9
Medium Landholders (9.89 & above)	Mean	20	21.50	-	16.09	-	50	10.20	4.73	-	7.17	-	9.05
	Sum	100	86	-	177	-	50	153	80.50	-	122	-	154
	% of T. S	3.4	9.8	-	20.6	-	7.1	7.3	6.3	-	17	-	30.3
Total	Mean	31.09	30.26	-	12.84	3.16	47.26	24.26	4.84	0.03	2.72	0.04	1.92
	Sum	2923	877.70	-	860.50	19	709	2087	1279.10	10	719	11	509
	% of T. S	100	100	-	100	100	100	100	100	100	100	100	100

Source: Primary survey, 2010

The productivity of all crops in agriculture was high before pollution. But after pollution research witnessed that the yield of every commodity had been severely decline. Before pollution the total yield was about 31.09 bags. But after the impact of pollution the yield was completely stopped. It is essential to maintain that almost all land is not involved in the cultivation practice as per as study villages as considered.

Hypothesis:

Water irrigation affected by industrial pollution, and pollution point in Km are the key factors to determine the loss of productivity.

Functions: $Y = a \pm bx$

Productivity loss = $-8116.785 + 7652.366 (WL) + 23868.801 (IW) - 245.021 (PP) + \mu$

Where, Y=Agricultural production loss

a = Constants

β_1 = Wet landholding acres (WL)

β_2 = Irrigation Water affected by industrial pollution (IW)

β_3 = Pollution point in Km (PP)

μ = Error term

R Square= .625

Theoretically, a large number of variables are determining the agricultural production. The agricultural damage cost function has been explained through the variables such as irrigation water affected by industrial pollution and wet landholding acres and Pollution point in Km. All these variables show a significant contribution on the agricultural damage cost. The loss of productivity is being proved through the respondent statement that the water is not suitable for cultivation. In reality, the irrigation water plays a vital role to determine the agricultural loss in grater extent.

HUMAN HEALTH DAMAGE LOSS:

Human health is the one of the most important factors in economic development. A healthy work force is essential for the development of on economy and they require a healthy environment like air, water, recreation and wilderness.

CONCLUSION

The way in which the Environmental externalities have occurred can mainly be attributed by human health and natural resources like land and water. The environmental problems arise in an unacceptable level of industrial pollution, which resulted into negative externalities and which further affected the rural communities in different forms such as productivity loss, which is due to man-days loss thereof. The irrigation systems are worsening due to pollution consequently as a result there exits low productivity, employment and economic conditions of landholders and landless. As a result as above said factors forced them to sell their land to the industrialists. Therefore they want the State and Central governments to turn their attention to their plight.

WATER SCARCITY AND ITS IMPACT ON MARGINALIZED GROUPS IN THE CAUVERY DELTA

Introduction

Water is a second basic input after land in agriculture. Both scarcity and excessive presence of this input in particular place and time makes agriculture uncertain. Droughts and floods cause negative impact on income and assets of both farmers and farm workers. Now-a-days, water scarcity becomes common in many river basins because of increasing natural and man-made causes.

Specific Objectives of the Paper

- a) To examine the nature of water scarcity in the study villages;
- b) To explore how the water scarcity makes impact on lives of marginalized groups – farm workers and marginal farmers - in the study villages;
- c) To examine the alternative strategies followed by these groups;
- d) To suggest policy measures for the economic inclusion of these marginalized groups.

Brief Methodology

In order to reach the specific objectives of the study the necessary primary data collected from the 65 agricultural workers of Thirupurampiyam, Thiruppanandal, Devanancherry, and Kabisthalam villages in Thanjavur District. Some of the secondary information are gathered from the Public Works Department and published sources like journals and magazines.

Main Observations/findings of the Study

Following are the main observations/findings of the research survey conducted among the sample villages and agricultural workers in the delta district.

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Variation in Opening of the Mettur Reservoir in the last 20 years

Months of opening of Reservoir	No of years	Percentage
On normal date (June -12 th)	08	40
June (other than normal date)	01	05
July	07	35
August	02	10
September	01	01
October	01	05
Total	20	100

Sources: PWD, Cauvery Basin Division Thanjavur

1. Canal water supply is highly uncertain. The date of opening and closing of reservoir are highly erratic in the past 20 years.
2. Three crop lands are converted into single crop land. This is more common among the marginal, small and some of the medium farm land owning groups. Farmers of these groups give up Kuruvai and Thaladi paddy, and also summer crop.
3. In the past, many farmers in the above groups cultivated Kuruvai and Thaladi paddy (instead of single Samba paddy) and summer crops also, with the help of water purchased from the well owners- usually medium and large farmers. But, now the farmers of marginal and small holding the cultivation area due to continuous increase in the cost of purchased water. Now, the cost of purchased water per crop/per acre comes around Rs.2000/-

Alternative Strategies of the Respondents

Particulars	No of Respondents	Percentage to the Total Farmers
Reduce the Number of Crops	52	100
Changing the Crop pattern to Crop Perennial	07	13
Convert the cultivation farm in to fish farm	04	08
Conversion of land into plots	02	03

Sources: Field Survey

1. A reasonable number of farmers changed their cropping pattern. They are in favour of perennial/ long term tree crops. Some other farmers converted their part of land as fish ponds. In other few cases, the lands are given for brick works.
2. Crop lands adjacent to the towns, villages, and main roads are converted as house sites, in a speedy manner.
3. As a result of canal water scarcity and uncertainty, many workers lost employment. 82 percent of the farm workers are reported that they have no regular farm work in the past many years. Time span of the work in a year reduced to 3 to 4 months i.e. September/October to December/January. Even in the busy agricultural season, the number of days worked per month is minimized to 15 or 20 days.
4. 20 per cent of the agricultural worker-households who had own land or leased-in lands were sold or broke the land-lease during the period of under canal water scarcity.
5. Another 20 per cent of the households reduce their own holding or size of leased-in cultivation area as a result of multiple factors, including canal water scarcity.
6. Among the 65 agricultural worker-households surveyed, 17 per cent have own lands up to 2 acres; 43 per cent continuously engaged in leased-in cultivation

Suggestions

Observations/findings made on the basis of field survey imply that economically and socially marginalized rural people i.e. Agricultural workers are not included in the growth process. So, we need some sort of arrangements for the inclusive growth. Following are the suggestions for inclusive growth:

1. As a long term and permanent solution, governments should take efforts to implement Cauvery Tribunal Award as a speedy manner.
2. Implementation of various micro-irrigation schemes — construction of percolation ponds, check dams, renovation of village tanks — at the village is essential.
3. Provision of assured irrigation for the marginal farmers can be possible under the system of community bore well.
4. Implementation of MGREGP in true sense is essential for the uplift of the agricultural workers.
5. Commercial banks should be advised to give more loan for the agricultural workers to purchase cattle, construction of bore wells, crop loans and starting of small business are essential.
6. Water market prices should be regulated to continue the farming activities of the marginal and small farmers.

Conclusion

Landless agricultural workers and marginal and small farmers are the majority sections in rural India. Constraints and problems in supply of basic inputs like land and water affect the economic and social life of the people. This should be eradicated in time. Otherwise, the principle of inclusive growth becomes meaningless.

WATER MANAGEMENT IN AGRICULTURE



Introduction

Water is the basic resource in the agricultural production system of any region. In improving and sustaining existing agricultural production systems, the first step is to improve the management of these basic resources. When the larger irrigation systems were planned and constructed, the main goal was to deliver water at the farm level. Water is used in both homes and industry. It is used for crop, livestock and fish production, for navigation and recreation, and for sustaining ecosystem processes. Such uses require that different quantities and qualities of water be available at different locations and times. As demand increases and supply is reduced by drought, over-use or pollution competition for water increases. Competition can lead to conflicts, which cause adverse environmental, social and economic impacts.

Water Table Management in Agriculture Ecosystem

In simple terms, water table management is the management, control, and /or regulation of soil-water conditions in the profile of agricultural soils. Essentially, excess and deficit soil-water conditions in the soil profile can be managed to provide better plant growth conditions for the production of food. Through the implementation of proper management practices and strategies, there also can be an environmental benefit. Soil-water conditions can be managed through the use of water management structures and strategies designed specifically for the given site conditions.

Water table management consists of three basic practices. These are conventional subsurface drainage, controlled drainage, and sub irrigation. Each of these are illustrated below.

Subsurface Drainage

Cropland that is susceptible to seasonal or intermittent high water table conditions usually requires subsurface drainage improvement, which serves to lower the water table to a level equal to the drain depth. Subsurface drainage is common throughout the flat and gently rolling areas of the Midwest, as well as in other parts of the country. Subsurface drainage improves trafficability, enhances field conditions for more timely planting and harvesting operations, and helps decrease crop damage that can result from saturated soil and standing water.

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Controlled Drainage

The addition of properly designed and constructed water control structures to a subsurface drainage system allows the drainage outlet to be artificially set at any level between the ground surface and the drain depth. Raising the outlet after planting helps keep water available for plant use longer than does "free" uncontrolled subsurface drainage. This practice also can be used to recharge the water table between growing seasons. Most existing subsurface drainage systems can be retrofitted for controlled drainage. Controlled drainage systems require a moderated level of management so that excess soil-water conditions following heavy rainfall can be avoided.

Engineering Practices for Land and Water Management under Agriculture Ecosystem

Although a large number of irrigation projects are being commissioned, most agricultural lands will continue to remain under rainfed agriculture. Engineering practices for land management under rainfed agriculture are necessary to control soil erosion and make the land suitable for other improved agricultural practices. Land management practices have to be suitably designed for use in high rainfall zones or in low rainfall zones.

Protection of Steep Agricultural Lands

The engineering measures for protection of steep agricultural lands consists of some land surface modification for retention and disposal of rainfall. The measures are contour and graded bunding, broad-base terraces, bed and furrow system, and ridge and furrow system. Suitable water disposal forms a part of all these methods.

Contour and graded bunding consists in construction small embankments across the slope of the land, similar to the broad-base terraces. Bunds or broad-base terraces decrease the length of slope and thus reduce erosion. A series of terraces or bunds divides the area into small strips and helps retain the rainfall falling between them.

Ridge and furrow system

The ridge and furrow system consists of alternate furrow and ridges across the slope and following the general contour. This system is generally established through interculture operations after flat sowing of the crops and results in increase crop yields due to in situ moisture conservation.

Agronomical practices

Several location-specific agronomic practices are in vogue for water retention and moisture conservation, such as tillage and mulches. Soil mulches are created by shallow cultivation and crop residues are used as organic mulches. Dry sowing is a method that has been used for deep black soils in India. In this approach, crops are sown shortly ahead of the rains in areas where the precipitation commences fairly reliably and where there is good probability of follow-up rains to ensure establishment of the germinating crop.

Gully control

Control of gully erosion becomes important particularly when the gullies contribute to sediment load of the downstream streams or rivers. Gully control measures consist of diversion of runoff from gully area and construction of temporary and permanent structures.

Farm ponds

Construction of small storage reservoirs is part of a soil conservation Programme. These could be dugout ponds, surface ponds, spring – or creek-fed ponds, or off-stream storage ponds depending upon the site conditions.

Watershed-based soil and water conservation

Soil and water conservation measures when implemented on a watershed or catchment basis are effective in controlling downstream flows and sediment loads. As each watershed or sub-watershed is an independent hydrological unit and modification of the land use in it will reflect on the water as well as sediment yield of the watershed.

Conclusion

The majority of water consumption in India goes to agriculture. In coming years the population is expected to reach 2 billion by 2050 and there by the demand for food grain production and their by the requirements of water also increases. With this backdrop it becomes importance for agricultural water management practices in India.

NATURAL RESOURCES MANAGEMENT-LAND & WATER RESOURCES

Natural resource management refers to the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations.

The term quality of life is used to evaluate the general well-being of individuals and societies. The term is used in a wide range of contexts, including the fields of international development healthcare, and politics. Quality of life should not be confused with the concept of standard of living that is based primarily on income. The standard indicators of the quality of life include not only wealth and employment, but also the built environment, physical and mental health, education, recreation and leisure time, and social belonging.

Natural resource management is congruent with the concept of sustainable development, a scientific principle that forms a basis for sustainable global land water management and environmental governance to conserve and preserve natural resources. Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources. The term environmental management is also similar to natural resource management.

Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. The term was used by the Brundtland Commission, which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability and sociopolitical sustainability.

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Forest Land Requirements

Several factors must be considered in projections of the areas of forest land needed to provide adequate supplies of this resource in the future. Important among these are the long-run nature of the forest production process, the character of the demand for forest products, and the difficulties that arise when one attempts to translate projections of forest product requirements into forest-land requirements. Because of the long-term nature of the forest production process, many of decisions affecting future production must be made years in advance. The quantity and quality of the land areas reserved for future forest use are always affected by current estimates of future supply and demand conditions. On the demand side, every forest-land owner speculates regarding future price levels. His prospects for profit are affected by possible changes in the need for forest products, by the possible development of new uses and new markets for his product. On the supply side, he must consider his prospective forest yield, his probable production costs, and the effect of the import-export situation upon his competitive position. He must also consider the relative pressure to use forestlands for food production and other uses, the alternative use he could make of his land, and the numerous management and risk factors that affect the willingness of public and private owners to engage in this long-term enterprise.

Housing and Residential Site Requirements

The housing shortage of the early post-World War II period stimulated considerable discussion of the housing problem in the United States and prompted numerous estimates of present and future housing requirements. These estimates varied over a wide range, partly because of differences in assumptions and partly because some estimates were concerned with probable construction while others were concerned more with the problem of social need.

Industrial and Commercial Site Needs

Generally speaking, the proportion of any city's area that is used for these purposes is usually small. From 10 to 16 % of the urban area usually suffices for these purposes. The trend, however, is in the direction of more extensive use of land for these purposes. With the continued expansion of the national economy and of the areas used for urban and suburban residential purposes, more and more land will be needed for commercial and industrial sites. Some of these sites will be provided by the redevelopment of urban areas now used for residential purposes. However the lure of lower land values, more space, and suburban markets will undoubtedly favor a marked expansion of these uses in suburban and now rural areas. The area requirements for retailing, wholesaling, office space, and industrial uses depend upon the types of enterprises undertaken, the competition for desirable sites, and the size, shape, location, and value of the land parcels involved. The demand for these sites also will be affected to a considerable extent by business conditions and by the existence of a present or potential market for the goods and services produced.

Land requirements for service areas

Service areas tend to fall into two groups, those which exist primarily for single service purposes and those which fit into multiple-use patterns, military reservations rank most important area-wise in the first group. Other important examples include the sites used for cemeteries, schools and public buildings, water-filtering operations, power plants, and public dumping grounds, the area requirements for most of these uses will probably increase with population growth. Future military reservation needs will depend upon international politics and the future course of peace and war.

Prospects for meeting future needs

Few problems provide a bigger challenge than that of meeting the world's future requirements for food and other land resources, with food, as with other land products, the problem of increasing supplies is always one of expanding production where the people live, transporting the food from where it can be produced to the people, or moving the people to the food supply, problems arise with each of these alternatives. Factors such as a limited resource base, operation of the law of diminishing returns and present production and ownership patterns may discourage efforts to increase production in the areas where people live. High transportation cost, limited consumer purchasing power, trade barriers, and international exchange problems frequently prevent the use of areas located away from the market for this purpose, the movement of people to areas of potential surplus production in turn is often stymied by immigration barriers, migration costs and restrictions, or the reluctance of people to move.

Water common property - It is a private property of a group. The group may vary in size, nature and internal structure e.g. indigenous tribe, neighbours of village. Some examples of common property are community forests and water resources.

Water resources are sources of water that are useful or potentially useful to human. Uses of water include agriculture, industrial, household, recreational and environment activities. Virtually all of these human uses require fresh water.

Climate change

Climate change could have significant impacts on water resources around the world because of the close connections between the climate and hydrological cycle. Rising temperatures will increase evaporation and lead to increases in precipitation, though there will be regional variations in rainfall. Overall, the global supply of freshwater will increase. Both droughts and floods may become more frequent in different regions at different times, and dramatic changes in snowfall and snowmelt are expected in mountainous areas. Higher temperatures will also affect water quality in ways that are not well understood. Climate change could also mean an increase in demand for farm irrigation, garden sprinklers, and perhaps even swimming pools.

Water pollution is one of the main concerns of the world today. Several countries have strived to find solutions to reduce this problem. Many pollutants threaten water supplies, but the most widespread, especially in developing countries, is the discharge of raw sewage into natural waters. Sewage, sludge, garbage, and even toxic pollutants are all dumped into the water.

AN ESTIMATE OF THE DISTRIBUTION OF GROUND WATER SALINITY IN THOOTHUKUDI DISTRICT AND ITS MANAGEMENT

This paper focuses an estimation of the distribution of ground water salinity in Thoothukudi district and its management. The water quality ratings of the coastal area of Thoothukudi district has been estimated by Tamilnadu Agricultural University, Research Laboratory, Kovilpatti, which is based on Electrical Conductivity, Sodium Adsorption Ratio, Residual Sodium Carbonate and Geo-chemical type as presented below in table 5.1, 5.2 and 5.3. Out of these, Electrical Conductivity is the most popular one. The researcher has selected this criteria for his analysis.

Taluk Level Irrigation Water Status

S. No.	Name of Taluk	Total Revenue Village	No. of Revenue Village with Well	EC (dsm ⁻¹)				
				C1	C2	C3	C4	C5
1	Kovilpatti	102	101	22	27	37	11	4
2	Vilathikulam	114	70	16	24	22	8	—
3	Thoothukudi	29	29	5	1	6	6	11
4	Tiruchendur	58	58	25	23	8	1	1
5	Srivaikuntam	67	58	31	22	4	1	—
6	Ottapidaram	63	63	7	25	17	5	9
7	Satankulam	23	23	10	4	6	1	2
	Total	456	402	116	126	100	33	27
	Percentage			28.86	31.34	24.88	8.20	6.72

Source: Research Laboratory, Tamilnadu Agricultural University, Kovilpatti.

From the table it is clearly understood that out of the total 402 villages with well in this district, 116 villages have C1 salinity status. 126 villages in C2 status, 100 villages in C3 status, 33 villages in C4 status and 27 villages in C5 status. Again, the salinity status has been distributed village-wise among the various taluks in the district.

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In Vilathikulam Taluk, the water status is normal in 40 villages (C1C2), whereas it is saline in 30 villages (C3, C4 and C5). In Thoothukudi Taluk, the water status is normal in 6 villages, whereas it is saline in 23 villages. In Thiruchendur Taluk, the water status is normal in 48 villages, whereas it is saline in 10 villages. In Ottapidaram Taluk, the water status is normal in 32 villages, whereas it is saline in 31 villages. In Sattankulam Taluk, the water status is normal in 14 villages, whereas it is saline in 9 villages.

MANAGEMENT OF GROUND WATER SALINITY

The commonly used management Practices are listed below.

Irrigation Practices

The salinity regime of a plant to which it is exposed depends upon a number of factors, such as stage of the growth when salinisation occurs the rate of salinisation the length and time of exposure to salinity, periods of low salinity levels and salinity distribution with depth in the profile. Complete reclamation of a saline soil is often difficult because of limited fresh water supplies and erratic and undependable rainfall. Thus, one may be obliged to find out management alternatives which right reduce the damage to plant growth.

a) Surface Irrigation methods

Surface irrigation methods have an overall low water application efficiency resulting in increased water logging and thereby leading to more problems of salinity and alkalinity. Precise land leveling and smoothening help in increasing the uniformity of water application and in decreasing deep percolation losses.

b) High frequency irrigations

The soil water salinity continually changes following an irrigation. Frequent irrigation with lesser depth of water per irrigation are supposed to maintain better water availability in the upper part of the root zone, even if the total amount of water applied is more or less the same. With each irrigation, this upper area is more thoroughly leached than the lower root zone thus reducing the osmotic effects and increasing the soil wetness.

Selection of Crops and Crop Rotations

Depending on the quality and quantity of water available for irrigation, selection of a crop and its variety which can be best suited to the soil environment is very important. On the basis of crop tolerance to quality of irrigation water or soil salinity the crops can be classified in four groups viz. (a) Highly Tolerant; (b) Tolerant; (c) Semi Tolerant; and (d) Sensitive.

Crop Tolerance Table

Highly tolerant	Tolerant	Semi-tolerant	Sensitive
Barley	Wheat Oats.	Rice <u>Cereals</u>	
	Pearl Millet Sorghum	Finger Millet Maize Minor millets <u>Millets</u>	
		Cluster bean Pigeon pea Cowpea <u>Pulses</u>	Black Gram Bengal Gram Green Gram Lentil
	Indian Mustard castor Indian rape Linseed Safflower Soybean Coconut Cotton Sun hemp	Niger Groundnut Sunflower Sesame <u>Oil seeds</u> Fibre Crops	
Sugar Beet	Tapiaco	Sugar and Starch Crops Sugarcane	
	Spinach Amaranths	Vegetables Ash Gourd Bitter Gourd Bottle Gourd Brinjal Cabbage Cluster Bean Pea Ladies finger Musk Melon Onion Potato Ribbed Gourd Sponge Gourd Dolichos Sweet Potato Tomato Turnip Water Melon <u>Condiments and spices</u> Chilies Fenugreek Garlic <u>Narcotics</u> Tobacco	Radish Carrot Coriander Cum in Mint Opium
Date palm	Pomegranate Guava Ber	Fruits Custard Apple Kagzi lime	Grape Sweet orange

Salt Balance and Leaching Requirement

The importance of the concept lies in the maintenance of salt balance in the root zone such that the amount of salt added during irrigation is equal to the amount of salt drained. Leaching fraction is defined as the ratio of the amount of water drained below the root zone and the amount applied through irrigation. While leaching fraction (LF) is the fraction of applied water that actually passes the lower boundary of the root zone, Leaching requirement (LE) is an estimate of leaching required to maintain soil water salinity within tolerable limits.

Rain Water Management

When the rainy season is short and most of the rain occurs within a short span of time, as in most arid and semi arid zones of India, rainfall may be sufficient to leach salts out of the root zone. As per field observations by Gupta and Abichandani (1970), it is reported that after the rains amounting to 35 to 45 cm, initially high salt concentration in the soils was largely reduced making 40 cm of the surface completely non-saline. It can be generalised that the depth of the soil from which the soluble salts (80 percent) are leached during monsoon season, corresponds roughly with the total rainfall during monsoon season. It is obvious therefore that if the root zone depth is 40 cm, a minimum amount of rainfall equal to 40 cm is necessary to leach down the accumulated salts.

Blending with Good Quality Waters

One of the practices for utilising water of high salinity consists in mixing it with good quality water so that EC and of SAR could be reduced to the desired extent. This would increase the total quality of water available for irrigation but at the same time reduces good quality water. Shalhevet and Kanbulov (1976) have brought out the following three points need to be borne in mind in this regard.

- i) The increase in yield through the increase in water supply should be at least as large as the potential decrease in yield caused by increased salinity.
- ii) When the decrease in water quality through mixing requires leaching the additional water required for additional leaching should be taken into account. Furthermore, if removal of leaching water requires the construction of an artificial drainage system, this should also be taken into account, in the evaluation.
- iii) The use of good quality irrigation water to dilute drainage water so that it may be reused is a questionable practice. It should be practised only when leaching is provided by rainfall.

Manures and Fertilizers

Growing of a green manuring crop in reclaimed saline soils during summers is important in the following two ways.

- (i) it provides a crop cover to the soil and therefore, desalinisation of reclaimed soil is minimized. The irrigation water applied to this crop also manages to keep the salt down.
- (ii) The Crop when turned over into the soil adds nutrients and organic matter which invariably helps in increasing crop yields.

RECOMMENDATIONS AND SUGGESTIONS

The following are suggestions or recommendations, which are taken in to consideration for better use of different geo chemical types of water, viz.,

1. Chloride type water (Calcium, Magnesium and sodium)
2. Carbonate type of water (Sodium, Magnesium)
3. Bicarbonate type of water (Sodium, Calcium Magnesium)

WATERSHED DEVELOPMENT PROGRAMME – A VEHICLE FOR SUSTAINABLE TAMILNADU AGRICULTURE

Introduction

India is an Agricultural based country almost 70% of people dependent on agriculture and allied activities. Indian Agriculture is subject to the vagaries of monsoon. Irrigation facility is one of the significant factors contributing to agricultural development in India. Despite various schemes of the Government to extend facilities for irrigation only around 40% of the net cultivable land has been irrigated so far while the remaining 60% is rain-fed. It is therefore imperative on the government to focus on watershed development, particularly in the rain-fed areas. The aim has been to ensure the availability of drinking water, fuel wood and fodder and raise income and employment for farmers and landless labourers through improvement in agricultural production and productivity.

Significance of Sustainable Tamilnadu Agriculture

Tamilnadu agriculture is the most overriding sector in the economy of the state. Around 70 percent of the state's population are involved in agricultural activities as this is one of the major means of livelihood in Tamilnadu. It has occupied an area of 1.3 lakh sq. km with an overall area of around 63 L.Ha for plantation. The primary responsibility of the government of Tamilnadu is to activate stability in the agricultural sector and also increase the sustainability in the agricultural production of the state. This is done with an objective to meet the demands put forth by the growing population in the food segment as well as the raw materials department in the agro-based industries. This will take a toll on the unemployment in the rural areas. The agriculture in Tamilnadu has executed a creditable performance over the years with the help of so many efficient farmers who are both responsive and receptive to the technological development introduced in the agricultural sector of Tamilnadu. The agricultural department of Tamilnadu has decided upon implementing various development schemes and generating innovative technologies to ensue growth in the state's agriculture.

Impact of Watershed Development Programme in Tamilnadu

Bio-physical Impacts

The watershed development activities have significant positive impacts on various bio-physical aspects such as investment on soil and water conservation measures, soil fertility status, soil and water erosion,

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expansion in cropped area, changes in cropping pattern, cropping intensity, production and productivity of crops in Tamilnadu.

The watershed treatment activities improve conservation of soil and moisture; improve and maintain the fertility status of soil (Sikka *et al.*, 2000; Ramasamy and Palanisami, 2002; Palanisami and Suresh Kumar, 2002); and reduce soil and water erosion. The organic carbon has increased by 37 per cent due to watershed intervention (Sikka *et al.*, 2000) and most studies have revealed that there is a significant reduction in soil and water erosion.

Environmental Impacts

The watershed development activities generate significant positive externalities which have a bearing on improving the agricultural production, productivity, socio-economic status of the people who directly or indirectly depend on the watershed for their livelihood. The environmental indicators include water level in the wells, changes in irrigated area, duration of water availability, water table of wells, surface water storage capacity, differences in the number of wells, number of wells recharged /defunct, differences in Irrigation intensity and Watershed Eco Index (WEI).

Socio-economic Impacts

The watershed development programmes influence bio-physical and environmental aspects and thereby bring changes in the socio-economic conditions of the people (Deshpande and Rajasekaran, 1997). In the state of Tamilnadu. The socio-economic indicators like changes in household income, per capita income, consumption expenditure, employment, migration, people's participation, household assets and wage rates at the village level were considered for the impact assessment.

Overall Economic Impacts

Experiences show that watershed development activities have overall positive impacts on the village economy. The impact of these watershed development activities can be assessed by using key indicators such as net present value (NPV), benefit cost ratio (BCR) and internal rate of return (IRR). However, only a few studies (Palanisami and Suresh Kumar, 2005; Palanisami, *et al.*, 2002; Ramaswamy and Palanisami 2002; Palanisami *et al.*, 2006; Palanisami and Suresh Kumar, 2006) have assessed the overall impact of watershed development activities through BCR and NPV. The benefit cost ratio was found to range from 1.27 to 2.3. The size of BCR also depended on the magnitude of benefits accrued due to the watershed development activities which in turn critically depended on the rainfall.

Peoples Participation in Watershed Management

Like all other development programmes, watershed development also banks heavily on the participatory approach. Though, watershed development programme envisages an integrated and comprehensive plan of action for the rural areas, peoples' participation at all levels of its implementation is very important. It is so because the watershed management approach requires that every piece of land located in watershed be treated with appropriate soil and water conservation measures and used according

to its physical capability. For this to happen, it is necessary that every farmer having land in the watershed accepts and implements the recommended watershed development plan.

Peoples' participation and Benefits from Watersheds

Peoples' participation in planning, developing and executing watershed activities is a critical factor that determines the success of the program. It calls for community participation and collective action. It is necessary because individual choices have collective consequences in the watershed frame work. The available evidence confirms that there existed a positive relationship between people's participation and benefits accrued from watershed programs.

People's participation, involvement of Panchayat Raj Institutions, local user groups and NGOs along side institutional support from different levels, viz. the Union Government, the state, the district and block levels should be ensured to make the programme more participatory, interactive and cost-effective.

Peoples' Participation and Community Mobilisation

Community participation is an important aspect of the WDP. The entire watershed community is involved for the integrated development of the watershed and the assets created in such an effort are maintained by the community. People's participation ensures conservation and development of common property resources.

Conclusion

Most farmers across the state reported that the sustainability of agriculture is possible by harnessing rainwater and improving the groundwater, which is possible through soil and water conservation measures. Farmers also reported that soil erosion can be minimized and irrigation potential can be improved through soil and water conservation structures. This paper indicates that the Watershed Management involves the management of Land, Water, energy and agricultural sustainability relevant scientific approaches appropriate to socio economic background for the development of watershed. The main theme behind the watershed management is to minimize the waste of rain water, which flows into the oceans at the cost of socio-economic and ecological

WATER MANAGEMENT FUTURE PERSPECTIVES

Water is very much essential to human consumption and availability of fresh water poses a concern especially in the wake of urbanisation, industrialisation, population growth combined with climatic change effects. The quantity and quality of water available for human consumption especially with the ongoing environmental stress creates a major problem for the human civilisation not only for the present but also for the future generations. The need is to sustain and protect the available fresh water. Whatever the source of fresh water there is an urgent need to protect it without wasting it. There has been instances of floods where rain water is not properly channelised to augment the fresh water resource. Perennial rivers which discharge precious fresh water into the sea due to the erratic climatic changes to be properly utilised for human consumption by creating more reservoirs and channels for cultivation. Climatic changes have triggered frequent floods, droughts which will indirectly affect the availability of fresh water.

Widespread urbanisation due to the ever changing requirements of mankind and indiscriminate destruction of natural resources has created acute shortages in the urban centre. Pollution is another major factor which destroys the fresh water base. There are instances where industrial wastes are let into the lakes, ponds, rivers and water available for human consumption gets contaminated. Water borne diseases spread due to this callous attitude of the industrialists. The flora and fauna of the river beds also gets spoiled. Skin diseases, animal deaths, land fertility also gets impaired. It is all our own creation. If we had wisely utilised our god given resources well we could have reaped more benefits and life on the earth will be much more happier.

India is heading towards a fresh water crisis mainly due to improper management of water resources and environmental degradation which has led to lack of access to safe water supply to millions of people. There has been lack of adequate attention to water conservation, efficiency in water use, water reuse, ground water recharge and ecosystem sustainability. An uncontrolled use of borewell technology has led to the extraction of groundwater at such a high rate that often recharge is not sufficient. The causes of low water availability in many regions are also directly linked to the reducing cover and soil degradation. Pollution of groundwater resources has become a major problem today. The pollution of air, land and water has an effect on the pollution and contamination of groundwater.

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Water potential of india is substantial but the scarcity is felt everywhere for drinking.to meet the relentless increase in demand for water for various purposes and to achieve the goal of optimal use and to ge the maximum benefits it is necessary to make water resource development holistic through a comprehensive integrated river basin planning and management.

Management of water can be done in the following ways:

- * Water harvesting storage capacity has to be increased adequately in order to ward off future difficulties.
- * Micro irrigation systems to be adopted and popularised.
- * Supply management : identify, exploit and utilise hitherto unexplored water resources.
- * Demand Management: use special incentives and water saving mechanisms to encourage economical and efficient use of water as a resource.
- * Inter linking the rivers to conserve the water draining into sea without being harnessed.
- * Improve storage structures.
- * Treatment and recycling of waste water.
- * Keeping up the ecological balances without deforestation and reduce the fury due to climatic changes.

We can learn valuable lessons from ISRAEL on water management. Israel produces products worth three dollars per cubic meter of water. Storagereservoirsarevital for exploitationof water resources. This will not only help in recharging theground water but also mitigate droughts and other scarcity problems. Thedemand for irrigation water in future is destined to multiply with increased crop intensity of improved planting materials, but the escalating and fierce competition from industrial and urbanised domestic use will drastically reduce the very availability of water for agriculture. It is required to sagaciously use the precious water resources scientifically to increase the per unit productivity.

Strategies for improved water management:

- * Integrated msnagement of water: water policies should encompass underground water,surface water and direct utilisation of rainfall as an integrate continuum requiring common strategies.
- * Training: Training of professionals for the water sector should develop new environmental dimensions and should comprise conservation of water,disaster preparedness,integrated land-water uses,sensitisation to new responsibilities and procedure for stakeholder participation.

- * The government can develop national water management policies that help not only to improve supply but also manage demand better. Key strategies include regulation of water depending on its end use, watershed management and appropriate pricing.
- * Need for environmental and social management in using water resources.
- * Special emphasis has to be laid on the conservation of quantity of water from the sources to the points of consumption by making use of different techniques such as efficient use, reuse, waste water treatment, setting priorities.
- * Revival of local and traditional water storage structures innovative methods of water harvesting (conservation and harvest the rain water) and integrated watershed development programmes.
- * Better involvement of stakeholders in the planning and implementation of water resource programmes is a must.
- * People's participatory institutions and panchayats and municipal bodies should be encouraged to shoulder the responsibility of maintaining local water supply system.
- * Industries should find ways to minimize the water pollution.

Government should take steps to strengthen proper institutional and regulatory mechanisms for conservation and preservation of water resources that directly help in protecting the natural environment and supplying water for future generation.

Conservation of water could be encouraged and skillfully handled by proper community participation and community action planning.

Documentation of water availability, water abstraction and annual natural recharge are essential to study the water demand and supply which are in turn essential for decision making in extraction of water in general and ground water in particular.

To overcome the problem and over exploitation of groundwater an integrated approach with fewer tube wells and sharing of ground water resources are considered as an appropriate water policy.

Exploitation of groundwater reservoirs must be regulated by local governments through appropriate economic, legal and fiscal instruments. Reforms in the areas of water resources are the need of the hour in water resource management.

Suggestions:

- ♦ All decisions about water must be based on eco-system and water shed based management.
- ♦ There is a need for stronger national and international laws to promote conservation of water.
- ♦ Water must be declared as a basic human right.
- ♦ Water should be treated as a national resource and its development and use should be determined on sound scientific principles.
- ♦ Water quality monitoring system for surface water and groundwater to identify the sources of pollution and to focus on the need for undertaking the correct steps.
- ♦ Major institutional policy and technological initiatives are required to ensure efficient, socially equitable and environmentally suitable management of water resources.
- ♦ Water shed development and management programmes should be implemented in a systematic and scientific way on watershed basis in a holistic way by all the departments in a co-ordinated manner.
- ♦ Integrated watershed development actions have to be taken to use rainwater, soil water, groundwater and runoff water to increase production in rainfed areas.
- ♦ National and international research institutions must be made available to the designers of irrigation system in order to ensure that water delivery requirements are used as the basis of system design.

CONCLUSION:

Water is emerging as a national challenge and its most efficient management has to be given top priority in order to meet the future demands of food grains for a fast growing population. Managing water resource is more important than managing material wealth.

TRENDS AND FLUCTUATIONS OF SEASONAL AND ANNUAL RAINFALL IN TAMIL NADU AND ITS IMPACT

Introduction:

Typical of its geographical location, the Indian subcontinent with its predominantly agrarian economy continues to revolve around the vagaries of rainfall, called the Monsoon. Broadly, the pattern of rainfall in India can be classified into two seasons, viz., South-West or the summer Monsoon covering the period from June-September and North-East or the winter Monsoon from October to December.

Monsoon rainfall is the basic resource for water availability in Tamil Nadu. Out of 30 districts in Tamil Nadu, Salem, Dharmapuri, Krishnagiri, Namakkal, The Nilgiris, Kanyakumari districts and parts of Villupuram, Cuddalore and Perambalur districts mostly benefit from Southwest monsoon season (June-September) rainfall.

Monsoon rainfall performance in Tamil Nadu

The Season wise contribution of rainfall to the total rainfall (in mm) during the year 04-05 is given below:

Season	Normal	Actual	Seasonal Contribution (%)	% Variation to Normal
1.South-West Monsoon	331.5	360.7	33.4	8.8
2.North-East Monsoon	464.6	472.1	43.8	1.6
3.Winter	37.4	14.3	1.3	-61.8
4.Hot- Weather	128.4	231.7	21.5	80.5
Total	961.9	1078.8	100	12.2

Source: India Meteorological Department, Chennai-6

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South-West Monsoon Season

The South-West Monsoon in the past five years in Tamil Nadu had recorded an a deficit rainfall in the years (i.e) 2005-06 and 2006-07 and has increased during the last two years (i.e) 2007-08 and 2008-09. In the year 2009-10 the monsoon was different.

North-East Monsoon Season

The North-East Monsoon in the past five years in Tamil Nadu had recorded an increased rainfall in all the five years taken into study. The % variation from the normal rainfall has been high in the year 2005-06 when compared to a nominal increase of 15% in the other years

Winter Season

The Winter Season has always showed a decrease in the actual rainfall received over the years except for the year 2007-08. The seasonal variation to normal has also shown a drastic variation of above 65% on an average in the four years of decreased rainfall analysis.

Hot-Weather Season

The hot weather season has shown fluctuating performance throughout the five years of analysis. In the years 2004-05 and 2007-08 the actual rainfall has been extensive when compared to a minimal increase in the years 2005-06, 2006-07 and 2008-09. The variation from normal has been more than 100% in the years 2004-05 and 2007-08 when compared to a minor variation on an average of 15% in the last three years of study.

The over all study indicated that rainfall intensity is greater than the actual rate of expectation and this can be utilised to solve the problem of water crisis in Tamil Nadu presently.

Management of Water Crisis:

Agricultural Water Management:

It is understood that agricultural sector consumes about 85 percent total water available in Tamil Nadu. High water requirement crops like rice (1200 mm), Sugarcane (2000 mm) and Banana (2000 mm) are largely grown in Tamil Nadu from canal irrigated area, tank irrigated areas and well irrigated area. The need of the hour is to change the cropping pattern from high water requirement crop to low water requirement crops, rice and alternatively some other efficient crops may be introduced in the existing cropping pattern. In addition to have sound alternate cropping pattern which requires lesser water all water saving techniques so far recommended by Tamil Nadu Agricultural University for various crops must be popularized with the farmers. This includes drip irrigation sprinkler irrigation, surge irrigation alternate furrow irrigation etc.

Home shed water management:

Water management at the household can be made effective through the following suggested measures

a) Harvesting rain water at home:

The Government of Tamil Nadu has taken right direction in this regard and provision of rain water harvesting structures in all houses has been completed during August 2003. This impact will be known with in few years on the ground water recharge.

b) Minimising water requirement at house:

- i. Replacing worn-out pipes and taps and closing the leakages in all the water pipes.
- ii. Clean the cars and two wheelers with wetted cloth.
- iii. Practicing irrigation to home garden in the evening hours rather than in the morning.
- iv. Using washing machine with full load once in a week.
- v. Reducing the flushout tank capacity from 10 litres to 5 litres in the toilets.
- vi. When drawing water from pipes to containers, close the pipe when $\frac{3}{4}$ th container is filled up so as to avoid over flow.

Conclusion:

Though there is no loss to water in spite of the drastic changes in the hydrological cycle, its availability is becoming scarce across the world including Tamil Nadu. Water use must be minimized both in agriculture and also in home. There may be some ecological imbalance temporarily, but it will get vanished at longer run through efficient use of water shed management.

CHALLENGES OF WATER RESOURCE MANAGEMENT IN INDIA

Introduction

India is endowed with a rich and vast diversity of natural resources, water being one of them. Its development and management plays a vital role in agriculture production. Integrated water management is vital for poverty reduction, environmental sustenance and sustainable economic development. National Water Policy (2002) envisages that the water resources of the country should be developed and managed in an integrated manner. The fresh water constitutes a very small proportion of this enormous quantity. What is effectively available for consumption and other uses is a small proportion of the quantity available in rivers, lakes and ground water. The crisis about water resources development and management thus arises because most of the water is not available for use and secondly it is characterized by its highly uneven spatial distribution. Accordingly, the importance of water has been recognized and greater emphasis is being laid on its economic use and better management.

Natural resource Management

Natural resource management is a discipline in the management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. Natural resource management is interrelated with the concept of sustainable development, a principle that forms a basis for land management and environmental governance throughout the world. Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources.

In recent years, the depletion of natural resources and attempts to move to sustainable development has been a major focus of development agencies. This is a particular concern in rainforest regions, which hold most of the Earth's natural biodiversity - irreplaceable genetic natural capital. Conservation of natural resources is the major focus of natural capitalism, environmentalism, the ecology movement, and green politics. Some view this depletion as a major source of social unrest and conflicts in developing nations. Natural resource management is congruent with the concept of sustainable development, a scientific principle that forms a basis for sustainable global land management and environmental governance to conserve and preserve natural resources. Natural Resources Management Program offers innovative management systems that will help in the efficient utilization and conservation of India's natural resources, especially water bodies.

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Water Management

The purpose of Sustainable Water Management (SWM) is simply to manage our water resources while taking into account the needs of present and future users. It involves a whole new way of looking at how we use our precious water resources. "It is recognized that water problems cannot be solved by quick technical solutions, solutions to water problems require the consideration of cultural, educational, communication and scientific aspects. Therefore, SWM attempts to deal with water in a holistic fashion, taking into account the various sectors affecting water use, including political, economic, social, technological and environmental considerations.

These principles reflect the importance of water in our daily lives and the need for proper communication, gender equity, and economic and policy incentives to manage the resource properly. The statistics show an alarming trend for India: rapid population growth, urbanization and industrialization will lead to a greater demand for an increasingly smaller supply of water resources in the area. The needs of India, and indeed the South Asian region to which it belongs, are unique. Nowhere else in the world does population growth and poverty play such a large role in affecting water resource issues.

Water Conservation

The Indian government provided the masses with adequate water supply but the management of the water supply systems wasn't undertaken efficiently this has resulted in deteriorating condition of the water supply network. Thus majority is forced to pump out ground water to fulfill the water requirements that has in turn created a huge drop in the ground water levels. Thus an effective strategy for water conservation is the need of the hour. The steps taken in this regard include water treatment plants, water pollution control so as to keep the water resources safe for other usage, careful scrutiny of water supply division and projects. The water supply department by adopting timely conservation methods can help solve the water shortage problem in India and deal with the ongoing water crisis in India.

Rainwater harvesting

Rainwater harvesting can also provide a solution to the water crisis in India. Certain areas in India receive plenty rainfall and thus creating huge rainwater harvesting water tanks can help in accumulation of natural water and then after some treatment can be utilized as a drinking water substitute.

Water Purification Industry

Large-scale water treatment is being undertaken so as to utilize the existing water resources to an optimum level. Water purification has become an industry in itself. The water purification industry in India deals in improving water quality standards of drinking water, management and treatment of ground water, bottling of mineral water available in various parts of the country and providing this bottled water throughout India as a safe drinking water solution. The major water treatment plants owners and water treatment companies in India products in the bottled water industry include Kinley, Bisleri, Aquafina, and Kingfisher etc.

Challenges of Water Resource Management

1. Industrial Activities

The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural. Water is also used in many industrial processes and machines, such as the steam turbine and heat exchanger, in addition to its use as a chemical solvent. Discharge of untreated water from industrial uses is pollution. Pollution includes discharged solutes (chemical pollution) and discharged coolant water (thermal pollution).

2. Household-Drinking water

In most developed countries, the water supplied to households, commerce and industry is all of drinking water standard even though only a very small proportion is actually consumed or used in food preparation.

3. Recreation

Recreational water use is usually a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

4. Environmental

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water usage includes artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders, and water releases from reservoirs timed to help fish spawn. Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream.

5. Water stress

Best estimate of the share of people in developing countries with access to drinking water 1970–2000. The concept of water stress is relatively simple: According to the World Business Council for Sustainable Development, it applies to situations where there is not enough water for all uses, whether agricultural, industrial or domestic. Defining thresholds for stress in terms of available water per capita is more complex, however, entailing assumptions about water use and its efficiency.

6. Population growth

Population growth is the main challenge to water resource management. In 2000, the world population was 6.2 billion. Thus, water demand will increase unless there are corresponding increases in water conservation and recycling of this vital resource.

7. Expansion of business activity

Business activity ranging from industrialization to services such as tourism and entertainment continues to expand rapidly. This expansion requires increased water services including both supply and sanitation, which can lead to more pressure on water resources and natural ecosystems.

Structure of Water Management in India

The Government of India (GoI) has formed various water management systems and authorities in India. These include Central Water Commission, Central Ground Water Board, National Water Development Agency, National Projects Construction Corporation Ltd. etc. for efficient water resources management, like construction and management of dams on various rivers.

Water Harvesting

The high rainfall area and in the lack of proper management system most of the rainwater goes waste as runoff. Farmers of the hill region have their traditional technology for making small dug-out ponds to harvest rainwater.

Water-Based Industry

In the hills flour mills are not available. Farmers have their indigenous technology to run flour mill by means of water fall. They use home-made wooden wheels as turbines to run the mills. These mills are locally known as gharat or panchaki. It is a local response to needs of the people without electric or any other complex machine systems.

Conclusion

Water is also an important source of energy. Living beings are energized when they consume water. Water falling under gravity turns the blades of turbine, which generate electrical energy. A main attraction of hydropower is based on the use of a renewable resource. Every source of energy generation has an associated environmental cost and a comparative evaluation of various sources is necessary to evolve the strategy to meet energy requirements while causing the minimum damage to the environment and society. Although water is a renewable resource, availability of water for the society is limited. In the future, considerably more water will be required for domestic, irrigation, hydropower and other uses.

AN INQUIRY INTO THE NATURE AND EXTENT OF CHANGE IN THE LAND USE PATTERN IN KUNNUKARA GRAM PANCHAYAT-ERNAKULAM DISTRICT

INTRODUCTION

Land is the basic unit of all material production. It is a scarce and inexhaustible resource which has to be used very judiciously to meet various competing demands. This vital resource, if properly utilized can ensure the best of advantage and can lead to progressive deterioration and loss of productivity if not properly utilized. Hence, it is the duty of the state and each citizen to show utmost concern for the proper utilization of land.

LAND UTILISATION IN KUNNUKARA

During the process of economic development the demand for land increases. The land gets diverted from the existing use to the new found uses. It is very essential to plan and manage all uses of land in an integrated manner. Any diversion of land from agricultural to non-agricultural uses may disrupt the balance of agricultural supplies and this adversely affects the whole process of growth. Hence, in this context, the present paper on "The Nature and Extent of Change in the Land Use Pattern at Kunnuvara Gram Panchayat- Ernakulam District" aims at analyzing the nature and extent of change and the causes and effects thereof in the land use pattern.

In recent years there has been a sea change in this area with the establishment of engineering and medical colleges, construction of roads and bridge to connect it to Parur Taluk and the construction of Cochin International Airport which is 13 Km away from the study area. As a result the land use pattern has changed thoroughly. Therefore a study on land use and its change can help one to understand the underlying process involved therein.

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OBJECTIVES OF THE STUDY

1. To draw attention towards the land use pattern in the study area.
2. To analyse the change in area under cultivation and the cropping pattern.
3. To know the pattern of land use before and after 2000.
4. To find out the causes for change in land use pattern.
5. To know the human induced factors determining the change in land use.
6. To assess the impact of change
7. To lend suggestions.

HYPOTHESIS

H_0 = There is no significant difference in the area under food and non-food tree crops during the study period.

METHODOLOGY

In this study both secondary and primary data relating to land use category, area under crops, cropping pattern, pattern of land holdings etc have been used. The secondary data have been collected from official records of Kunnukara Gram Panchayat office, village office, Department of Agriculture and Soil Lab at Vyttila. The primary data have been collected from the residents, agriculturists and households of Kunnukara Panchayat.

REVIEW OF LITERATURE

A few studies relating to land use pattern are as follows-

- The study conducted by Poddar et al. (1995) in Karnataka has revealed that the optimization of resource use with the existing and improved technology led to cultivation of a few but more profitable crops in the new cropping patterns.
- Crop combination studies are essential to understand the agricultural system as the individual crops are rare and they are not grown alone, but they are raised in combination. (Weaver, 1954).
- Velayudham (2000) reported that land degradation is caused by excessive pressure on land to meet the competing demands of the growing population for food, fodder and fibre.

KUNNUKARA GRAM PANCHAYAT

LOCATION-10° 90" N 76° 180" E

Kunnukara is a census town and panchayat in Parur Taluk of Ernakulam district, Kerala. The village is situated in airport road connecting North Parur (NH 17) and Nedumbassery (NH 47). The village is surrounded by three rivers namely Periyar on the south, Chalakkudy river on the north and Uzhathu river in the west. Arabian Sea is located just 10Km away towards west. This increases its natural beauty. Kunnukara is considered to be the „rice grain of Parur. The main source of income comes from agriculture. Brick construction is the major industry.

SOIL

Soil forms the basis of life supporting system. The soil in Kunnukara is laterite, its texture loamy, rich in aluminium and iron, red in colour and a fertility code between 3-4.

LAND

The land in kunnukara is broadly classified into two. They are:-

- (1) Upland:-Upland is considered as hard land.
- (2) Lowland:-Lowland is considered as soft land. Most suitable cultivation in this type of land is paddy.

GENERAL LANDUSE

Details on the land use pattern and the area under different crop groups during the study period have been highlighted in the following tables

LAND	AREA(in hect)	
	1999	2009
Total geographical area	2214	2214
Excess land	64	5
Total cultivation	1394	1200.3
Paddy cultivation	510	253
Other cultivation	884	947.3
Clay mines/Brick kilns	8.8	2.4
Road	9.5	14.5
No. of houses	3017	5317
Total No. of wells	3205	40
Canals	12	12
River	38	38

SOURCE: PANCHAYAT OFFICE, KUNNUKARA.

TABLE NO: 2
AREA UNDER DIFFERENT CROP GROUPS

CROPS	YEAR 1999	PERCENTAGE	YEAR 2004	PERCENTAGE	YEAR 2009	PERCENTAGE
TOTAL SEASONAL FOOD CROPS	965	69.23	727.5	67.45	909.3	75.43
TOTAL FOOD TREE CROPS	13	0.94	26	2.51	27	2.30
TOTAL NON-FOOD TREE CROPS	414	29.69	313	29.22	253	21.35
TOTAL PLANTATION CROP	-	-	6	0.60	11	0.92
FLOWER CULTIVATION	2	0.14	2	0.22	-	-
TOTAL CROPPED AREA	1394	100	1074.5	100	1200.3	100

SOURCE: DEPARTMENT OF AGRICULTURE, KUNNUKARA.

With the help of χ^2 test, it was found that the calculated value was greater than the table value. So the null hypothesis stands rejected and it is concluded that there is significant difference in the area under food and non-food tree crops during the study period.

AGRICULTURE

Rice, coconut and Banana are the important crops cultivated. Rice is cultivated in almost all parts of the panchayat. Cropping pattern depends upon agro climatic conditions and socioeconomic factors. Vegetables of almost all varieties, pepper, and pineapple are cultivated. As crop rotation, cowpea is cultivated. This is to improve the fertility of soil. Cucumis Melo is cultivated as summer crop. Table below shows the total area of cultivation during the study period.

TABLE NO: 3
TOTAL AREA OF CULTIVATION (in hect)

CROP	AREA (in hect)		AREA (in hect)		AREA (in hect)	
	YEAR	PERCENTAGE	YEAR	PERCENTAGE	YEAR	PERCENTAGE
	1999	1999	2004	2004	2009	2009
PADDY	510	36.59	289	26.89	253	21.08
BANANA(NENDRAN)	296	21.23	216	20.10	307	25.58
OTHER VARIETY BANANA	57	4.09	84	7.82	81	6.75
ELEPHANT FOOT YAM	60	4.30	70	6.05	40	3.33
OTHER VARIETY VEGETABLES	20	1.43	30	2.79	68	5.67
COCONUT	246	17.65	181	16.85	143	11.91
NUTMEG	18	1.29	22	2.05	40	3.33
ARECANUT	150	10.76	110	10.24	70	5.83
RUBBER	-	-	6	0.55	11	0.92
MANGO	10	0.72	18	1.68	21	1.75
CASHEWNUT	3	0.22	8	0.74	6	0.5
GINGER	-	-	3.5	0.33	12.8	1.07
PEPPER	5	0.36	10	0.93	15	1.24
TAPIOCA	12	0.86	20	1.86	120	10
TURMERIC	5	0.36	5	0.47	12	1
PINEAPPLE	-	-	-	-	0.5	0.04
FLOWERS	2	0.14	2	0.19	-	-
TOTAL	1394	100	1074.5	100	1200.3	100

SOURCE: DEPARTMENT OF AGRICULTURE, KUNNUKARA.

CROP COMBINATION

The divergence in the cropping pattern has led to the agricultural growth of the area; this as given economic benefits to the farmers. The diversity of crops varies from area to area because some places have hard land and some have soft land. Some of them are may be very significant, but some are inconsequential.

TABLE NO: 4
CROP COMBINATION-SEASONAL AND TREE CROPS

SL. NO.	COMBINATION	CROPS
1	1 CROP	PADDY
2	2 CROPS	YAM-(RED)AMARANTH
3	2 CROPS	BANANA-VEGETABLES
4	2 CROPS	TAPIOCA-GREEN GRAM
5	2 CROPS	NUTMEG-COCOA
6	2 CROPS	COCONUT-ARECA NUT
7	2 CROPS	PEPPER-ARECANUT PEPPER-JACK
8	2 CROPS	ARECA NUT-BETEL VINE

SOURCE: PRIMARY DATA

Monocropping practices for cultivation of paddy because the land is low (soft land). This is not suitable for the cultivation of other seasonal crops and tree crops.

CROPPING PATTERN-PADDY

Paddy is cultivated in the wet low land. It is cultivated in almost all parts of the Panchayat. In the low land where paddy is cultivated, double cropping is restricted due to some topographical and climatic conditions. 3 varieties of rice were grown:-

TABLE NO: 5
GENERAL CROPPING PATTERN OF PADDY

SEASONS	PERIOD	
	FROM	TO
VIRIPPU(I crop/autumn)	April-May	Sep-Oct
MUNDAKAN(II crop/winter)	Sep-Oct	Dec-Jan
PUNCHA(III CROP/SUMMER)	Dec-Jan	Mar-April

SOURCE: DEPARTMENT OF AGRICULTURE, KUNNUKARA

CHANGE IN CROPPING PATTERN-PADDY

For the past 3 years, there is no summer cultivation of Puncha due to water shortage and low yield.

NATURE AND EXTENT OF CONVERSION OF PADDY LANDS

The physical area under paddy cultivation is now only 253 hectares and there are signs of showing further decline.

Since, the paddy land is wet and low, soils from other dry regions are brought and filled for construction of houses and roads.

The paddy land is converted for growing perennial and commercial crops like coconut, areca nut, pepper, nutmeg, banana, tapioca and vegetables as shown in Table No:6

TABLE NO: 6
CONVERSION OF PADDY LANDS-NATURE AND EXTENT

LAND	PERCENTAGE
PADDY TO HOUSE PLOT	8
PADDY TO PLANTAINS	20
PADDY TO COCONUT	20
PADDY TO MIXED TREE CROPS	5
PADDY TO SETTLEMENT WITH MIXED	12
TREE CROPS	
PADDY TO WASTE LAND	5
PADDY TO RUBBER	1.5
PADDY TO TAPIOCA	10
PADDY TO OTHER VEGETABLES	12
PADDY TO BRICK KILNS/CLAY MINES	1.5
PADDY TO NUTMEG	5
TOTAL	100

SOURCE: PRIMARY DATA

PRODUCTIVITY TRENDS HAVE BEEN HIGHLIGHTED IN TABLE NO: 7

TABLE NO: 7
PRODUCTIVITY (PER HECTARE)

CROP	1999	2004	2009
PADDY	16 tonnes	12.8 tonnes	12.4 tonnes
BANANA(NENDRAN)	4.8 tonnes	4 tonnes	3.2 tonnes
OTHERVARIETY	3.2 tonnes	2.8 tonnes	2 tonnes
BANANA			
ELEPHANT FOOT YAM	320 Kg	320 Kg	440 Kg
OTHER VARIETY	180 Kg	180 Kg	324 Kg
VEGETABLES			
MANGO	600 Kg	1800 Kg	2200 Kg
TAPIOCA	600 Kg	1000 Kg	800 Kg
GINGER	-	1.6 tonnes	2.2 tonnes
CASHEWNUT	420 Kg	36 Kg	18 Kg
TURMERIC	72 Kg	120 Kg	120 Kg
COCONUT	288 NO.S	160 NO.S	144 NO.S
PEPPER	320 Kg	440 Kg	600 Kg

SOURCE: PRIMARY DATA

THE TWO NOTICEABLE FACTORS CAUSING CHANGE IN LAND USE PATTERN ARE:-

1. Diseases to plants especially in cashewnut and coconut have reduced the productivity.
2. Fluctuations in monsoon/climate is another factor for the change in land use pattern.

HUMAN INDUCED FACTORS DETERMINING CHANGE IN LAND USE PATTERN

1. The STATE INTERVENTION of expansion activities like construction of bridge and roadshad made it easy for Kunnukara to connect it to Parur Taluk. The construction of Cochin International Airport, Public library, training centers, market etc. has led to the change in land use.
2. PRIVATE ESTABLISHMENT of engineering and a medical college has led to increase flow of traffic into this area.
3. INCREASE IN DEMAND OF LAND FOR NON-AGRICULTURAL PURPOSES such as investment, construction of housing units etc., led to the rise in price of land which again led to increase in conversion of land for profitability.
4. The subdivision of agricultural farm due to INCREASE IN POPULATION led the owners of small farms to change to other occupations.

5. **SHORTAGE OF AGRICULTURAL LABOURERS and HIGH LABOUR CHARGES** has contributed to the change in the land use pattern.
6. The **PRESENT GENERATION** considers cultivation of paddy, coconut and cashew nut as **LOW PRODUCTIVE AND LESS PROFITABLE**. Hence has shifted to cultivation of pepper, vegetables and fruits.
7. **DUE TO MARKET FORCES** the attention of farmers has been presently diverted to perennial crops.
8. **SHORTAGE OF WATER AND BUND PROBLEMS** contributed mainly to the refilling of paddy land.
9. **LACK OF STORAGE FACILITY** is yet another factor.
10. Poor drainage led to **WATER LOGGING** in the low land during monsoon.
11. **LACK OF TIMELY CREDIT** support system especially to the marginal farmers made them turn to other means of livelihood.
12. **INSUFFICIENT ASSISTANCE** from agricultural department in the supply of seeds and machines is another factor.
13. **CLAY MINING**-last in the list but not the least. **IMPACT OF LANDUSE CHANGE**
The land use conversion in Kunnukara had its impact mainly on paddy cultivation and working of clay mines.

The impact can be analysed under Three heads:-

1. Economic
2. Social
3. Environmental.

I. ECONOMIC IMPACT

1. The reduction in cultivation of paddy has displaced agricultural labourers. If this trend continues Kunnukara is likely to lose the title of Rice grain .
2. The incorporation of technology in the field of agriculture and rise in the cultivation of crops like pepper, ginger, turmeric and mango led to the reduction in employment opportunities.
3. Increased demand of land for non-agricultural purposes has led to the rise in price of land.
4. Summer cropping of paddy has been ceased. This has led to seasonal unemployment and forced the farmers to opt other jobs.

II. SOCIAL IMPACT

1. The livestock management in the study area has been affected due to the breakdown of traditional farming sector that led to the non- availability of straw, farm yard and manure.
2. Due to migration, the family structure in the study area has been changed. Now majority are nuclear families.
3. The children of farmers are now receiving good education and are opting for professional qualifications. Hence there is less preference to take up their family s traditional job.

III. ENVIRONMENTAL IMPACT

1. Indiscriminate clay mining in paddy fields had led the wet land to be fallow. Due to the non-availability of clay, now only brick kilns are there.
2. Excessive draining of sand from the rivers for non-agricultural purposes, have degraded the quality of ground water.
3. The increase flow of traffic through this area has led to air pollution.
4. Finally the changes in the land use pattern has led to the depletion of natural resources and has downgraded the scenic beauty in the study area thereby creating a negative impact on tourism and tourist revenue.
5. In spite of the above cited negative impacts, the change in the land use pattern has positive impacts too. It has improved the living standards of most of the people. The rural masses are now getting more exposure and exposed to variety of recreational facilities. The people are receiving better quality and efficient medical and educational facilities.

The construction of Panchayat roads has reduced the problem of water logging and travelling right to their doorstep has become accessible. But the disparity between rich and poor is yet to be accounted for.

SUGGESTIONS

1. Regulatory measures may be introduced to arrive at proper land use mix and to systemize land use change.
2. Appropriate land use practices such as cultivation of fresh water fishes can be cultivated in the newly created fallow lands due to non-cultivation of paddy.
3. To overcome the problem of water shortage, the programme of micro water- shed management and rain water harvesting can be introduced. Ponds can also be utilized for this to a certain extent.
4. Clay mining has altered the land scape configuration. Since this industry provides jobs, some regulatory measures at local level should be adopted.
5. There is a need for creating awareness at the local level, as local people find it difficult to relate environmental issues with off-site impacts.
6. Adoption of alternate land use increases the employment opportunities for the landless farmers during off-season.

CONCLUSION

On the whole, the land use pattern in Kunnukara Panchayat has changed in a big way bringing with it a flood of economic, environmental and social impact. Most of this change has been attributed to Human induced factors.

GEOCONSERVATION – THE RATIONALE FOR SUSTAINABLE LAND MANAGEMENT

Introduction

Geodiversity and the concept of 'geoconservation' will be new to many people. The fact that the physical elements of the landscape – rocks and soils – need to be managed and in some cases protected is not evident to many. The very structure of the surface of the Earth perhaps seems so robust that protection is not needed. Consideration of the scale of soil erosion around the world, the rate of mineral extraction, the extent to which landscapes can be modified and remoulded to suit human needs, demonstrates that this is not true.

Threats to Geodiversity

There are many threats to geodiversity, although the majority of these threats are predominantly induced by human land use. However, natural processes such as erosion, climate change and the dynamic nature of the Earth can also present a threat to our existing geological heritage. A large number of geological sites or features have been lost, obscured or irreversibly damaged in response to changes in land use and increased urbanisation. In some cases this could have been prevented if adequate consultation had taken place at the planning stage, together with an increased recognition of the importance of protecting our geodiversity.

Human impacts on geodiversity can be summarised as:

- Complete loss of the geological features of interest (burial, excavation, or obliteration by engineering activity)
- Irreversibly interrupting natural geomorphological systems (for example, through coastal engineering)
- Partial loss or physical damage
- Fragmentation of features of interest, by systematic, or sporadic, human land management activities
- Loss of visibility of the geological features
- Loss of access, affecting our ability to view or study the geodiversity
- Interruption of natural processes in dynamic geomorphological sites.

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Geoconservation

Conservation of natural environment plays a key role in the sustainable development. Because biodiversity and geodiversity are two equally important components of the global ecosystem, nature conservation initiatives are incomplete if the physical aspects of the environment are ignored. Therefore, an integrated approach to nature conservation ought to be obvious. Geoconservation stems from the values of geodiversity and the real and potential threats to it. Everything we have, we inherited from the past, and everything we use or lose deprives future generations of it. That, in a nutshell, is the case for valuing and conserving abiotic nature. The conservation of areas, sites and features of geological and geomorphological importance is referred to as geoconservation. Different elements of geodiversity need to be protected and managed in different ways.

- Creating a protected area with the supporting legislation and penalties.
- Physically restrain visitors from reaching sensitive sites by fencing or even by placing them within specially constructed buildings.
- If we are dealing with rare fossils, minerals, or rocks, an effective means of protecting is burial *in situ* or removal and curation in a museum. This is often the approach taken with dinosaur and other fossils.
- The nature conservation charity should buy sites with the remit of retaining them for their nature conservation value in perpetuity. Example: The Nature Conservancy, which owns Egg Mountain in Montana, famous for its Maiasaur dinosaur finds.
- Education has an important role to play in helping to conserve features.
- Adequate scientific documentation about the geological interest of protected areas.
- Monitoring the condition of geoheritage assets within the protected area and an enhancement and restoration program to upgrade facilities and repair damage.

Geoconservation in India

In a vast country of sub-continental dimensions like India whose rocks provide a unique spectrum of geoheritage and geodiversity from the oldest (nearly 4000 million years old) to the youngest rocks, establishing geoparks for showcasing geological attractions for public education, recreation and sustainable economic development, can be a comprehensive panacea. We are nowhere on the world map as an enlightened nation caring for sharing its vast knowledge resources.

Not far from city beautiful, a few km from Kala Amb, the GSI established Saketi Fossil Park on its 125th Anniversary. HP Tourism failed to maintain it or effectively utilize it for promoting geotourism. In contrast, nature has conserved better the fossil wood near Kumharhatti or volcanic ash behind Hotel North Park near Nadha Bridge. Almost all over the country, Geological Monuments and Parks built by GSI are in utter neglect and in total disuse.

The Swiss have a history of quickly converting their limestone quarry in Juras into a National Park, the moment dinosaur footprints were noticed in wonderful preservation. Recently a road construction near

the French Border in Canton Jura was diverted and dinosaur discovery converted into a roadside natural history museum. Our dinosaur fossil eggs in the limestone near Jabalpur were consumed by the cement plant and now are plundered by one and all buying these at huge price from locals.

It is actually very easy to make people realize the close links between their lives and rocks, fossils and resources around them. The concept of geoparks and geosites must not be dismissed as mere cliché coined by scientists in search of survival or funds.

Conclusion

I conclude with these important words of the Scottish poet Hugh MacDiarmid who wrote by contemplating the beach shingle above the shoreline on one of the Shetlands Islands:

"I look at these stones and know little about them,
But I know their gates are open too,
Always open, far longer open, than any bird's can be,
That every one of them has had its gates wide open far longer
Than all birds put together, let alone humanity. . . .
What happens to us
Is irrelevant to the world's geology
But what happens to the world's geology
Is not irrelevant to us.
We must reconcile ourselves to the stones,
Not the stones to us. . . .
Let men find the faith that builds mountains
Before they seek the faith that moves them".

Hugh MacDiarmid, (1956) On a raised beach

WATER CONSERVATION MANAGEMENT

Introduction.

Water is the elixir of life, a precious gift of nature to mankind and millions of other species living on the earth. It is fast becoming a scarce commodity in most parts of the world. Water resource development has taken place all over the world. There is a tremendous Amount of pressure in protecting the water resources available in the country. Protecting the surface water resources from wastewater pollution plays a vital role for the development. The disposal of wastewater into the surface water bodies leads to serious problems and affects the people in health aspects. Especially in the urban areas, the pollution of domestic effluent discharges into the nearby surface water bodies created problems for the public.

In Tamil Nadu there are about 34 river basins, which are grouped into 17 major river basins, all flowing eastwards from the Western Ghats and Deccan Plateau. Out of the 17 river basins, many basins are water deficient and some have surplus water. The population and area of Tamil Nadu are 7% and 4% respectively of that of India, but the available water resources are only 3%. Even though the annual average rainfall is in the order of 925 mm there are a number of rain shadow regions receiving less than or around 400 mm rainfall making them drought prone.

Tiruchirapalli district lies at the **heart of Tamil Nadu**. The district has an area of 4,404 square kilometers. Kaveri river flows through the length of the district and is the principal source of irrigation and water supply.

Tips to save water :

- Avoid leakage of water from the taps.
- Turn the tap off when not in use especially when you brush your teeth or wash clothes.
- Rainwater harvesting is the another method to conserve water.
- The water supply should be limited in those areas which enjoys the unlimited water supplies.

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- Check the leakage of water in the toilets. Also get check the hidden water leaks.
- Educate the mind of the people in the rural areas to save the water.
- Promote the conservation of water through media and wall posters.
- Never throw the water unnecessary on roads which can be used for gardening and cleaning.
- Avoid unnecessary flushing the toilets. Dispose off the tissues, cigarettes and other waste into the bin instead of toilets.
- Use minimum amount of water to bath.
- Water Waste restrictions.
- Improvement in the water distribution system.
- Water your lawn only when it is needed.
- Use a broom instead of hose to clean the sidewalks or to wash the car.
- Capture the water that is leaking and repair it as soon as possible.
- You can use washing machine to wash clothes that does not consume much water.
- Do not leave the tap running while washing the dishes in the kitchen.
- Install small shower heads to reduce the flow of water.

Rural Water Supply is one of the major challenges that has been addressed by the government and attempts made towards tackling the crisis in providing safe and adequate water to the rural people. Lately, the problem has become particularly severe in rural areas. A review of the government's efforts in implementing various programs, policies adopted has shown that there has been progress but has not been successful in providing adequate quantity of potable water to all persons. Several factors like, increased urbanization leading to negligence of traditional water sources, poor water management, resource depletion due to over exploitation of existing resources, poor co-ordination between departments and poor institutional setup in addressing the problem have led to the severity of the problem over the years.

Benefits to conserve water:

- 1) If you save water it can save your money bills.
- 2) Reduction in interior water use cuts waste water flows, especially overflowing of gutters which contaminates the environment.
- 3) Environment benefits include eco system and habitat protection.
- 4) Water conservation helps in improving the quality of your drinking water.

Conclusion

The International observance of World Water Day is an initiative that grew out of the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro. The theme for World Water Day 2007, is "Coping with water scarcity" which is celebrated each year on 22nd March. This year's theme highlighted the increasing significance of water scarcity worldwide and the need for increased integration and cooperation to ensure sustainable, efficient and equitable management of scarce water resources, both at international and local levels. It is the responsibility of every one to educate our children. With this we are indirectly conserving the water in future also. The children who are educating to save the water will save the water in future also. Now if we cut the usage of water it definitely helps the future generations. Water is mainly related to environment. Green also helps for the environment. Growing greenery everywhere and encouraging forest causes rain fall. So green is also conserving the water.

STEPS TO IMPROVE WATER RESOURCE MANAGEMENT IN INDIA

NATURAL RESOURCE

Natural resources are the materials, which are required for the survival and prosperity of human beings. Natural resource can be a substance, an energy unit or a natural process or phenomena.

Climate change and uncertainty in water availability

The threat of climate change is now considered as an established fact. General circulation models simulate the behavior of the atmosphere and paint "what if scenarios for various levels of greenhouse gas estimations using these models the weather experts have predicted that global warming will intensify the hydrologic cycle; more intense the floods will be more frequent; The rainfall will shift towards winter and there may be a significant reduction in the mass of glaciers resulting in increased flows in the initial few decades but substantially reduced flows thereafter

The MOWR has already initiated some studies in cooperation with research institution and reputed academic institutions to assess the impact of climate change on water resources.

The hydrologists are yet to translate what climate change means for the water availability, its distribution in time and space and changes in demand. An increase in mean temperatures would increase the energy for evapo - transpiration.

The increased potential evapo-transpiration in the forest could trigger major changes in the environment and it would result in an increased cropwater requirements in the farms. The changes in seasonal temperatures could change the crop seasons.

In the post climate change-scenario, systems that are more resilient will fare better than system that are less resilient. Engineering Infrastructure that enables the water manages to store and transfer water with greater certainty can reduce the impact of uncertainty.

Climate change considerations need to be factored in as we plan water resource infrastructures.

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Water Requirement:

The requirement of water for various sectors has been assessed by the National commission on integrated water resource development (NCIWRD) in the year 2000. The requirement is based on the assumption that the irrigation efficiency will increase to 60% from the present level of 35-40% the standing committee of MOWR also assesses it periodically.

WATER REQUIREMENT FOR VARIOUS SECTORS

water demand in Km ³ (or) bcm						
	standing sub committees of MOWR		NCTWRD			
Sector	2010	2025	2050	2010	2025	2050
irrigation	688	910	1072	557	611	807
Drinking water	56	73	102	43	62	111
Industry	12	23	63	37	67	81
Energy	5	15	130	19	33	70
Others	52	72	80	54	70	111
Total	813	1093	1447	710	843	1180

Augmenting Utilizable water:

Usable water availability can be increased by tapping water that otherwise would have run-of to the sea. Water storage above ground through dams and diversion through weirs are the conventional means. However, water can also be stored underground by enhancing procolation through artificial recharge. Rain water harvesting in many small ponds through construction of bunds can also add to water availability. Inter basin transfer of water through inter-linking of rivers can substantially expand availability

Steps to improve Water Resources Management:

(i) Inter – sectoral management:

Historically, water mgt was synonymous with irrigation since the irrigation sector was by far the largest user (90 %) of water. However, with urbanization and Industrialisation, water requirement in the domestic and industrial sectors has grown considerably. Water is needed throughout the year and in locations which may not be close to major water sources. Often water has to be stored, transported and treated for particular uses. since the water resources of the state and are limited and in many cases committed to

irrigation, diverting waste for other uses has become a major challenge. Drinking water has been accorded the highest priority in the state water policy and "water security" has also been given the top priority by the government.

(ii) River Basin Boards:-

The National and state water policies recommend the management of water resources at the river basin Level. As part of the water Resources consolidation project, the Government of TamilNadu has approved the creation of river basin boards for the palar and Tamiraparni basins. River basin management committees have been set up to monitor the water related activities of different agencies and user. The palar has been heavily polluted by effluents from the tannery Industry, while the water resources of the Tamiraparani are already heavily utilized by a variety of users.

(iii) Ground Water Regulation:

About 60 percent of the ground water available through recharge is extracted annually in TamilNadu. However, over-exploitation has taken place in 35.8 percent of the blocks. It is imperative, therefore to manage the ground water resources of the state in a sustainable manner. The TamilNadu legislature passed the Ground water (Development and Management) act and the act came into force after receiving the assent of the president in march 2003. The act is applicable to the whole state of Tamil nadu except the Chennai metropolitan Area which is governed by a separate act.

(iv) Recycling and Reuse of water:

Since the total availability of surface and ground water (46, 540 Mcm) in the state is less than the present demand (54, 395 Mcm) and much less then the projected demand, there is an urgent need for both water conservation and recycling 75-80 percent of the water used for irrigation is consumptive, but the balance in the form of return flows has to be utilized. However, return flows from irrigation can lower water quality because they may carry sediment, fertilizers pesticides etc.

COASTAL POLLUTION IN TAMILNADU: WITH SPECIAL REFERENCE TO CHENNAI PORT

1. INTRODUCTION

The planet is over-populated and its limited resources, unevenly distributed among the world's people, are being used at an accelerated pace. In developing countries, seeking to expand their economic activities, consideration for environmental conservation often receives a low priority. In addition, approaches used in industrialized countries often cannot be applied directly in developing countries.

Water quality and air pollution are serious problems in developing countries in the Asian region. Air pollution in major cities marked by many factories and heavy vehicle traffic also has high concentrations of sulphur dioxide and suspended particulate matter (SPM). In addition, problems such as damage from acid rain and transboundary pollution are growing more serious.

RECOMMENDATIONS FOR POLLUTION CONTROL

The most urgent task is to contain megalopolization of our cities through a definitive policy of decentralization. Plans should be made for regional development in order to distribute industrialization to various levels of settlements. In this sense, the present arbitrary division between urban and rural development should at once be eliminated, and balanced industrial investment, dependent upon various socioeconomic and environmental factors, must be encouraged. Many problems of urban pollution in India are due to extremely high concentration of people in urban areas, generating an abnormal number of industrial and other human activities. Huge economic losses due to smoke, dust, and poor zoning practices, in addition to the creation of blighted areas in cities, are due to disorderly and haphazard development. The pollution problems in our cities can be attacked more systematically and effectively only if they are of manageable size. For most people, amorphous and large cities through systems planning, taking into account all aspects of urban life and, more importantly, the human consideration, since cities are built for people and not the other way around.

INDUSTRIAL POLLUTION CONTROL

It is cheaper to prevent pollution at the source than to treat it at the end. Too long, industries and government have taken for granted that pollution is a necessary part of production, and the cost of pollution has been externalized in the form of the price paid by the public through ill health or early deaths. Such

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externalization of cost must be stopped. Industries must have systematic plans of introducing pollution control technologies in different stages. And for this, if necessary, the government must give various incentives, even to the extent of financial assistance for pollution control. If industries pose serious health hazards to the public in highly concentrated areas, as are posed by the Bombay Gas Company, it is imperative that such industries institute pollution control devices, be moved to safe areas, or even be closed. No industry has a right to play with the health and safety of a large number of people.

GOVERNMENT

An Environmental Planning Ministry should be established on a national level, with state and municipal subsidiaries. The task of such a ministry or agency should be:

- To collect overall data on environmental conditions, pollution, and environmental damage to health, as well as on other aspects of human urban life.
- It should have strict legislative authority and the machinery to control all forms of pollution—air, water, noise and thermal.
- There should be a master plan for total urban development, which would emphasize scientific and aesthetic environmental planning.
- The government must support and encourage research in pollution control technologies either through industries or universities or other educational institutes. And, most importantly, such an agency should have the expertise available to guide and advise industries or other agencies on how to control pollution.
- There is no escaping the fact that definite standards and norms must be established and enforced.

CONSERVATION

There should be total plan for conservation of the environment—beaches, parks, lakes, rivers, and streets. In this regard, we must create a green belt around each city in order to stop the endless sprawl. More than 10 years ago London declared a five – miles green belt, as did Leningrad. India has been continuously deforested. At the present rate of destruction of trees, there may not be any forest by the end of the century. A massive program of creating forests and planting trees should be enunciated immediately. People should even be encouraged to grow plants in their homes. Vast areas around cities like Bombay remain fallow and are not cultivated. Special efforts should be made to develop large vegetable gardens to supply the city, as it done in Perking and Osaka. Solid waste from the city can be composted and used as fertilizer for these gardens.

EDUCATION

Ultimately, environment belongs to the people. If people are apathetic, careless, and callous, no one can protect the environment. The result will be cities that are vast dumps of environmental garbage.

The most important lesson to be learned from ecology is respect for the environment. Our urgent task is to inculcate ecological conscience: maintaining a reverence for our surroundings and nature cannot be taken for granted. For this purpose, educational programs must be undertaken through television, films, radio, newspapers, and schools. Such education should teach people not only simple things like where to throw garbage, and how to keep places clean, and why not to make noise, but more importantly to understand legislation and how to use it for the purpose of protecting society. Ultimately, people must develop a sense of beauty and humane environment.

SOCIETY

Recognizing that India is a poor country with limited resources and a large number of people, protection of the environment requires immediate limits of exploitation. Population must be controlled immediately: All wasteful use of resources must be discontinued. For example, if 25 percent of the pollution in cities like Bombay is due to automobiles, all our investments must be in public and mass transportation systems in order that the use of private automobiles, is reduced or even discontinued. Since resources remain limited, urgent priorities should be set up for their equitable and judicious utilization. There is no other way to bring environmental equilibrium. Society divided between stark poverty on the one hand, created by Malthusian refugees, and reckless waste on the other, generated by Madison Avenue Mandarins, threatens urban man with pollution, sterility, and unstable society. Pollution is a disease of environment.

CONCLUSION

Man has originated and survived because an environmental equilibrium has provided all the ingredients for the realization of his immense potential. This equilibrium cannot be distorted or dismantled without jeopardizing the very survival of man. To assure that survival, society must treat the environment with cooperation and a sense of commitment. This demands sacrifice and may mean a simpler style of life for all – a revolution in thinking to go beyond prestige, power, and profit. The proper utilization of technology for quality of life will release innumerable potentialities of man and nature for his ultimate happiness.

EDUCATION

WATERSHED APPROACH FOR SUSTAINABLE AGRICULTURAL DEVELOPMENT IN INDIA

An Overview:

Watershed Development Programmes (WDPs) have been initiated in India to improve and sustain productivity and the production potential of the dry and semiarid regions of the country at higher levels, through adoption of appropriate production and conservation techniques. The rainfed area constitutes 70 percent of the total cultivated land in India and nearly 42 percent of the food production comes from the dry land farming [CMIE 1986]¹⁴. The term '*watershed development*' has ideally been accepted "as a geophysical unit for planning and executing development programme for rational utilization of all natural resources for sustained optimum production of biomass with the least damage to the environment" The basic unit of sustainable development of Agricultural sector shall remain a watershed approach, which is a manageable hydrological unit of the overall environment¹⁵.

Watershed Management: Current Status in India

India has 16% of the world's population, roughly 4% of the world's water resources and 2.45 % of the world's land area. With the scenario of population becoming around 1500 million by year 2050, and current status of land degradation and erratic monsoon; watershed development and management in a sustainable manner has become crucial. The activities in this area by government and non-government organizations have achieved varying degrees of success¹⁸.

Watershed Sustainability

Sustainable development of natural resources is the need of the hour particularly to meet the basic requirement of the growing population, and maintaining the optimum balance between the available resources and their exploitation. The concept of sustained development envisages watershed development, which is a comprehensive developmental unit in which all the natural resources are interdependent.

Essential Approach

In ensuring Sustainable Agriculture, micro watershed of about 500 ha or more can be taken to saturate it with soil and water conservation works and promotes suitable and sustainable production system both arable and non-arable lands on a phased manner over a period of four or six years. The watershed project can be implemented by Project Implementing Agency (PIA) with the help of a multi-disciplinary team, beneficiaries and its groups and field functionaries of line departments. This approach can be utilized all over the country¹¹.

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Ascertainment of the Impact of the New Approach

The adoption of watershed approach by and large can improve the soil and water status on one hand and cropping pattern on the other. The per unit production in successfully implemented watershed projects can increase substantially. However, it can also generate controversy about effectiveness in improving the overall socio-economic condition of the people and the ecology of areas. **Approach to Conservation of Natural Resources and Agriculture Development**

An Integrated approach that deals with the conservation of all natural resources and addresses the problems of poverty, employment and equity have a very good prospect of success. Though watershed development and Sustainable Agricultural Development. Both soil and water conservation are organically linked to each other and their conservation must slow down and reverse the degradation of environment including arable and non-arable lands.

The role of Farming Communities and Active Participation

The Watershed Development programme can be prepared with complete involvement of the community (people) right from the initial stage of identification of the problem from Monitoring to Evaluation. The User Groups can be allowed to attend proper orientation and training programs with regard to watershed management and Technologies. **Development of Watershed Areas vis-à-vis Agricultural Development**

The Entry Point Activities (EPA) under Watershed Development Programmes and their overall Social Activities can clubbed and merged⁶ below:

(i) Soil and Water Conservation Activities

- Tank Silting.
- Construction of Major & Minor Check Dams

(ii) Land Developmental Activities.

- Land Leveling
- Earthen Bunding
- Stone Bunding

(iii) Social Activities

- Community Bore wells
- Drinking Bore wells
- Fixing of compressor with ground
- Level Reservoir (GLR)

Sustainable Watershed Development through Community Based Approach for Sustainable Agriculture

In 1987, Brundtland Commission popularly known as "World Bank Commission on Environment and Development" introduced the term "Sustainable Development" into common parlance. The term sustainable development has been defined as that development which meets the needs of present generation, without compromising the needs of future generations²⁵. Hence, Sustainable watershed development through community should aim at maximizing the agricultural output, eradicating poverty, ensuring sustainable income

along with equity, conserving the soil and water; and enabling people to enjoy material comforts with social cohesion in the long run⁸.

Factors determining the Sustainability of Agriculture Development

1. Enhancement Farm Income

The effect of the watershed can be felt in terms of crop diversification process. It can also be observed that, the farmers have earned more income per acre of land as well as yield per acre have increased due to the effect of the watershed development programmes/projects³.

2. Creation of Continuous of Employment Opportunities

The impact and effect of watershed development entailed extensive that the cultivation of more than one crop thereby generating more employment opportunities in their farmers field.

3. Cultivation of High Yielding Varieties of Crops/Improved Crop Husbandry Practices

By the introduction of watershed approach, farmers can cultivate high yielding and hybrid crops varieties drawn from Agriculture Research Station of Agriculture Universities (All) in India. Farmers can be highly motivated to have advanced type of cultivation only for these highly yielding varieties that would ensure high yield per acre in all types of soil in the rural area/region.

4. Improvement of Land and Natural Resources

It has been scientifically tested and proved that, the watershed developmental activities like land leveling, earthen bunding, deep ploughing and formation of furrows were useful to improve the land and pave the way for increased income and yield in the long run. With the introduction of watershed development programmes there will be sufficient water in the farmers land and there will be no difficulties due to lack of water in the long run.

5. Enhancing the Standard of Living of Farming Community

A Comparative Analysis on the effect and the impact of the Watershed Development Programmes can be analysed in terms of "Before and After" treatment. It can easily be observed that when income increases among the farmers as a result of the introduction of the watershed development programmes, correspondingly their standard of living status also increases. Additionally, they will purchase Agricultural Equipments and land implements such as Power Sprayers, Tractors, two wheelers and electric motors etc.

Conclusion

To sum up, watershed approach and strategies have gained more importance in the last two decades which is aimed at increasing the productivity of the land by conserving soil and water resources. It eventually improves soil fertility, reduces the soil erosion, increases the water levels etc of the area/region. The watershed approaches and strategies must aim at integrated development of the watershed areas by encompassing community (people) technology (Indigenous and Modern), Planning, Management, Monitoring, Evaluation and natural resources like land, water, vegetation etc Agricultural Sustainability¹⁰.

WATER MANAGEMENT IN AGRICULTURAL

Introduction

Poverty in India is predominantly a rural phenomenon. About 70% of the population, and about 75% of the poor, live in rural areas and most depend on agriculture. Agriculture provides livelihood to 60 percent of the rural people and remains vital for food security. In recent years, the slowdown in agricultural growth has become a major cause for concern.

The Government of India places high priority on reducing poverty by raising agricultural productivity. The World Bank too is assisting the country to build a solid foundation for a highly productive and diversified agricultural sector.

Diversification of Production and Income Sources

Rising incomes are driving the increased demand for higher-value fresh and processed agricultural products in domestic markets and globally. This opens new markets and income opportunities for farmers. Many of these commodities, however, are highly perishable and inadequate rural infrastructure and services increase farmers' losses and inhibit the more rapid expansion of high value production. The GOI recently launched the National Horticulture Mission — the single largest agriculture plan scheme — to promote increased horticulture production. The Bharat Nirman Program, which supports the expansion of irrigation, rural roads, electrification and telecommunication, will help reduce losses and marketing costs and improve the competitiveness of local products. The MoA is also encouraging states to amend their Agricultural Produce Marketing Committee (APMC) Acts to liberalize the marketing of agriculture produce at the state level and improve farmer access to markets. So far, 11 states have adopted the amendments. In addition, the MoA is also promoting public-private partnerships to develop markets and is providing investment grants to encourage investments in agro-processing and marketing.

Ensuring Food Security

While pursuing crop diversification, an emerging concern is the stagnation in foodgrain production which is raising food security concerns. The 11th Plan approach paper notes that to achieve the goal of a 4 percent overall agricultural growth rate per year, foodgrain yields per hectare need to increase by at least 2 to 3 percent per year to compensate for the possible shift in cultivated area from foodgrains to high value

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crops. To enable this, a concerted effort is needed to raise the relatively low foodgrain yields, particularly in Eastern and Central India.

Improving Public Expenditures

In recent years, the GOI and state governments have exerted greater effort to cap the amount of various subsidies, while increasing expenditures on more productivity enhancing investments. The latter includes several centrally sponsored programs, such as the National Horticulture Mission, the Bharat Nirman rural infrastructure program, and the National Rural Employment Guarantee Scheme. Participation of the poorest states in these programs is hampered, however, by lack of capacity to develop appropriate plans and implement them effectively.

Improving the Rural Investment Climate

Continuing trade and domestic regulatory reforms are encouraging increased investments in rural areas. These include the removal of most domestic marketing controls – for storage, movement of produce, credit, wholesale marketing, and food processing. However, reforms of the institutional and policy framework for land are needed. Many states have computerized their land records/registration, but reforms of the institutional and data structures are essential to reduce the cost of land transfers and enhance tenure security in rural and urban areas (for example, eliminate overlapping property claims and facilitate access to credit). The bans or restrictions on land leasing limit the access to land by poor and landless rural households and drive tenancy underground. They also limit the productivity of land use.

Fostering Rural Non-Farm Growth

Diversification of incomes through rural non-farm activities is an important element of the overall strategy to address rural poverty. More rapid growth of the rural non-farm sector is, however, constrained by government interventions in labor, land, and credit markets, as well as inadequate and poor quality infrastructure and services. To improve access to credit in rural areas, the GOI is supporting reforms of the credit cooperative system.

Conclusion

Global blueprints on agricultural water management should serve only as guidelines. The issue is a complicated tangle of political, social, historical, institutional and technological factors. In the process let us put to the test of our judgement every move we make so as not to lose sight of the welfare and advancement of farmers' community.

Water, Sanitation and Health

Safe drinking water is essential for good health, as is improved sanitation. The lack of these two essential elements of good health, along with poor hygiene, result in significantly increased morbidity and mortality. This has been recognized by the Right to water and sanitation (CESCR 2002) (1)

The world summit for sustainable Development held at Johannesburg (Safnica) and the earlier Millennium Development Declarations of United Nations have said stress on the global goal of halving by 2015 AD, the population without access to water supply and sanitation.

Water management in India has been exercised since first five-year plan onwards. Water supply and sanitation were added to the national agenda during the first five-year planning period (1951 – 56). In 1954, the first national water supply programme was launched as part of government's health plan.

There were many Major Milestones in the development of water supply and sanitation. The Ministry of water Resources drafted a National Water policy in 1987 to guide the planning and development of water resources throughout the country. Domestic water supply was given highest priority. The 1987 policy was revised and the National Water Policy 2002 was adopted, which once again gave importance to drinking water. The New Delhi Declaration, adopted by the United Nations General Assembly in December 1990 guided India's approach to water supply and sanitation. The Main focus was on protection of the environment and safeguarding health through the integrated Management of water resources and liquid and solid waste. The Tenth plan advocated highest priority to school sanitation, which is critical to the formation of proper habits her hygiene, sanitation and safe water use.

Through the 1980, and 1990, rural India saw improvements in access to water. Rural, India on the other hand, continues to depend primarily on open defecation.

Waterborne diseases are caused by contamination of water with virus, bacteria, parasites (or) chemicals. Water gets contaminated either at source or while passing through water pipes which are poorly laid and maintained, or in the homes when it is not stored properly. The risk of water contamination resulting in water-borne diseases is higher under the conditions inadequate availability of water (particularly during summer), poor quality of water at source, ill-maintained water pipelines and sewer lines, open air defecation in rampant, lack of disposal of human, animal and household wastes and lack of awareness about good sanitation and personal hygienic practices. Hence, millions of India's poorest people are affected by preventable diseases caused by inadequate water supply and sanitation services.

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It is found that today, 37.7 million people in India are affected by waterborne diseases annually, 1.5 Million children are estimated to die of diarrhea alone. ("Sick water" – UNEP Report 2010) It is mostly attributed inadequate and inefficient management of water resources.

TamilNadu's achievement in health is for better when compared to other states in the country. In the case of vaccine preventable diseases except measles its achievement is highly remarkable. But acute diarrhoeal diseases and suspected cholera are common among the water borne diseases. Tamil Nadu is endemic for acute diarrhoeal diseases with sporadic out break of cholera in most of the districts through out the year, and epidemic properties (Public health emergencies) during the rainy seasons and peak summer period.,

The following table shows the incidence of diarrhoeal diseases and cholera in Tamil Nadu during 1997–2010.

Table-2
Incidence of Diarrhoea and cholera in Tamil Nadu.

Year	Acute Diarrhea Diseases			Cholera		
	Cases	Deaths	Fatal Rate	Cases	Death	Fatal Rate
1997	78025	520	0.67	2261	2	0.09
1998	77677	368	0.47	1807	0	0.00
1999	74583	266	0.36	1807	1	0.06
2000	64130	195	0.30	1328	1	0.05
2001	59511	159	0.27	1110	1	0.09
2002	69889	199	0.28	1591	3	0.19
2003	59784	66	0.11	390	1	0.26
2004	77333	119	0.15	1500	2	0.13
2005	70465	65	0.09	777	1	0.66
2006	52555	22	0.04	152	1	0.00
2007	37556	19	0.05	212	0	0.00
2008	57463	62	0.11	994	0	0.00
2009	87207	21	0.02	826	0	0.00
Jan.-Sep. 2010	42463	40	0.09	776	1	0.1

Source: Directorate of Public Health and preventive Medicine (2010)

The above table reveals that the number of diarrhoeal cases reported is very high during 2009, 1997, 1998, 2004 and 1999. But the occurrence of death was maximum, that is 520 in 1997 which has been rigorously reduced to 21 during 2009. Fatal rate was also high during 1997 and reduced to 0.02 during 2009. Declining total rate is due to the efforts taken by the d government through health interaction.

Tamil Nadu has been making efforts to improve the provision of safe drinking water and many drinking water projects are planned and implemented. Attempts are also taken to provide hundred percent sanitation both at urban and rural areas. But rural areas still lack improved sanitation where most people are living. The poor rural people are vulnerable to disease. The incidence of poverty and hunger make people not to have any awareness regarding sanitation and safe drinking water which further exacerbates disease pattern in rural Tamil Nadu.

Similarly the incidence of cholera was recorded during as 2261 in the year 1997 with a total rate of 0.09. During the year 2006 the reported cholera cases were 152 with one death and it accounted for total rate of 0.06.

The rural sanitation in Tamil Nadu have to be improved. With safe drinking water and precaution of vaccine preventable disease the disease pattern has to come down.

It is also suggested that people in developing countries like India need to have access to good quality of water in sufficient quantity, water purification technology, availability and distribution system for water. Previously only the water sources were developed and not managed. Presently we neither develop water sources nor manage.

Year	Cases	Deaths	Rate
1997	2261	2	0.09
2002	6889	1	0.08
2003	5978	1	0.08
2004	7733	2	0.13
2005	7045	1	0.06
2006	152	1	0.06
2007	212	0	0.00
2008	994	0	0.00
2009	8207	0	0.00
Jan-Sep 2010	12463	1	0.1

Source: Directorate of Public Health and Preventive Medicine (2010)

The above table reveals that the number of diarrhoeal cases reported is very high during 2009, 1997, 1998, 2004 and 1999. But the occurrence of death was minimum, that is 250 in 1997, which has been rigorously reduced to 21 during 2009. Fatal rate was also high during 1997, and reduced to 0.02 during 2009. Declining total rate is due to the efforts taken by the Government through health intervention.

RESOURCE MANAGEMENT IN INDIA

Natural resources defined as factors and materials available in nature, which owe their origin and existence to the natural phenomena or that occur automatically in nature. These resources are used in production and consumption natural resources are considered to be the gifts of god to mankind, or it may be called gifts of "nature originating from biological, chemical and geological process that cannot be controlled at will.

Water resources development has received the highest importance in India at present, many impressive storage works like dams, were constructed to augment irrigation facilities and hydropower generation.

Rain water harvesting is an ideal solution to mitigate drinking water problem. Rain water is pure, free from organic matter & bacteria & soft in nature. It will help in reducing the flood hazard. It improves the quality of existing ground water through dilution. If it improves well yields and reduces pumping lifts and costs. It arrests sea water ingress. It reduces strain on municipal water supply also. In India we have lot of rules to ensure the water treatment, they are hardly implemented. This has resulted in lot of water pollution and there is yawning gap between demand and supply of pure drinking water.

Water demand & supply:

The demand is increasing day by day but the availability is constant. In fact large quantity of water is polluted due to sewage & effluents coming from municipalities and industries respectively. Hence the problem is how to manage the water demand in all sectors in the coming years especially in Tamilnadu where most of the available water resource has been harnessed. In most parts of the state, the ground water is over exploited and in many pockets in the west & southern districts the ground water level has gone beyond 1000.

Water management in agriculture

Water management refer to economies applied in the usage of water be it ground water or surface and ensures a judicious distribution of water to as many parts of the farms as possible. The objective of water management in irrigation agriculture is to provide a suitable moisture environment to the crops to obtain optimum crop yields with maximum economy in the use of water. Thus the process of water management includes in takes, conveyance, regulation, measurement and application of water to crops in a appropriate quantities at the right time and good drainage system. It can be ensured by augmentation of water resources and conservation and its judicious utilization.

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Government policy on water resources:

India's water policy since independence or more specifically, since 1950-1951, consisted of the construction of huge dams and reservoirs, distribution of canals etc., all of which were designated as major and medium irrigation works. They were also known as multi-purpose projects, since they were designed to generate electric power, provide irrigation water to agriculture and control floods.

The government launched a new agricultural strategy in 1962 in the form of intensive agricultural district program (IADP) and high yielding varieties program (HYVP) water was a major component of this program. It was to support the new agricultural strategy that the government encouraged intensive utilization of ground water resources in the form of tube well irrigation & surface wells. This form of irrigation was called minor irrigation.

Even though the government encouraged minor irrigation, it did not formulate any policies to prevent ruthless and uncontrolled exploitation of ground water resources or for their regeneration. In the formulation of its policy regarding utilization and management of water resources, the government did not consider the role and significance of traditional sources of water, namely ponds and tanks, small rivers & water sheds. Their importance as sources of drinking water, means of irrigation, usefulness for controlling and moderating floods, use for inland fisheries etc., all these were ignored by the planners and policy makers.

Reliance on large dams:

A serious blunder our planners have committed and continue to commit is their reliance on big irrigation dams as a means of raising agricultural production. These gigantic dams costing hundreds and thousands of crores or rupees, because of poor planning, and bad execution have brought much less benefits than were anticipated and have caused positive harm to people and the environment. They displace hundred of thousand of people mostly tribal, who are the poorest and the most powerless in the country. They drawn thousands of hectares of rich forests. Even though one of the professed objects of large dams is the prevention & control of flood, this object is rarely achieved.

Since 1951, 256 big surface irrigation projects have been initiated. Only 65 out of these have been completed. 181 are still under construction this is not a happy state of affairs. For more than 16 years we poured money out the people have not got nothing back.

The following measure are suggested for better management of water resources

Desalination of sea water for drinking & industries in the coastal areas.

- Use of brackish water for agriculture
- Prevention of Leakage in pipes in municipal areas
- Seepage /percolation while transporting water and
- Evaporation losses from water bodies.

Judicious use of water in all sectors especially in irrigation as it consumes more than 80% of all the water. Rain water harvesting promotes self sufficiently, it also promotes water conservation. Surface water storage structure improves the yield of hand pumps and wells.

Reuse of food industries waste resources are used in agriculture, the farmer's co-operation is a most in the process of water management at all levels. They must adopt water saving techniques like sprinkle or drip irrigation against flood irrigation. They must follow the instructions of the agriculture, ground water management departments and avoid excessive use of water. Recycled water must be used for irrigation, for washing purposes, for kitchen garden and toilet flushing etc.,

Government should strengthen state holder participation in the allocation and management of water resources. Water management programs should be implemented in a systematic way with the coordination of all relevant government departments at state and central level.

We have to keep in mind that we have cannot make more rain, so we have to manage water better. Thus managing water supplies is one of the critical issues facing humanity & a real challenge of this country. Due to improper management of water in India, even the people living in cherapunji, the place that has the world's highest rainfall, experience water scarcity.

Hence the government should adopt latest water management technology to construct and a thrust area with more allocation of money.

It is concluded that the government should take necessary steps to create awareness among farmers, industrialists, women, and the public in general about the need for managing water resources successfully & minimizing wastage of water.

IMPORTANCE OF LAND REFORM IN INDIA

INTRODUCTION

Land reform is most prevalent topics of discussion in developing countries of today. This indicates the importance of the pertinent problems for development in its economic, social as well as political aspects. As the basis of all economic activity, land can either serve as an essential asset for a country to achieve economic growth and social equity. Study based on Secondary source only and explained of land reform and its relevance in the twenty-first century and Discusses the scope of the problem and summarizes the potential benefits of land reform based on past experience and research findings.

OBJECTIVES

It is against this background that the specific objectives of the Study have been articulated as:

- ✓ To monitor and scrutinize national and transnational economic trends that have a specific bearing on issues related to land and agriculture.
- ✓ To recommend alternative policies and approaches to contemporary land challenges.

The government-led land reforms had been imbued with some effort to attain equity, social justice, and dignity, the new land reform agenda is solely market driven, and aimed at increasing GDP regardless of any externalities or costs associated with the process. Promoted and guided by various international financial institutions (IFIs) such as the World Bank and the International Monetary Fund (IMF), government emphasis on land reform since the 1990s reflects and seeks to fulfill the macroeconomic objectives of these multilateral economic institutions.

The implementation of certain specific IFI-sponsored programs in particular states with a view to examining their short-term and long-term impact on the lives and livelihoods of local residents. It is hoped this shall enable an informed critique of the IFI-led land reform programs and serve as a lesson for people's elsewhere in India and in other regions of the globe.

POTENTIAL BENEFITS OF LAND REFORM

Agricultural land still constitutes the primary source of income, status, and security for over half a billion families outside of the developed world. Decisively improving the relationship of cultivators to land through land reform has generally led to many crucial benefits, such as:

- Increased crop production and improved nutrition for poor households;
- "Ladders out of poverty" and a foundation for sustained and inclusive economic growth;
- Grassroots empowerment and movement towards more democratic societies;

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- Reduced social unrest and instability;
- Reduced urban migration;
- Better environmental stewardship;
- and creation of wealth.

It also helps the rural poor to benefit from broad-based economic growth.

THE COMMERCIALIZATION / INDUSTRIALIZATION OF AGRICULTURE

Agriculture is the World Bank's largest portfolio in any country. One hundred and thirty agricultural projects have received US\$10.2 billion in World Bank financing in India since the 1950s.

The green revolution had increased Indian food production by only 5.4 percent, while the new agricultural practices resulted in the loss of nearly 8.5 million hectares, or 6 percent, of the crop base to water logging, salinity, or excess alkalinity (World Resources Institute 1994).

Furthermore, although the amount of wheat production doubled over a period of twenty years, and rice production increased by 50 percent, greater emphasis has been placed on production of commercial crops such as sugarcane and cotton at the expense of crops like chickpeas and millet, traditionally grown by the poor for themselves. These changes in practice have steadily eroded the self-sufficiency of the small farmer in food grains.

NEW LAND REFORM OPTIONS IN THE TWENTY-FIRST CENTURY

The land reform approaches in the new century, however, involve both new challenges (such as those in the de collectivizing and market-creating transitional economies) and new responses. The approaches are likely to be substantially revised from those that dominated the past century. Such a new set of approaches should begin by reaffirming that the provision of secure land rights (ownership or owner-like tenure) to the roughly 230 million households in the developing and transitional economies⁸¹ is one of the highest economic development priorities. Policymakers should also recognize that the provision of secure land rights may be necessary for the maintenance of political stability in many countries.

In countries that had previously undertaken land reforms that collectivized agricultural land and production, second generation land reform programs that undo the damage caused by involuntary collectivization in the transitional economies will continue to be a central challenge.

CONCLUSION

The Study analysis provided above describes the increasing importance of land reform. The direction of land politics and land reform in India will continue to be one of struggle and hope and there is robust evidence of a link between poverty reduction and two kinds of land reform legislation-tenancy reform and abolition of intermediaries. Another important finding is that land reform can benefit the landless by raising agricultural wages.

Economic impact of agrochemical and its management in Bhavani Basin of Tamil Nadu

Economic development and human welfare largely depend on optimum utilization of natural resources. There exist the wide spatial diversity in quantity and quality of land and water resources and its efficiency in use for agricultural and non-agricultural purposes. The intensive agriculture and the commercialization in agriculture in terms of cultivation of high value commercial crops enhanced the indiscriminate use of agro chemicals in agriculture creates pollution load to the crop production system. Despite the critical situation, the increase in population, decline the per capita availability of net sown area were not match with the increasing demand by the changing cropping pattern. This warrant sustainable agriculture for maintain the production resource base for increase the production.

Bhavani basin is one of the intensive agricultural zones in Tamil Nadu dominated by high water consuming commercial crops like rice, turmeric, banana, sugarcane, tobacco and coconut. It has a large variation in irrigation water availability in different canal system that has resulted in spatial difference in water use and water use efficiency. Therefore, Bhavani basin has been selected purposively for this study to examine the potential for reducing the pollution load by agrochemicals in the present intensive agricultural production system with the following objectives; i) to characterize the land and water resources in the Bhavani basin; ii) to identify alternative crop set in maximizing agricultural income with minimum water use and environmental effects.

Sustainability, Pollution load in production system and index of measurement

The concept of sustainability has been defined based on the resources and the context of it use. Conway and Barbier *et al.* (1990) defined sustainability as the ability to maintain productivity, whether of a field, farm or nation, in the face of stress and shock. Agricultural sustainability would be, continuing productivity, while maintaining the resource base and minimizing adverse environmental effects from farming activities (Hamblin, 1994).

Methodology

In the present study, sustainability in agriculture production would mean maintaining productive capacity in crop production, considering resource quality and resource use efficiency of land and water. The bio-physical and socio economic conditions of the farm and the region would be used for evolving optimum cropping pattern that would ensure a net income higher than the present level besides minimize water-use and enhance environmental quality through minimize the pesticides load in crop production system. Environment impact quotient (EIQ) is one of the well accepted measurement index for environmental damage due to application of agro chemicals to the crop, considering the human health, application, soil and water quality degradation. The present study uses the static land use model using the Interactive Multiple Goal Linear Programming (IMGLP) methodology for Bhavani basin. IMGLP could be useful in handling the conflicting objectives in identifying the alternate crop sets. The conflicting objectives considered in the study were i) maximize the net income; ii) minimize the water use and ii) minimize the pollution load to the production system by over all reduction in the total EIQ value of the new alternate crop set.

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a) Estimation of EIQ

The impact of agrochemicals in crop production would affect three potential elements such as the farm worker, the consumer and the ecology. The EIQ is a composite index which measures the impact of each pesticide active ingredient (*ai*) was worked out by assigning an equal weight to each of its three components; the farm worker, the consumer and the ecology (Kovach *et al.*, 2004) and has a scale of 1 to 5. The farm worker component includes acute and chronic elements and is calculated from mammal toxicity and persistence. The consumer component is based on chronic toxicity, persistence, and systemicity (to account for ability of a pesticide to be absorbed by the plant). The ecological component is calculated from fish, bird, bee, and beneficial arthropod toxicity; persistence; and leaching and surface loss potential. In order to account the different formulations of the same active ingredient and different use patterns, a simple equation called **EIQ Field Use Rating** was used. The field EIQ rates was calculated by multiplying the EIQ value for the specific chemical obtained from table (Kovach *et al.*, 2004) by the per cent of the active ingredient in the formulation by the rate per hectare used. The field use rating EIQ value was calculated for each crop cultivated in the sample farm specifically for this study, using the following formula.

$$\text{EIQ Field Use Rating} = \text{EIQ} \times \text{Rate of active ingredient (\%)} \times \text{Rate of application} \times \text{No. of application}$$

By applying the EIQ Field Use Rating, comparisons can be made between different pest management strategies or programs followed in different season/ year for the particular crop in a particular homogeneous region. In this study, the crop and sub basin specific EIQ Field Use Ratings was calculated considering the number of applications of each pesticide throughout the crop season and these values are then summed to determine the total seasonal environmental impact of the sub basin.

5. Programming – objective and Constraints

The present static land use model considered land, water, pollution load (EIQ), as a constraints besides considering the biophysical features of each sub basin delineated using the GIS. The sub basin wise crop suitability and crop season matrices were incorporated as constraints in the land use model. Month wise land availability after adjusting the perennial crop share, month wise surface and ground water use were included as the constraints.

6. Data

Primary data were collected for the agricultural year 2000-01 (normal year) through field enquiry. The ayacut map of Bhavani basin and other spatial and bio-physical data were collected from secondary sources and digitized and used for the land unit delineation work of the study. Three main spatial bio-physical attributes of the Bhavani basin, viz. soil productivity, Length of Growing Period (LGP) and irrigation sub basin wise canal water and ground water availability of digital maps were overlaid on each other under the GIS platform and delineated nine homogeneous land units. 13 sub zone were delineated using GIS technology. The old ayacut occupied about 13.3 per cent of geographical area but contributed 12.79 % NSA and 16.54 % of net irrigated area. The LBP canal system had 31.28 thousand ha of net sown area with 83.47 per cent irrigation facility. The LBP off area represent the alternate sluice system irrigation water will be supplied in alternate year. Thus, the total Bhavani basin covers 1.31 lha of net sown area of which 0.99 lha supported with the different type of canal irrigation system.

7. Results

In the Bhavani basin, about one third of the farmers were marginal in size, having good farming experience and half of the farm family members were active in crop and livestock activities. The indiscriminate use of pesticides in cotton, sugarcane and turmeric had resulted in pollution hazards. The results revealed that around two third of the farmers were marginal and another one fifth were under small size category. The large size farmer constituted 25% which was more in Kalinkarayan canal area where as small farmers were more in LBP area. There is no dry land area in old ayacut system of Thadapalli, Arakankottai and Kalingarayan canal systems. But in LBP, about 60 per cent area under garden land supported with alternate sluice system.

a) **Agricultural input use system**

The input applications were collected from the sample farmers selected in each indentified homogenous land units. The application of pesticides depends on pest incidence and the commercial nature of the crops grown during the particular crop season. The average quantities of agrochemical used for various crops in different canal sub-systems were worked out. It could be observed that most of the crops received more than one liter or kg of agro-chemicals. The agro-chemical usage was higher in the case of turmeric, summer paddy, tobacco and cotton with 5.77, 5.60, 6.39 and 4.27 kg or lit per ha. This might be due to differences in formulation like dust or granules. Irrigated gingelly received the highest quantity of dust formulation (20.16 kg/ha) for managing the post harvest sucking pest, followed by rainfed gingelly and onion with 17.04 and 13.15 kg/lit per ha.

It could be observed that few chemicals such as Monocrotophos, Endosulfon, Quinalphos, Bavistin, and Dithane M-45 were used for almost all crops and the EIQ value of these chemicals were more than 40. Cotton was one crop that received large volume of toxic chemicals such as Dichlorvos and Cypermethrin apart from the commonly used chemicals such as Endosulfan, Quinalphos and Phosalone that would lead to higher values of EIQ.

Table 1
Commonly Used Agro-chemicals and their EIQ values

Sl. No	Name	Active ingredient %	No of farmers	% of Farmers	Crops applied	EIQ value*
1	Bavistin	50	120	46.15	All crops	69.5
2	Endosulfan	35	92	35.38	All crops	40.5
3	Carbofuran	10	90	34.62	Banana	56.8
4	Monocrotophos,	36	85	32.69	All crops	53.3
5	Neemgold	1	76	29.23	Paddy	11.4
6	Dimethoate	35	67	25.77	Groundnut	74.0
7	Quinalphos	25	44	16.92	All crops	42.5
8	Cypermethrin	10	28	10.77	Cotton	54.4
9	Dichlorvos	76	25	9.62	Cotton	40.6
10	Butachlor	5	25	9.62	Paddy	18.3
11	Dithane M45	80	23	8.85	Groundnut	44.0
12	DecoMINE	20	18	6.92	Tobacco	56.3
13	Imidacloprid	17.8 sl	4	1.54	Cotton, G.nut	34.9
14	Spinosad	45sc	3	1.15	Cotton	17.7

* Published in the EIQ value table (Kovach et al., 2004)

b) Environmental Impact Quotient (EIQ) for Different Crops

The field rated EIQ values for the agro chemicals used in different crops were calculated based on the active ingredient of the specific product, no. of application and rate of application in different canal sub-systems are presented in Table 2. It could be observed from the table that the field rated EIQ values highly varied among crops and for the same crop it varied between the canal sub-systems. The (per hectare field rated) EIQ values were the highest in the case of sugarcane with 62.12 units followed by tobacco, turmeric, samba paddy, banana, irrigated groundnut and maize with the EIQ values of 60.47, 50.18, 49.72, 45.98, 44.36 and 42.80 units in that order. The EIQ value was very low in the case of cumbu and ragi with 26.61 and 15.55 units, respectively (Table 5). The EIQ values for black gram and fodder sorghum were zero indicating the non-application of agro-chemicals. The EIQ values were relatively high in long duration/ and high water consuming crops such as paddy, sugarcane, banana, turmeric and tapioca, due to more application of agro-chemicals realizing their commercial importance by the farmers. Studies would show that the IPM adopters could bring down the field rated EIQ value to 20.45 against 47.25 for the non-IPM adopters in the Cauvery and Thaminabarani rice production system (Sivanandam, 2003).

Table 2 EIQ Values for Agro-chemicals Used for Different Crops (EIQ units per ha)

Crops	TA	KA	LBP	LBPoff	Basin	CV%
Paddy Summer	31.84	50.65	-	-	41.25	32.26
Paddy <i>Kuruvai</i>	24.87	37.83	25.55	-	29.42	24.80
Paddy <i>Samba</i>	53.27	61.97	47.76	35.88	49.72	21.98
Cumbu (i)	18.26	-	25.04	36.52	26.61	34.70
Ragi (i)	23.83	-	18.15	4.66	15.55	63.34
Ragi (r)	-	-	50.35	47.20	48.78	4.56
Maize (i)	33.12	38.81	53.95	45.34	42.80	20.92
Groundnut (i)	33.30	42.34	57.08	44.71	44.36	22.10
Groundnut <i>Kharif</i>	21.46	18.45	12.69	-	17.53	25.43
Groundnut (r)	71.50	-	18.15	4.66	31.43	112.43
Gingelly (r)	31.21	-	40.96	46.30	38.49	6.25
Gingelly (i)	38.59	-	26.47	26.53	30.53	8.68
Sunflower (i)	-	-	29.42	35.53	32.48	13.29
Cotton (i)	20.94	47.35	45.46	32.12	36.47	33.93
Sugarcane (i)	59.94	-	60.69	65.74	62.12	5.07
Turmeric (i)	50.66	40.98	53.19	55.88	50.18	12.94
Tobacco (i)	71.26	-	55.11	55.03	60.47	15.46
Onion (i)	42.47	36.53	45.21	50.43	43.66	13.26
Banana (i)	47.81	43.77	46.18	-	45.98	4.42
Tapioca (i)	43.92	-	41.68	43.90	43.17	2.74

Note: i: Irrigated; r: Rainfed; CV%: coefficient of variation in per cent

It could also be seen from the table that the field rated EIQ value for cotton in Thadapalli/ Arakkankottai and LBP off turn area were very low as compared to other canal sub-systems probably due to the application of the low volume pesticides like Spinosad and Imidacloprid. Thus, it could be inferred that the adoption of low volume pesticides would reduce the toxicity largely, without altering the cropping pattern which would ultimately reduce the residues in the agricultural produce which would increase the quality of the produce.

Table 3 Effect of Use of Low Volume Pesticides in Cotton in Sample Farms

Pesticides	Unit	common pesticides	Low volume* pesticides	Percentage change over common pesticides
Total quantity of chemicals used	lit/ha	5.45	3.30	-39.45
Cost of chemicals and application cost	Rs./ha	4423	4490	+1.51
Field EIQ rating	Unit/ha	70.4	26.68	-62.1

Note: * Average derived from eight sample farmers in Thadapalli and Arakkankottai canal sub-system.

The result showed that a reduction of 39 per cent of chemical use would be achieved by using the low volume pesticides in cotton. The use of low volume pesticides would also simultaneously reduce the pollution hazard to around 62 per cent over the application of conventional pesticides.

Conclusion

The economic impact of agrochemical was studied in this paper under the IMGLP framework. The conflicting objectives of maximizing crop net income, minimum water use and EIQ values were done under IMGLP land use model frame work for Bhavani basin which consist of old ayacut of Thadapalli, Arakkankottai (sub basins 1,2,3), Kalingarayan canal (sub basins 4 & 5) and new LBP canal (sub basin 6 to 9) ayacut systems. The farm sample were taken to represent the newly identified homogenous land units considering soil productivity, length of growing period and type of canal irrigation system. Nine homogenous land units were identified under GIS framework and the alternative turn sluice system which was taken care by additional four sub basins (sub basin 10-13) which has roughly half of the area was respect area sub 6 to 9.

4.25	38.48	46.30	40.96	-	31.51	Gingelly (1)
8.82	30.23	26.23	26.47	-	28.29	Gingelly (1)
13.29	32.48	32.23	29.42	-	-	Sunflower (1)
23.93	36.47	32.12	42.46	47.32	20.94	Cotton (1)
2.07	62.12	62.74	60.69	-	28.94	Sugarcane (1)
12.94	20.18	22.88	22.19	40.98	20.66	Turmeric (1)
12.46	60.47	22.03	22.11	-	71.26	Tobacco (1)
13.26	42.66	20.42	42.21	36.23	42.42	Onion (1)
4.24	42.98	-	46.18	42.72	47.81	Banana (1)
2.74	42.12	42.98	41.68	-	42.92	Tapioca (1)

Note: 1. Irrigated; 2. Kanit; CV% Coefficient of variation in per cent

Spatial Production Resource variability and delineation of Sub-Agro Climatic regions in Western Zone of Tamil Nadu

According to an estimate of the Central Water Commission (CWC, 2000), the average annual surface water potential in the river basins of India had been recorded at about 1869.35 billion cubic meters (bcm). But the utilizable flow, excluding ground water source, was estimated to be 690.31 bcm. As like in land resources, the per capita availability of surface water is declining over years at national level. Annual internal renewable water resources in India fell by 652 cubic meter(cum) per capita in about 12 years i.e., from 1896 cum in 1988 to 1244 cum in 2000 (HDR, 2000). About 50 per cent of the total irrigated area depends upon groundwater (CWC, 2000) and about 60 per cent of total food production from the irrigated area depended on irrigation from ground water (Shaha, *et al.*, 2000). During the period from 1984-85 to 1998-99, the number of dark blocks had increased from 253 to 428 at the national level. If this trend continues, the number of overexploited blocks would be doubled over a period of every twelve and half years (Swaminathan, 2002). The same declining trend decreasing groundwater level was notice in Tamil Nadu, 54 blocks spread over 16 districts (including Coimbatore) are under the overexploited category (CWC, 2000).

Methodology

The spatial variability in quality and quantity of the surface water, ground water and climate variability (rainfall, temperature, etc.,) were captured through suitable variable and the GIS platform was used to delineate the homogenous sub zones. This study considered the criteria such as surface and ground water status and climate. The length of the growing period (LGP) was used as an index of climate to assess the suitability to grow rain fed crops. The framework used in the delineation of homogenous land units is prepare spatial map were overplayed and identify the new homogeneous land units. Three spatial layers namely; surface irrigation water availability, block-wise ground water status and the length of growing period were developed. Further, these spatial layers were overlaid for delineating the homogenous land units under GIS platform. The area under reserve forest was excluded from the analysis, in the homogenous land units classification.

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Variation in the resource base in the western zone

1. Surface water availability

Table 1. Irrigation development in Western zone

Details	TE 1986-87		TE 1996-97		TE 2005-06		CGR %
	Area	%	Area	%	Area	%	
Net canal	144214	46.85	126403	41.90	115512	39.62	-0.65
Net Tank	4050	1.32	2724	0.90	864	0.30	-3.82
Net Tube well	0	0.00	5146	1.71	23119	7.93	33.63
Net Dug well	155762	50.60	161701	53.60	169266	58.06	1.89
Net Surface irrigation	148265	48.16	129127	42.81	116377	39.92	-0.70
Net Ground water	155763	50.60	166847	55.31	192385	65.99	2.35
Net irrigated area	307850	100	301652	100	291533	100	0.86
Gross irrigated area	359506		349370		320960		0.26
Net sown area	682449		623584		600689		-0.72
Number of all wells	39600		80400		259392		
Average area supported per well	3.93		2.08		0.74		
Irrigation intensity (%)	116.78		115.82		110.09		
Share of irrigated area (%)	45.11		48.37		48.53		

2. Groundwater categorization in western zone (2003)

The block wise status of ground water exploitation in Coimbatore and Erode districts during 1998 and 2003 was collected from Ground Water Data Centre, Tharamani and the same was used to develop the spatial layer of ground water status. A comparative analysis of 1998 and 2003 of ground water status are presented in Table 2.

Table 2. Distribution of blocks according to various stages of ground water exploitation

Ground water category (% of extraction to the annual recharge)	Coimbatore		Erode		Western zone	
	1998	2003	1998	2003	1998	2003
Over exploited (>100)	11	11	0	3	11	14
Critical (90-100)	3	4	1	3	4	7
Semi critical (70-90)	3	5	5	10	8	14
Safe (<70)	3	0	14	4	16	4
Total	20	20	20	20	39	39

It could be revealed from the table that 11 out of 20 blocks in Coimbatore district were over exploited as compared to only three in Erode district. There was no safe block in Coimbatore district, while it was four blocks in Erode district. The unbalanced extraction of ground water in the western zone led to creation of more over exploited blocks that led to increasing depth and also higher cost of extraction. Based on the different categories of ground water exploitation, the ground water status map was used as second spatial layer in delineation of homogenous land units (Map2).

3. Climate

The normal, deficit and surplus rainfall years were regrouped based on the percentage deviation against the normal rainfall received in each seasons were calculated for the last decade and the results are presented in Table 3.

Table 3. Deviation in seasonal rainfall in Coimbatore and Erode in last decade (1996-97 to 2005-06)

Month/ Season	Number of years (% of deviation over normal rainfall)					
	Coimbatore			Erode		
	Deficit	Normal	Excess	Deficit	Normal	Excess
South West	5	3	2	5	4	1
North East	4	5	1	4	4	2
Winter	7	1	2	6	3	1
Summer	4	3	3	6	2	2
Annual	3	5	2	2	5	3

Deficit rainfall year: negative deviation above 10% of normal rainfall

Normal rainfall years: deviation between -10 to 10 %

Excess rainfall years: positive deviation above 10% of normal rainfall

It could be inferred from the table that both in Coimbatore and Erode districts, five out of 10 years (50 per cent) were marked as the deficit years with respect of receipt of rainfall in south west monsoon. However, in the north east monsoon, four out of 10 years were marked as deficit years which would cause scarcity for water availability in the Rabi season. Though, the annual rainfall showed only three years in Coimbatore and two years in Erode were as deficit years in the last decade, more number of deficit years in south west and north east monsoon seasons affects the area coverage, establishment and ultimate production of crops in the Western Zone.

The rainfall received in the study area during the past ten years would indicate the existence of variation in the rainfall received over space (between rainfall stations) and time. In Coimbatore, the hill rainfall stations of Anamalai and Valpari recorded the highest rainfall of more than 3000 mm per year, while

plain rainfall stations such as Annur, Suler and Thirupur were recorded less than 600 mm of annual rainfall. The temporal variation was more in Coimbatore district which was confirmed from the CV ranged between 19.22 and 47.31 per cent. But, in Erode district, the temporal variation was relatively less and the CV ranged between 16.63 and 39.65 per cent. In general, spatial variation between rainfall stations (the coefficient of variation) of the annual rainfall was relatively more in Coimbatore (31 per cent) than in Erode (27 per cent). This large variation in the annual rainfall would affect the selection of crops in the cropping pattern.

2.4 Spatial Variation in climate and estimation of Length of Growing Period

The above discussion on rainfall clearly indicates the spatial and temporal variation in rainfall in last decade in Western zone. Similarly, temperature varied from 36° C in April to 19° C in December in the Western Zone. The variation in temperature and precipitation would result in variable pan-evaporation rate that would range from 3.2 mm per day in November to 9.2 mm per day in July. This would affect the water demand for crop production. The variation in rainfall and temperature could be collectively captured through length of growing period (LGP). The LGP is the length of period wherein the crop would get sufficient soil moisture for its growth without any interruption. Jeevanada Reddy (1983) method of LGP estimation was used to compute the LGPs for 30 rainfall recording stations spread over both Erode and Coimbatore districts, using the standard mean weekly rainfall and the weekly potential evapotranspiration (PET). Ten years weather data from 1996- 2005 were used to derive the standard week rainfall data. The calculated LGP days are presented in Table 5. Excluding the hilly areas, the LGP varied from 21 days to 130 days with many stations having around 70 days of LGP. The calculated rainfall station wise LGP was extrapolated using affine transformation technique in GIS platform to derive the spatial LGP layer.

The derived LGP layer is presented in Map 3. Based on the major crop water requirement, the LGP was further grouped in to two categories viz., low LGP (below 70 days of LGP) and high LGP (above 70 days of LGP) to suit the two major crop durations.

Table 4. Selected Rainfall Stations and Starting and Ending Weeks of Moisture Availability and

Sl.No	LGP District	Village	Starting std. week	Ending std. week	LGP DAYS
Western zone districts					
1	Coimbatore	Anamalai	17.0	48.0	217
2	Coimbatore	Annur	42.5	45.5	21
3	Coimbatore	Avinashi	38.5	48.0	67
4	Coimbatore	Coimbatore	29.0	47.5	130
5	Coimbatore	Koduverianicut	37.0	48.5	81
6	Coimbatore	Mettupalayam	37.0	48.5	81
7	Coimbatore	Palladam	38.3	47.0	61
8	Coimbatore	Periyayakanpalayam	37.5	50.0	88
9	Coimbatore	Pollachi	39.3	48.0	61
10	Coimbatore	Sulur	38.5	48.0	67
11	Coimbatore	Tiruppur	39.0	49.0	70
12	Coimbatore	TNAU	38.5	48.0	67
13	Coimbatore	Udumalpet	38.5	50.0	81
14	Coimbatore	Valparai	16.5	46.0	207
15	Erode	Ammamet	35.5	45.5	70
16	Erode	Bhavani	35.5	46.0	74
17	Erode	Bhavanisagar	38.0	46.0	56
18	Erode	Chennimalai	36.5	49.0	88
19	Erode	Dharapuram	38.5	49.0	74
20	Erode	Erode	36.0	49.0	91
21	Erode	Gobichettipalayam	36.0	48.5	88
22	Erode	Kangayam	38.0	48.0	70
23	Erode	Kavundapadi	36.5	46.0	67
24	Erode	Modakkurichi	35.8	48.3	88
25	Erode	Mulanur	38.5	49.5	77
26	Erode	Muthur	36.5	46.0	67
27	Erode	Nambiyur	38.0	48.5	74
28	Erode	Perundurai	35.5	48.5	91
29	Erode	Sathiyamangalam	38.0	49.0	77
30	Erode	Thalavadi	38.0	48.5	74
Other Rainfall recording station in surrounding Districts¹					
31	Dharmapuri	Dharmapuri	29.0	47.0	126
32	Dindugul	Kodaikanal	21.0	52.0	217
33	Namakkal	Paramathi	36.0	47.0	77
34	Nilgris	Connoor	30.0	52.0	154
35	Nilgris	Ooty	20.0	49.5	207
36	Salem	Mettur	36.5	49.0	88
37	Salem	Salem	25.5	46.5	147

Note: 1 Daily rainfall were collected for out side the study area (the rainfall station Sl.No 31- 37 from the IMDA data set.) to convert the point data to spatial data for the LGP layer Source: 10 years (1996-2005) daily rainfall data fro 37 rain gauge stations were collected and derived the weekly rainfall and LGP for this study.

Distribution of Homogenous Land Units in Different Administrative Blocks

The above discussion clearly indicated the spatial and temporal variation in surface water, ground water and climate with the agro ecological zone. The further delineation of sub regions would help in minimize the production variability and regional specific input application and management for increase crop production further. The surface irrigation map showed ayacut and non ayacut area; ground water map showing four categories based on the level of ground water extraction comparing the per cent of annual recharge.

Conclusion

The newly identified ten sub regions would help in site specific approach in crop production, management and demand supply management strategies in western zone.

Comparative Economic analysis of "Rajarajan 1000" in different Irrigation Systems in Tamil Nadu

Rice agriculture is being described as the most important economic activity in any country particularly in south and Southeast Asia. Providing adequate supply of food and improving the health for rapidly increasing population are the two greatest challenges today. Rice is the most important food crops which provide 43 per cent of the calorie requirement for more than 70 per cent of Indians. The advent of modern green revolution technology has transformed the country from a chronically food deficit stage into a surplus. India accounts 27.5 per cent of area and 14.5 per cent of production in global rice. In India, the rice constitutes about 43 per cent of total food grain production accounting for the 35 per cent of the total food grain area during 2006-07.

"Rajaran 1000" is an emerging paddy cultivation technique as a potential alternative to traditional way of flooded rice cultivation in the canal system and is showing great promise to address the current ominous problems viz., quality seeds, scarcity in water and labour in rice cultivation. In last few years, "Rajarajan 1000" method of rice cultivation has given a multidimensional supports from different stake holders in the state for enhancing the state rice production. Now, the issue is how the farmers are responding to "Rajarajan 1000" over years? The sustainability of "Rajarajan 1000" method and its constraint in adopting various components of the SRI technology are not explored and documented well in Canal irrigation Systems. In this context, it is proposed to study the adoption of "Rajarajan 1000" method of rice cultivation under canal water irrigation system in Tirunelveli compare with lift irrigation in Thiruvannamalai district. The specific objectives are; to evaluate the performance of "Rajarajan 1000" in Tirunelveli district; and to study the adoption levels covering 2-3 seasons under different irrigation systems.

2. Data and methodology

Present study on Rajarajan 1000 method of cultivation in Tirunelveli district was the part of study funded by the International Water Management Institute (IWMI), Sri Lanka project on "Adoption level under different irrigation sources and farm size categorization in Tamil Nadu". Canal irrigation was used in the district and was compared with the well irrigated rice cultivation followed in Thiruvannamalai. The primary data were collected through well designed pretested questionnaire from each 25 SRI and 5 Non

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SRI farmers from two selected blocks in both districts. Based on the block wise coverage of SRI method (Collected from Commissioner of Agriculture, Chennai), Ambasamuthram and Cheramadevi blocks in Tirunelveli district and Tiruvannamalai and Keelpennathur blocks in Thiruvannamalai district were selected purposively. Two or three villages were selected randomly which are widely adopting the SRI technology. The ultimate sample units –SRI or non SRI farmers were selected randomly from paddy growers list prepared.

3. Results

The “Rajarajan 1000” method has increased the income which was contributed by reducing the cost of cultivation particularly on cost of seed, nursery preparation, pulling out of seedlings and had increased grain, straw yield and quality.

3.1 Paddy performance in Tirunelveli and Tamil Nadu

In order to estimate the performance rice in different decades, three years moving average technique was used to smoothen the data in estimating the annual compound growth rates for area, production and yield and the results are presented in Table 2. The results revealed that rice productivity starts decline in current decades in Tirunelveli, Thiruvannamalai and the state. However, rice area starts decline in last two decades in Tirunelveli and in nineties in Thiruvannamalai. (Endnotes)

¹ Government of Tamil Nadu has renamed SRI- System of Rice Intensification in to “Rajarajan 1000” in memories 1000th Birthday of Great Tamil King Choal, at Tajnavur.

Table 1. Performance of rice in Tirunelveli, Tiruvannamalai and Tamil Nadu
(Area lha; Prod: l t and irce yield kg/ha)

Period (Triennium ending)	Tirunelveli			Thiruvannamalai			Tamil Nadu		
	Area	Prodn	Yield	Area	Prodn	Yield	Area	Prodn	Yield
1980-81	1.59	3.89	2.45	2.46	5.21	2.12	26.54	52.12	1.96
1990-91	1.14	4.84	4.23	1.08	4.17	3.86	19.00	67.86	3.57
2000-01	1.04	4.77	4.60	1.80	6.09	3.39	21.73	76.80	3.53
2007-08	1.07	4.20	3.92	1.70	5.30	3.12	19.24	56.20	2.92

**Table 2. Annual compound growth rate (in %) of rice area, production and yield in
Different periods in Tirunelveli, Thiruvannamalai and the state**

CGR Period (Triennium ending)	Tirunelveli			Thiruvannamalai			Tamil Nadu		
	Area	Prod.	Yield	Area	Prod.	Yield	Area	Prod.	Yield
1980-81 to 1989-90	-5.02	0.39	5.70	-3.67	2.32	6.22	-3.20	3.22	6.63
1990-91 to 1999-00	-2.47	-1.53	0.96	7.73	6.91	-0.76	1.43	0.70	-0.71
2000-01 to 2007-08	1.20	-1.13	-2.30	1.56	-1.21	-2.73	-1.71	-4.99	-3.34
1980-81 to 2007-08	-1.59	0.59	2.21	-0.99	0.61	1.62	-0.95	0.32	1.29

The rate of decline in rice productivity was more in Thiruvannamalai district compared to Tirunelveli and the state had a negative growth of -3.34 for productivity in last decade. This may be due to incomplete adoption of yield boosting low cost and no cost technologies besides non adopting optimal and timely applications of inputs. The, "Rajarajan 1000" method of rice cultivation was promoted through State Department of Agriculture and the University through various programmes from 2006-07 onwards. The farm size post categorization of sample data was shown in the Table 3. The farm size distribution in different irrigation system revealed that in Tirunelveli, distribution of marginal farmers were more (68%) compared to 25% in well irrigated area. The average farms size were 1.39 ac, 3.25ac and 12.77 ac in marginal, small and large size farm respectively, in canal irrigated rice system in Tirunelveli. In Thiruvannamalai, the average farm size in marginal and small farmers were more (1.93 ac and 4.04 ac) compared to the canal irrigation system. However, the large farmers in well irrigation system was less at 9.00 ac.

Table 3. Distribution of farm size and average area

Farm Size	Operational land in Tirunelveli		Operational land in Thiruvannamalai	
	Area ac	% of farms	Area ac	% of farms
Marginal	1.39	68.3	1.93	25.0
Small	3.25	13.3	4.04	35.0
Large	12.77	18.3	9.00	40.0
Total	3.73	100	5.49	100.0

3.2 Sustainability of "Rajarajan 1000"

The "Rajarajan 1000" method of cultivation was followed in 10-15% of the paddy farmers in selected villages in both the districts. Among the selected farmers, the sustainability of "Rajarajan 1000" was estimated though collecting area under rice and area allocated to Rajarajan 1000, method for 4 years from 2007-010. The results of the sustainability of "Rajarajan 1000" method of rice cultivation in *kuruvai* and *samba* paddy seasons are presented in Table 4.

Table 4 “Rajarajan 1000” in Kuruvai and Samba season in different irrigation systems

Year	Tirunelveli (Canal)				Thiruvannamalai (Groundwater)			
	Kuruvai		Samba		Kuruvai		Samba	
	Area Share	% farm	Area Share	% farm	Area Share	% farm	Area Share	% farm
2007	21.64	24.56	22.99	26.32	23.33	1.85	2.50	7.14
2008	60.82	64.91	66.67	70.69	61.67	52.63	34.30	69.64
2009	80.00	81.82	70.42	77.59	75.00	53.85	45.98	75.00
2010	82.04	71.43	81.56	65.52	75.04	64.00	75.98	71.43

The progress of area coverage and the diffusion of technology to the farmers in the selected villages were gradually increased from one fourth of farms in 2007 to more than two third (71.43 % farms in Kuruvai and 65.53 % farm samba) of farms in 2010 under SRI method in Tirunelveli (canal irrigation). While, in Thiruvannamalai, less than two per cent of farms in kuruvai and 7.14% farms in samba season were followed “Rajarajan 1000” technique in 2007. This has increased further to 64% in kuruvai and 71.43% in samba season in during 2010. However, the share of paddy area allotted to “Rajarajan 1000” method in well irrigated paddy farmers was comparatively less due to crop diversity exist in the well irrigated area which provided more control over irrigation.

4.3 Adoption of SRI components

The recommended technology for each component was discussed in Table 5. “Rajarajan 1000” suggests 5 kg per ac of seeds for nursery raised in modified mat nursery method in 40 square meter of nursery area. While in conventional method, farmers used 35- 40 kg/acre of seeds raised in 3 cents of nursery area and transplanted 35 -45 days old seedlings in 15 X 10 cm, or 15 X 15 cm spacing depending upon the duration of the crop. But, “Rajarajan 1000” method warrants, 14 days old seedlings planted in square plating (22.5 X 22.5 cm spacing) in wider spacing. Farmers practiced 2-3 times of manual hand weeding, same time used herbicides in controlling the weeds, while the “Rajarajan 1000” method recommended the mechanical method of weed control by specially designed rotary or cono-weeder at 2 times (15,30 DAT) in both sides for weed control. This also helped in aerating the root zone of the paddy which facilitate in increasing the number of productive tillers per hill.

Table 5. Intensity of adoption on different components of SRI method of rice cultivation

SIR components	Conventional method	Intensity of adoption of SRI (% farms)					
		full adopter		partial adopter		Non adopter	
		Level	%	level	%	level	%
Nursery method Area (cents)	Flat bed 5 cents/ac	Mat 1 cents	36.00	Raised bed 2 cents	56.00	Normal >3 cents	8.00
Seed (kg/ac)	35-40	5	68.00	5-15	30.00	>15	2.00
Age (days)	35-45 days	<15	70.00	15-20	28.00	>20	2.00
Square planning (cm)	15x10 or 15x 15cm	22.5x22.5	3.00	25x16-20	22.00	Row planting	75.00
Cono weeding	Manual	>2times	38.00	2 times	50.00	1 times	12.00

Table 6. Level of adoption of SRI components

Component	Recommended	TNV	Thiruvannamalai
Type of nursery	Mat nursery	18	24
Seed Rate	2-3 kg/ac	40	28
Age of the seedling	12-14 days	20	26
Number of seedling	single	10	16
Square planting	22.5 x22.5	24	20
Cono-weeding	3 times both side	14	2
Alternative drying and wetting	After max Tillering	12	26
Good leveling	Good	22	32
Use of LCC in N application	Need based	4	6

4.4. Productivity differences in SRI method

The partial and non-adoption of even core “Rajarajan 1000” components like single seedling, wider spacing, square planting and cono weeding which leads to marginal difference in rice productivity compared to conventional method. Few farmers were also reported that the partial adoption of all core component leads to decrease in rice productivity. The yield realized among “Rajarajan 1000” and conventional method in both kuruvai and samba seasons for both the districts were estimated from the sample for 2009-10 crop year and the results are presented in Table 7.

Table 7 Paddy yield in SRI and Non SRI Farms in 2009-10 (kg/ac)

Details	Tirunelveli		Thiruvannamalai	
	Kuruvai	Samba	Kuruvai	Samba
SRI	2212	2120	2210	2176
NSRI	2065	1954	1967	1912
% Increase	7.12	8.53	12.37	13.83

It could be observed from the table, the average productivity was 2.2 t/ac in "Rajarajan 1000" farms, which was only 7.12% higher than conventional method of rice field in Tiruvannamalai district. While it was 12.37% higher yield achieved in Thiruvannamalai over conventional method was observed in well irrigated especially in kuruvai season due to more control over irrigation. The productivity difference among "Rajarajan 1000" and conventional rice farms in samba was less (8.53%) in Tirunelveli (canal) and 13.83% in Tiruvannamalai (well irrigation). The yield analysis clearly revealed that there is further scope to enhance the rice productivity in Canal system and in the state through complete adoption of the core components of "Rajarajan 1000" method.

4.5 Economics of SRI cultivation

Table 8. Cost and return of rice cultivation under SRI and conventional method (Rs/ac)

Particulars	Conventional	"Rajarajan 1000"
Nursery establishment	1650	450
Transplanting	1250	1000
Other cost	9600	9600
Total	12500	11050
Yield q/acre @ Rs. 1050	20	22
Gross return Rs.	21000	23100
Net income over variable	8500	12050
Per cent increase in	Yield 10 per cent	Income 42 per cent

Note: fixed cost was not included for comparison

5. Conclusion and policy recommendation

"Rajarajan 1000" or System of rice intensification (SRI) method of cultivation following difference practice such as young seedlings (14 days) at wider square planting (22.5 x 22.5 cm) for an enable for cono weeding to aerate the soil. The continuation in "Rajarajan 1000" method cultivation and level of completeness in adoption of various components were responsible for achieving the additional yield over conventional method.

Efforts may be taken to impart the skill on modified mat nursery seedling preparation, square planting of young seedling. Necessary arrangement may be taken to develop and supply the power operated cono weeder which is suitable to the Tirunelveli soil for increase the use of cono weeding which lacking largely. The proper training and facilitation would further increase the adoption of "Rajarajan 1000" method of rice cultivation and further increase the production to 10-20 per cent with the current paddy area.

Human Health and Water

Introduction

Water pollution is any chemicals, physical or biological that changes the quality of water and has harmful effects on any living organism that uses it. When humans drink polluted water, it often has serious affects on their health. Water pollution can also make water unsuited for the desired use. A little negligence on the part of civic bodies can result in the spread of many diseases. Access to safe drinking water remains an urgent necessity, as 30% of urban and 90% of rural households still depend completely on untreated surface or groundwater. While access to drinking water in India has increased over the past decade, the tremendous adverse impact of unsafe water on health continues. It is estimated that about 21% of communicable diseases in India is water related. A majority of inland rivers which are the sources of drinking water in urban India are also contaminated. While the shift in usage from surface water to groundwater has undoubtedly controlled microbiological problems in rural India. The same has however, led to newer problems of fluorosis and arsenicosis. Excess iron is an endemic water quality problem in many parts of eastern India. Hardness is mainly caused by the presence of carbonate, bicarbonate, chloride and sulphate salts of calcium and magnesium in water. Iron is found in parts of Madhya Pradesh, Uttar Pradesh, Coastal Orissa, Andhra Pradesh and Tamil Nadu.

Objectives

1. To study the Socio-economic characteristics of the respondents
2. To examine the awareness of the respondents about the water pollution
3. To find out the methods to control the ill affects of water pollution on human health.

Methodology

The present study was conducted to assess the ill effects of water pollution on human health in Erumapalayam village in Salem District. Salem is the fifth largest city in Tamil Nadu State. A sample of 50 respondents was selected through simple random sampling techniques. The data was collected through well structured interviewing schedule. The collected data was analyzed by using descriptive and inferential statistics.

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Result and Discussion**Physical Characterization****Table: 1 Physical and Chemical Characteristics of Ground Water in Salem**

Parameters	Acceptable Limit	Rejection	Results of the Sample
Physical Examination	(A)	(B)	
Appearance	-	-	Sli.brownish
Colour (Pt.CoScale)	5	25	-
Odour	Unobjectionable	-	Objectionable Odour
Turbidity NT units	2.5	10	36
Total Dissolved Solids mg/lit	500	2000	4283
Electrical Conductivity micromho/cm	-	-	6140
Chemical Examination			
PH	7.0-8.5	6.5-9.2	6.91
Iron (Fe)	0.1	1.0	2.8
Total Alkalinity	-	600	2.8
Total Hardness as CaCO ₃	200	600	964
Nitrate as NO ₃	46	100	2240
Chloride as Cl	200	1000	155
Fluoride as F	1.0	1.5	1.0
Sulphate as SO ₄	200	400	110

(A) CPHEEO (Central Public Health Engineering Environmental Organization) Standards- Acceptable Limit

(B) CPHEEO Standards- Cause of rejection when exceed Result of Chemical Examination are expressed in mg/lit Acceptable limit for Mg can go upto 125 mg/lit with an allowance of 1 mg per 25 mg so₄

The analysis of water samples reveals that the quality of ground water in the solid waste dumping site are affected and the ground water from these nearer sites are not fit for human consumption.

Distribution of the respondents with regard to their age, education and income has been given table 2. Majority of the respondents (50%) said that the main reason of water pollution was solid waste dumping and bad sewage system. Majority (50%) respondents were not satisfied with the quality of water that they drink.

Table: 2

Distribution of the respondents with regard to their age, education and income

Age (in years)	Frequency	Percentage
Below- 20	4	8
31-40	6	12
41-50	11	22
51-60	22	44
61-Above	7	14
Education of Respondents		
Illiterate	10	20
Primary	16	32
High School	17	34
HSC	4	8
Degree	3	6
Monthly income of the Respondents		
Less than-2000	9	12
2001-3000	6	12
3001-4000	2	4
4001-5000	7	14
5001-6000	7	14
6001-7000	11	22
7001-Above	8	16
Total	50	100

Source: Primary

Majority of the respondents (74%) replied that some members of their family suffered from any disease due to polluted water and (26%) said that none of their family member suffered from any disease due to polluted water. Distribution of the respondents according to the type of disease they suffered due to polluted water is given in table 3.

Table: 3

Distribution of the respondents according to the type of disease

Type of diseases	Frequency	Percentage
No disease	13	26
Diarrhoea	3	6
Cholera	2	4
Hepatitis	10	20
Typhoid	4	8
Skin disease	3	6
Common Cold	13	26
Viral Fever	2	4
Total	50	100

Source: Primary

Table: 4 Association between education of the respondents and their awareness about water pollution
(Hypothesis 1: Higher will be the education, higher will be the awareness about water pollution)

Education Level	Awareness about water pollution		Total
	No	Yes	
Illiterate	6(12%)	4(8)	10(20%)
Primary	4(8%)	12(24%)	16(32%)
Secondary	1(2%)	16(32%)	17(34%)
HSC	0	4(8%)	4(8%)
Degree	0	3(6%)	3(6%)
Total	11(22%)	39(78%)	50(100%)

Source: Primary $X^2=15.680$ d.f.=1 Significance=.000 *= Significance

The Chi-Square value shows a significant association between education of the respondents and their awareness about water pollution. Chi-Square=15.680 with 1 degree of freedom and it is statistically significant. It means highly educated respondents had more awareness about water pollution. So the hypothesis "higher will be the education, higher will be the awareness" is accepted.

Table: 5 Association between income of the respondents and their awareness about Water pollution
(Hypothesis 2: Higher will be the income, higher will be the awareness about water pollution)

Income (Rs.)	Awareness about water pollution		Total
	No	Yes	
Below-2000	7(14%)	2(4%)	9(18%)
2001-3000	1(2%)	3(6%)	4(8%)
3001-4000	2(4%)	1(2%)	5(10%)
4001-5000	1(2%)	5(10%)	6(12%)
5001-6000	0	8(16%)	8(16%)
6001-7000	0	10(20%)	10(20%)
7001-Above	0	10(20%)	10(20%)
Total	11(22%)	39(78%)	50(100%)

Source: Primary $X^2=15.680$ d.f.=1 Significance=.000 *= Significance

The Chi-Square value shows a significant association between income of the respondents and their awareness about water pollution. Chi-Square=15.680 with 1 degree of freedom and it is statistically significant. It means higher income respondents had more awareness about water pollution. So the hypothesis "higher will be the income, higher will be the awareness" is accepted.

Conclusion

The water pollution should be included in the national curriculum for creating awareness about the benefits of body water and all effects of poor quality water on human health. Mass media can play vital role to create awareness among the public about the problem of water pollution. Social workers, local government and leaders should be involved to seek greater public participation in seminars and workshops about awareness of water pollution in rural areas. The programmes on T.V. and radio should be presented in easy languages so that illiterate persons may also get awareness about water pollution.

RISKS AND BENEFITS FROM WASTEWATER IRRIGATED IN SALEM DISTRICT

Introduction

Urban wastewater use is not new to India. For ages, marginalised communities in India have used urban wastewater to grow vegetables, fruits, cereals, flowers and fodder. As a result of rapid population growth, massive industrialization, and the growing number of cities large amounts of sewage are discharged into the water bodies. Therefore, today indirect use of wastewater has increased even further. Urban wastewater use for irrigation in India is informal, uncontrolled and indirect like many other developing countries around the world.

This illustrates an integral connection between household income, wastewater-related livelihood activities and household food security, which is more evident in semi-arid areas where frequent periods of drought are a common phenomenon. Salem in Tamilnadu is one such area and this paper is based on a study carried out in Verapani wherein wastewater is important for the livelihood of various social groups using wastewater in the urban, peri-urban and rural areas along the Thirumani Mutharu River.

Objective

- To Study the risks and benefits of wastewater use in irrigated agriculture along the Thirumani Mutharu River.

Materials and Methods

This study is based on both Primary and Secondary Data. The interviews were carried out with help of Well Designed Questionnaire. Considering the time constraints and the project requirements the sample was limited to 30 users.

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GIS mapping, laboratory tests and surveys

An area of 15 000 m² (5 squares of 50 x 50 m² and 4 squares of 25 x 25 m²) was ground-truthed for the vegetable crop types, based on a Quick Bird satellite image of 2006. Vegetable plot boundaries were identified using Arc GIS software, and polygons were drawn to represent the different types of vegetable plots (Figure 3). The area under cultivation was calculated for the different types of vegetables. Selected vegetable types were tested for heavy metals and biological contaminants (*E.coli* and helminthes). Questionnaires were administered to study the dynamics of vegetable cultivation and the role of biodiversity as a livelihood strategy in Salem District.

Results and Discussion

Table -1

English Name	Botanical Name
Spinach	Spinacea oleracea (L.)
Amaranth, green	Amaranthus tricolour (L.)
Amaranth, red	Amaranthus tricolor (L.), red variety
Roselle	Hibiscus acetosella (Welw.), H. sabdariffa (L.)
Mint	Mentha sp. (L.)
Malabar Spinach	Basella alba var. rubra (Moq.)
Bladder Dock	Rumex vesicarius (L.)
Coriander	Coriandrum sativum (L.)
Dill	Anethum graveolens (L.)
Common Purslane	Portulaca oleracea (L.)
Lady's finger	Abelmoschus esculentus (L.)
Taro	Colocasia esculenta (L.)
Chennangi	Lagerstroemia parviflora (Roxb.)

Vegetable varieties grown with wastewater along the

Thirumani Mutharu River

A considerable number of vegetable varieties (Table 1) appeared to flourish in the vegetable gardens irrigated with wastewater, contrary to expectations. Even though fodder and rice were the dominant crops in the periurban fringes, the vegetable gardens played an important role by producing leafy vegetables and supporting livelihoods of small farmers, many of whom were women (Buechler & Devi 2002). Nearly 1/3 of the area under cultivation was spinach (*Spinacia oleracea*) followed by *Amaranthus gangeticus* (15.7%) and *Hibiscus cannabinus* (12.4%). The popular leafy vegetables were in high demand, had a short growth phase (15-30 days) and fetched high market prices due to their usage in traditional dishes. Most of the

vegetables are listed in the Global Facilitation Unit for Underutilized Species (GFU) and can therefore be considered as important for further research (www.gfu.org)

Figure-5: Wastewater irrigated vegetables (percentage area)

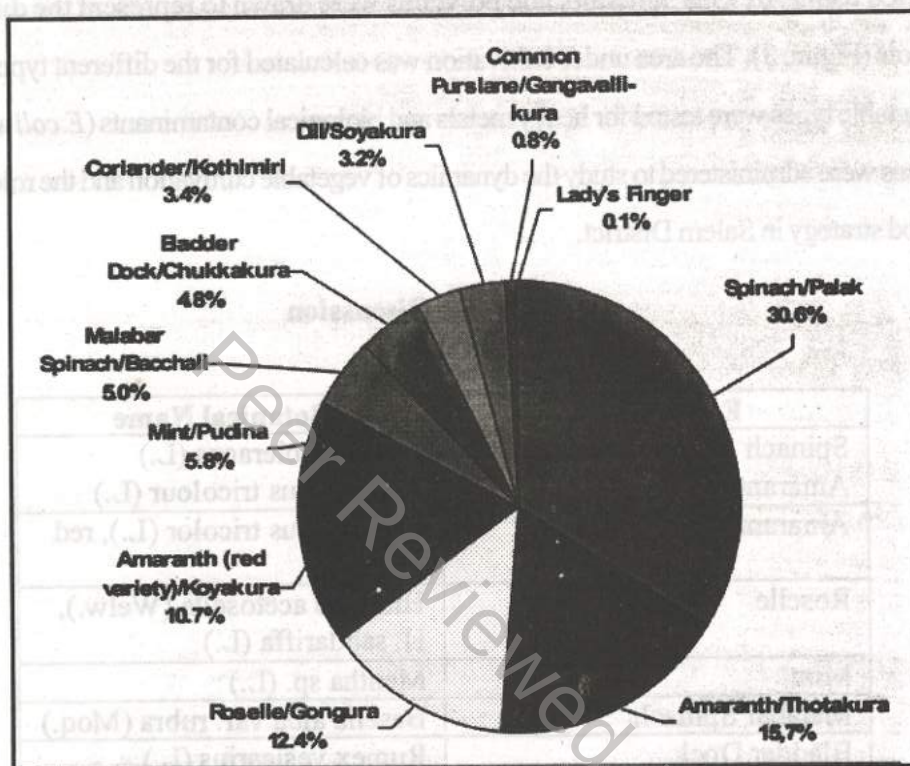


Figure-5: Wastewater irrigated vegetables (percentage area)

Farmers had a mostly positive perception of wastewater. In the vegetables tested (spinach, amaranth, coriander and mint), Cd and Pb levels posed negligible risks to the human food chain, also helminths (*Ascaris* and hook worms). Microbiological contaminants (indicator: *E. coli*) were found above permissible levels in spinach. In general, the health risks associated with pathogens were considered to be negligible where vegetables were cooked prior to consumption. The two exceptions were the herbs (mint and coriander) which were eaten raw, however, these herbs are usually not eaten in large quantities and most contaminants can be removed through washing the leaves. Despite the benefits, contamination of vegetables with chemical and biological agents are evident, and the study emphasizes the need for integrated water resource management with intersectoral collaboration such as separating industrial wastewater from domestic effluents, that will help reduce the health risks and sustain this livelihood activity.

NGOs AND SELF-HELP GROUPS FOR LARGE SCALE IMPLEMENTATION OF WATERSHED PROJECTS

INTRODUCTION

The Indo-German Watershed Development Programme (IGWDP) is a large-scale bilaterally assisted effort presently being implemented in the State of Maharashtra.

Coordinator of the Indo-German Watershed Development Programme (IGWDP), Maharashtra, Executive Director of the Watershed Organisation Trust (WOTR), IGWDP and Coordinator - Women's Promotion of the IGWDP, Director of the Women's Sector of WOTR, respectively.

This programme was the brainchild of Fr. Hermann Bacher, the founder of the Social Centre, a voluntary agency which did pioneering work laying the foundation for large-scale effort at watershed development. He is also the Founder-Chairman of the Watershed Organisation Trust (WOTR) which is the coordinating and support agency of the IGWDP. He initiated it in 1989. However, full scale implementation only began in 1993.

The Programme

A) THE OBJECTIVE

The programme aims to support people's initiatives in the area of Natural Resource Management (NRM) along watershed (WS) lines. Wherever such an initiative does not spontaneously occur, the programme aims to support Non-Government Organisation (NGOs) or other Self-help Group (SHG) promoters in their efforts to mobilise and catalyse a watershed community. The focus of the programme is strengthening the capabilities of villagers as well as their facilitators (e.g. NGOs) to successfully implement and manage a watershed development (WSD) effort.

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C) PHASES

The programme consists of two phases : the Capacity-Building Phase (CBP) and the Full Implementation Phase (FIP)

NGOs or self-help groups with no previous experience in watershed development or who nevertheless feel the need of testing the potential of a watershed community as well as their own capabilities before committing all resources in the effort can avail of the CBP which is managed by WOTR.

Once the CBP is successfully completed they move into the FIP which is managed by NABARD. NGOs with demonstratable capabilities in participatory watershed management can go directly into the FIP.

B) SELF SELECTION CONDITIONALITIES

This is a dynamic interactive process which is part of an induction process called the Participatory Operational Pedagogy (POP). The POP has been developed over the years by WOTR in consultation with some of its partners, notably the Social Centre (an NGO), Ahmednagar.

The POP consists of two components - self selection by the NGO and the villagers and Capacity Building. In this section we shall deal with self-selection only.

For an NGO to participate in the programme, it has to demonstrate that it has a committed cadre of personnel (the number is no issue), as well as has built a rapport with and enjoys the confidence of the people living in the watershed.

The NGO is asked to organise the villagers to contribute four work days of voluntary labour on activities pertaining generally to soil and water conservation. In addition it has to secure an agreement in principle from the villagers to fulfill all the conditions mentioned in 4 (iii) above.

Now usually, the bulk of the village would never respond to the call of an NGO to do four work days of voluntary labour unless they have an implicit trust in the bonafides of the NGO, believe that they are not being cheated and are confident that the NGO would be able to deliver the promise of a project. This stipulation serves the purpose of keeping away

NGOs of doubtful purpose or antecedents and those that have not invested considerable time and effort in the proposed project area.

It also serves the purpose of gauging the intensity of desire of the villagers as well as determining their readiness to accept project discipline and assume responsibility for managing the same.

Every village is a fractured entity consisting of competing and often antagonistic groups which are based either on caste, political affiliations, economic interest or a mix of all. Watershed development, if it is to be successful, has to involve the consent and active

collaboration of all those groups that draw their sustenance and livelihood from the environment, as well as the involvement of those groups that control the institutional and political life of the village. Furthermore, if these groups did come together in a common effort at voluntary labour, spread over several days, it would indicate that though there might be divisions in the village, they are not of a nature that is rigidly inhibiting or irreconcilable. This is very important because only when there is a strong social consensus on a particular course of action and the possibility of negotiating sharing arrangements and resolving conflicts, can an effective and representative village level social institution and mechanism be evolved to implement and maintain the project. This is vital for the success as well as sustainability of any development intervention / project.

The NGOs and the villagers are not left alone in this process of self- selection. Initially, often, neither the NGO nor the villagers would know fully well what watershed development is all about and the implications of undertaking such an activity. WOTR through its Regional Centres assists them by conducting training programmes as well as awareness generation activities such as participating in village meetings, organising visits to watershed where work is being successfully undertaken, and by use of folk media.

A) QUALIFYING OF NGOS AND VILLAGERS

When the Programme was started in 1992, only nine NGOs were felt to have the necessary potential for watershed development. Of these only two had past experience. It was realised that despite having expertise in some sectors of watershed development such as plantations, water harvesting structures etc., the other NGOs experienced considerable difficulties in the areas of technology, overall management as well as mobilisation of all the village groups to implement the project. Most of the shortcomings were in the area of social engineering, record keeping and maintenance, quality of work and technology especially with respect to soil conservation measures and plantations.

Furthermore, it is observed that initially villages come forward because of the availability of assured employment opportunities within their watershed. However, in the course of time, as they acquire greater skills in both managing and executing project measures and realise and enjoy the benefits thereof, social cohesion as well as a sense of identity and ownership of the project increases. This is particularly evident from the changed way they look upon their environment, in the reduction of instances of violation of social fencing and a sense of confidence in their capabilities to weather lean years (i.e. poor rainfall). Moreover, many of these villages have practically mastered/acquired sufficient familiarity with the principles and management of watershed development so that they can now teach and motivate other villages.

The time required for motivating and mobilising new villages has in fact drastically come down from 9-12 months to 3-6 months. This has been further accelerated due to the "core-cluster" strategy followed which has resulted in a significant "demonstration effect" being obtained.

ON RELATIONSHIPS WITH INSTITUTIONAL ACTORS

The programme's insistence on close interaction with government departments, the political establishment and credit agencies has been validated. Not only has the Government of Maharashtra passed enabling orders extending support to the programme, but, in a remarkable gesture of facilitation, NGOs and SHGs are permitted to treat forest lands under the concept of Joint Forest Management (JFM). A government officer of the Forest Department has also been deputed to the programme.

Furthermore, NGOs in the programme are supported by local government agencies who also extend other development schemes to project areas. The involvement of NABARD has facilitated the involvement of local banks in extending credit support to project areas.

Conclusion

Today, watershed development is viewed as an efficient and effective way of not only restoring the environment, but also of addressing the issue of poverty directly. However, unless it becomes a "people's movement" the benefits will not reach a large number of people and such efforts will not attract in sufficient volumes, resources and support from government and other framework institutional actors. Without mass mobilisation, we will not be able to mitigate drought and reduce poverty in rainfed rural India in which over 70 per cent of our people live.

In order that the sparks of a participatory environmental effort spread into an all-inclusive movement the necessary conditions, especially in terms of enabling frame conditions, as well as institutional capabilities must exist. Getting the right actors who possess the appropriate competencies and capabilities holds the key to large scale cost effective replication and sustainability.

ANALYTICAL VIEW OF SOIL AND WATER CONSERVATION IN TAMILNADU

Land and water are the most precious natural resources, the importance of which in human civilization needs no elaboration. The total available land area in the State sets the limits within which the competing human needs have to be met. The needs of agricultural, industrial, domestic and others often result in diversion from one use to the other. Diversion of land from agriculture to non-agriculture uses adversely affects the growth in agriculture sector. Even the available land is subjected to soil-erosion of varying degrees and degradation problems of different magnitudes. Water supports all forms of life on this mother earth. It plays a vital role in agricultural and industrial development and sustaining human life. Rainfall is the only source of water. The water is confined as i) soil moisture, ii) stored water in surface storage like reservoirs, tanks, ponds, ooranies, temple tanks, and in open wells etc., iii) groundwater in sub surface, iv) sea water and v) waste water like sewage and effluent. Depending upon the rainfall, its intensities, and frequencies, an area becomes drought or flood affected. Land or the soil acts as storage for all the water. Land being the major non-renewable natural resource is inelastic in nature. There is lot of pressure on the land due to the increasing population from the agricultural, industrial and housing sectors. On the other hand, the land is subjected to soil erosion and land degradation problem due to rain or wind action and faulty cultivation practices resulting in loss of topsoil, which is the place where all nutrients are available. This leads to poor yields, uneconomic returns, reservoir sedimentation, and reduction in storage capacity, reduction in ayacut area, and shutdown of hydel power stations, ecological imbalance, environmental pollution, droughts and floods. Hence the conservation, development and management of the land resources which ensures the physical and chemical and bio-logical health of soil profile is of prime importance and also a sine qua non for water resources management, right from soil moisture conservation to flood control. In a predominantly agricultural system, the objective of improving the productivity, profitability and prosperity of the farmers and achieving agricultural development on an ecologically sustainable basis can be attained only when conservation, development and management of the land and water resources are assured. As watersheds support the entire dry land agriculture/horticulture and also remain the catchments for tanks and reservoirs, their health is essential for development. The strength of the watershed development programmes will largely determine the growth in agriculture.

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Status of Land and Water use in Tamil Nadu

The total geographical area in Tamil Nadu is 130 L.ha. The land utilization pattern for the last ten years is set out in the Table below.

Classification	Total area in L.ha. (Average For Ten years - 1990's)	% of total area
1. Forests	21.44	16.49
2. Barren and uncultivable land	4.95	3.81
3. Land put to non agricultural use	19.07	14.67
4. Cultivable waste	3.25	2.50
5. Permanent pastures and other grazing lands	1.23	0.95
6. Land under miscellaneous tree crops and groves not included in net area sown.	2.31	1.78
7. Current fallows	10.57	8.13
8. Other fallows lands	10.93	8.41
9. Net area sown	56.32	43.33
10. Total Geographical area	129.98	100
11. Area sown more than once	10.97	
12. Gross cropped area	67.29	
13. Area under food crops	46.46	
14. Area under non-crops	20.83	
15. Cropping Intensity	119.46	

- The area under forest represents only 17.56% of total area against the normal prescribed level of 33% (required for a sound ecological system).
- Wasteland is nearly 22 L.ha.
- An area of 50.66 L.ha. is subjected to various degrees of soil erosion and land degradation. (Area under rainfed agriculture – 24.92 L.ha., cultivable waste - 3.49 L.ha., fallow land 22.25 L.ha.). Almost the entire land under rain fed agriculture is subjected to sheet and gully erosion.

The land degradation profile of the state

Sl.No	Wasteland category	Area (ha.)	%
1	Gullied and /or Ravenous	22546.8	0.93
2	Upland with or with out scrub	870500.7	36.00
3	Water logged and marshy land	44818.3	1.85
4	Land affected Salinity/alkalinity	286517.8	11.85
5	Shifting cultivation area	53.0	Negligible
6	Under utilized/ degraded notified forest land	888376.7	36.74
7	Degraded pastures/grazing land	17560.0	0.73
8	Degraded land under plantation	54413.3	2.25
9	Sands- Desert /Coastal	72390.4	2.99
10	Mining/Industrial wastelands	16246.5	0.69
11	Barren Rocky/Stony waste/sheet rock area	110803.0	4.58
12	Steep sloping area	33541.5	1.39
13	Snow covered area	0.0	0.00
	Total	2417768.0	100.00

Source: National Remote sensing Agency survey Report

Area under Irrigation - An area of 29.45 L.ha. is irrigated as against 55.81 L.ha. of net area sown (1997-98). An area of 35.19 L.ha. is irrigated more than once resulting in 119 % of irrigation intensity. The irrigation intensity has been eclining and it has come down from 133 % in 1979-80 to 119%. The peak level of net area irrigated source wise and the area irrigated in 1997-98 is furnished below.

(Lakh hectares)

S.no	Source	Peak level	Net area irrigated	%
1	Canal	9.42 (1972-73)	8.38	28.5
2	Tanks	9.90 (1996-97)	6.75	22.9
3	Wells	14.10 (1997-98)	14.13	48.0
4	Others	0.76 (1979-80)	0.19	0.6
	Total Net Area Irrigated	29.84 (1979-80)	29.45	100

An area of 52% of the net area sown is irrigated. There has been a sizable expansion in creation of irrigation potential and the net area irrigated has risen from 21.16 L.ha. in 1950 to 29.45 L.ha. in 1997-98.

Soil and Water Conservation in Tamil Nadu

Tamil Nadu was one of the pioneer States, which has sponsored and implemented soil conservation programmes in agricultural lands from 1949. Before initiating soil conservation measures, field trials in Agricultural Research stations were conducted for over fifteen years since 1934. Soil Conservation Schemes were launched as part of Famine Relief programme in 1949. Conservation of soil moisture, gully control, and generation of employment to rural people were the prime objectives of earlier programmes. In 1959 wind erosion control measures were initiated in Bodinaickanur area of then composite Madurai district to control wind erosion hazards. In 1967, a pilot water management project was implemented as part of soil and water conservation in Siddhamalli village of Cauvery delta, that won the appreciation of the Irrigation Commission (1972), which recommended such projects for the whole country. In 1969 water management works were initiated in Sathanur Command area. All water management works in command area are taken up now under the Command Area Development from the Sixth Five Year Plan. Soil Conservation in tribal areas was taken up from 1976. In 1978, Ravine Reclamation scheme was taken up in South Arcot and North Arcot districts. In 1979, wind erosion control measures were taken up in Tirunelveli district. The scheme for Water conservation and harvesting technology and Energy Plantation in degraded lands were few pilot projects executed by Agricultural Engineering Department successfully.

Constraints and Shortcomings

The Soil Conservation programmes were target-driven requiring procedures to be completed in scheduled time with the result the officials concerned could not integrate themselves with the community. There was no training component for the beneficiaries. The beneficiary participation was confined to preparation of action plans and no stakeholder contribution was envisaged resulting in lack of involvement. An aberration in Soil Conservation works was the vastly differential fund allocation per hectare by different agencies: State government – Rs. 1500/-; Central Government Rs. 6000/-; In externally assisted Comprehensive Watershed Development Programme - Rs. 12,500/-. The allotment of funds per hectare by the State Government was inadequate to carry out water harvesting works needed to improve the groundwater recharge.

Tenth Five Year Plan

Land and water conservation is the basic responsibility of Agricultural Engineering Department. The Mission mode approach of the Government is to accomplish the goals of saving every drop of rain, providing adequate water for agriculture and conservation of life support system – Land and Water Resources through watershed management and irrigation water management strategies.

New approaches and Strategies and Goals for Development

Mission for land and water conservation will be actualized through

- Micro watershed approach
- Water Budgeting
- Participatory approach
- Micro Watershed Development Work Plan
- Special attention for problem soils
- Convergence and Synergy of schemes and
- Monitoring and Evaluation.

This new approach has emerged from the lessons learnt from the DANIDA assisted 'Comprehensive Watershed Development Project' and based on the past experience in the implementation of soil conservation programmes.

Micro Watershed Approach and Development Plan

The State has been delineated into 33 river watersheds, which feed to main rivers and tributaries. These are further delineated into macro watersheds based on streams and large nallahs. These macro watersheds are suitably divided into sub-watersheds based on minor streams and small tributaries. The sub-watersheds are further divided into micro watersheds, which would respond to various resources management treatment more efficiently. In order to facilitate comprehensive water budgeting, the mini watershed of 5000 ha would be the optimum

area to be taken up for treatment. The approach will incorporate measures for soil moisture conservation, soil erosion control, run off harvesting and rainwater harvesting and individual based farm developments. The plan will be prepared in consultation with the watershed committees, line departments and Regional Research Stations of Tamil Nadu Agricultural University.

Convergence and Synergy - Apart from the State Plan support, the micro water shed plan will avail funds from Employment Assurance Scheme, (EAS) Swarna Jayanthi Gram Swarozgar Yojana (SGSY) and the Central Ground Water Board. The stockholder's contribution is also expected to sustain their interest in maintaining the assets. It may be worthwhile to consider prescribing a farmers' contribution ranging from 10 to 25 % depending on the status of farmers instead of present system of providing loan cum subsidy.

Monitoring and Evaluation - It is proposed to monitor the performance of the micro watersheds development programme in terms of bio-physical and economic indicators like reduction in rainwater loss and sediment, yield, augmentation of ground and surface water resources, change in cropping pattern, cropping intensity and productivity, grass and fodder production, fuel production and improvement of soil fertility - sharing of usufruct.

Water Security- Ensuring adequate water for agriculture, industry and eco-system maintenance besides providing safe drinking water, enhancing water sources through percolation ponds and other water recharge structure in Tamil Nadu, rainwater harvesting for all households, development and popularization of appropriate rainwater harvesting technologies in line with the topography of the specific region concerned are the elements in "Water Security", one of the points in the Chief Minister's 15 point programme.

The failure of monsoon over a period of years and indiscriminate exploitation of groundwater have led to the scarcity of water for drinking and agriculture. This situation is due to the improper maintenance of irrigation tanks, which have been the asset in providing irrigation for crops and also due to ineffective water management and conservation practices. In fact, the water table has been very rapidly sinking in Tamil Nadu. This problem is due to over exploitation of ground water at a rate much faster than the natural recharge without creating an environment to facilitate rainwater percolation to improve recharge. The forest destruction has accentuated the problem of reduced percolation of rainwater. Hydrologically over 95% of rainwater must percolate into the subsoil system in order to keep all the drainage system (including river system) full of water round the year. Break in this cycle decreases water percolation into soil system. Inadequate impounding of water and improving soil conservation have further added to the ground water scarcity. Today nearly 65% of rainwater in Tamil Nadu runs off into sea.

GROUND WATER CHARACTERISTICS AND THEIR SIGNIFICANCE WITH SPECIAL REFERENCE TO FOOD PROCESSING INDUSTRY

INTRODUCTION

Sago the edible starch in the form of globules is manufactured from tapioca tubers (Manihot Ulillisema). In the southern region of India alone there are about 800 sago mills which were medium and large scale units producing 15 to 30 tonne of sago per unit per day. These units discharge about 40,000 to 50,000 liters of sago per tone of sago processed. Many investigators observed that the wastewater from sago mills is of serious concern from stream pollution point of view (Murthy and patel, 1961; Sastry and Mohan, 1963; Saroja and Sastry, 1964).

The untreated effluents are discharged into low level areas, in streams and lands which finally accumulate in the form of large ponds and affect the environment both at the surface level as well as the ground water quality through seeping (Appa Rao et al., 1991). When the waste water is discharged into the water bodies or into the soil, it putrefies rapidly leading to foul odour and contaminates the receiving water course or ground water. Therefore, it is necessary to treat the waste water discharged from food processing industries prior to disposal (Gandhirajan et al. 1995).

Central pollution control board has reported the national effluent standards for sago and starch industry based on WQA 1987. The limits are pH 6.5–8.5, BOD at 27°C for 3 days 100 mg/lit, Suspended solids 150 mg/lit, BOD shall be made stringent up to 30 mg/l if the recipient fresh water body is a source for drinking water supply. BOD shall be allowed up to 350 mg/l for applying on land, provided the land is designed and operated as a secondary treatment system with the requisite monitoring facilities. The drainage water from the land after secondary treatment has to satisfy a limit of 30 mg/l of BOD and 10 mg/l of nitrate expressed as 'N'. The pet addition to ground waste quality should not be more than 3 mg/l of BOD and 10 mg/l of nitrate expressed as 'N'. Suspended solids shall be allowed up to 450 mg/l for discharge into town sewer, if such sewer leads to a biological secondary treatment system.

The BOD test is widely used to determine the polytonal strength of domestic and industrial waste (Gandhirajan et al. 1995). COD test is one of the most important indicators of the status of water pollution, while the determination of TSS is a quick and simple test for monitoring the strength of water pollution (Sahoo et al., 1997). The determinate of TDS, sodium, potassium and calcium are important

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parameters for assessing the water quality and extent of aquatic pollution has been outlined (Pondhe et al. 1997; Kumar and Siddiqui, 1997 and Ramasamsy and Sridharan 1998).

THEORETICAL BACKGROUND OF THE STUDY

Externalities are defined as conditions arising from when actions of some individuals have direct effects on the welfare or utility of other individuals, none of whom have direct control over that activity. These externalities can either be positive or negative, and in this case pollution is a negative externality; having a negative effect on the welfare of people living in the polluted area. Environmental pollution is an 'externality' in welfare economics. An externality is present whenever individual A's utility and production relationships include real (i.e. non-monetary) variables, whose values are chosen by others (persons, corporations, governments) without particular attention to the effects on A's welfare. An externality can be either beneficial (positive) or harmful (negative). Examples of beneficial externalities are, a neighbour's rose garden entering as a real variable in the utility functions of others living in the neighborhood, and services of a lighthouse entering as a real variable in the production function of shipping companies. Negative externalities include noise pollution by aircrafts using an airport, which enters as a real variable in the utility functions of persons living in the neighborhood, and the pollution of a river, which enters as a real variable in the production function of water-supply undertakings drawing from the river or agriculture. The present study has also been undertaken to assess the impact of polluted water in Attur Taluk (Govindarajalau 2003).

AREA OF THE STUDY

Attur is situated approximately 55 km to the east of Salem. Salem is the fifth largest city in Tamil Nadu State. The town has a fort on the northern banks of the Vasishta Nadhi or Upvellar River that flows from the Kalvarayan Hills. The average elevation of the town is 212 metres (695 feet) above mean sea level (msl). It is also famous for tapioca (cassava roots), and there are several tapioca-based industries today which manufacture products like "javvarisi" (sago) for markets all over India. The 2001 census Report has a population of 58,150. Males constitute 50% of the population and females 50%. 10% of the population is under 6 years of age. It has an average literacy rate of 68%, higher than the national average of 59.5%, with 55% of the males and 45% of females literate. It is a 56 percent of total sago factories in Salem district is concentrated in Attur Taluk alone.

MATERIAL AND METHODS

To evaluate the nature of the ground water in the study area, water sample were collected from the bore well. The samples were collected in 1 liter plastic containers, which were thoroughly washed twice with the water to be analyzed. The depth of the Bore Well is 350 feet. The sampling stations were located in a close proximity of the sago industries within 2 km. the samples were examined as per the standard of CPHEEO (Central Public Health Engineering Environmental Organization). The Physical and Chemical Characteristics of ground water were studied in the month of October 2010.

RESULTS AND DISCUSSION

The results of the study are presented in table no.1. P^H is one of the important parameters of water whose determination facilitates a quick evaluation of acidic and alkaline nature of water. The P^H of observed water samples range between 7.29 and 6.77. The desirable P^H of water ranged between 7.0 and 8.5 according to CPHEEO. The study indicates light alkaline nature of the ground water.

Turbidity levels varied in the range from 2-5. Turbidity in water is caused by suspended matter such as clay, silts, finely divided organic and inorganic matter, soluble colored organic compounds and plankton and other micro scopioic organism.

Total dissolved solids are the concentrations of all dissolved minerals in water indicate the general nature of salinity of water. In the present study TDS value ranged from 2144mg/l and 3478mg/l. All the samples showed higher range of TDS than the desirable limits of 600 mg/l. TDS levels above 600 mg/l will usually yield poor tasting water. Levels above 2000mg/l are considered undrinkable due to taste. The total hardness ranged between 670mg/l and 1060mg/l.

Table: 1 Physical and Chemical Characteristics of Ground Water in Attur

Parameters	Acceptable Limit (a)	Rejection (b)	Sample I	Sample II	Sample III	Sample IV	Sample V	Sample VI	Sample VII
Turbidity NT units	2.5	10	4	2	3	4	5	3	5
Total Dissolved Solids mg/lit.	500	2000	2667*	2324*	2114*	2290*	2886*	3478*	2963*
Electrical Conductivity micromoh/cm	-	-	3810	3320	3020	3280	4130	4980	4250
PH	7.0-8.5	6.5-9.2	7.76	8.01	7.56	7.58	7.29	7.42	7.25
Total Alkalinity	-	600	576	556	632*	540	676*	648*	456
Total Hardness as CaCO ₃	200	600	1020*	920*	870*	870*	900*	670*	1060*
Calcium as Ca	75	200	232*	216*	204*	220*	200*	152	248*
Magnesium as Mg	30	150	106	91	86	89	96	70	106
Pottasium as K			44	40	39	45	65	96	50
Iron as Fe	0.1	1.0	1.2*	1.4*	1.2*	1.4*	1.8*	1.2*	1.6*
Nitrite as NO ₃	45	100	105*	84	78	84	73	130*	126*
Chloride as Cl	200	1000	790	630	460	690	920	1120*	950
Flouride as F	1.0	1.5*	2.4*	2.4*	2.0*	2.0*	1.8*	2.2*	1.4*
Sulphate as SO ₄	200	400	180	160	120	120	130	150	150

(A) CPHEEO Standards - Acceptable Limit

(B) CPHEE Standards- Cause of rejection when exceeds result of chemical examination are expressed in mg/lit acceptable limit for Mg can go upto 125mg/lit with an allowance of 1 mg per 25 mg SO₄

Source: Water Samples collected in the study area and tested in Registered Laboratories in Salem.

*Indicates the level of Pollution higher than the drinking water standards prescribed for CHPEEO Sample I. Ammampalayam, II. Thulukkanur, III. Gandhipuram, IV. Navakuruchi, V. Manivizhunthan, VI. Kutukottai, VII. Thlaivasal

The electrical conductivity (EC) varies between 3020 and 4980. Potassium content of the samples ranged between 39mg/l and 99mg/l. the calcium concentration in water samples ranged from 152 mg/l and 248mg/l the maximum permissible limit of calcium in drinking water is 75mg/l (CPEEO).

Total hardness is considered as a major character of drinking water the total hardness in the studied area varied from 670mg/l and 1060mg/l the value of hardness more than permissible limit to (CPEEO). Hardness more than 200mg/l in water is not suitable for domestic purpose.

Hardness is defined as the concentration of calcium and magnesium ions. Ca and Mg are also found in some brine. The calcium concentration of most of the water samples is above permissible limit of 75mg/l the maximum and minimum concentration of magnesium is between 30mg/l and 150mg/l. the maximum and minimum concentration of magnesium have been registered to be 70mg/l and 106mg/l respectively. The calcium ranged between 90 and 248 mg/l.

The chloride content of different water samples ranged between 460mg/l and 1120mg/l. the maximum permissible limit of chloride 200mg/l. Sulphate occurs naturally in all kinds of water. In the study area it ranged between 120mg/l and 180 mg/l. all the samples showed the sulphate content within the permissible limit of 200mg/l.

Nitrate is the highest oxidized form of nitrogen. Sources of nitrate in water (Particularly groundwater) include decaying plant or animal material, agricultural fertilizers, manure, or domestic waste. Logical oxidation of nitrogenous substances from sago industries is the main source of nitrate. As nitrate is very soluble and highly mobile therefore in soil they can readily migrate to the water. Nitrate concentration above 40 mg/l may cause methemoglobinemia in infants. Nitrate concentration of all the samples found exceeds the prescribed limits of 45mg/l.

Fluoride content of the ground water samples of the study area ranged from 1.8mg/l and 2.4mg/l the maximum permissible limit is 1.0mg/l all the samples were within the permissible limit. Never the less, fluoride causes health hazards at both the lower and higher concentration Lower concentration. Lower concentration of fluoride (<0.5mg/l) causes dental carries, while higher concentration (beyond 1.5mg/l) causes dental and skeletal fluorosis.

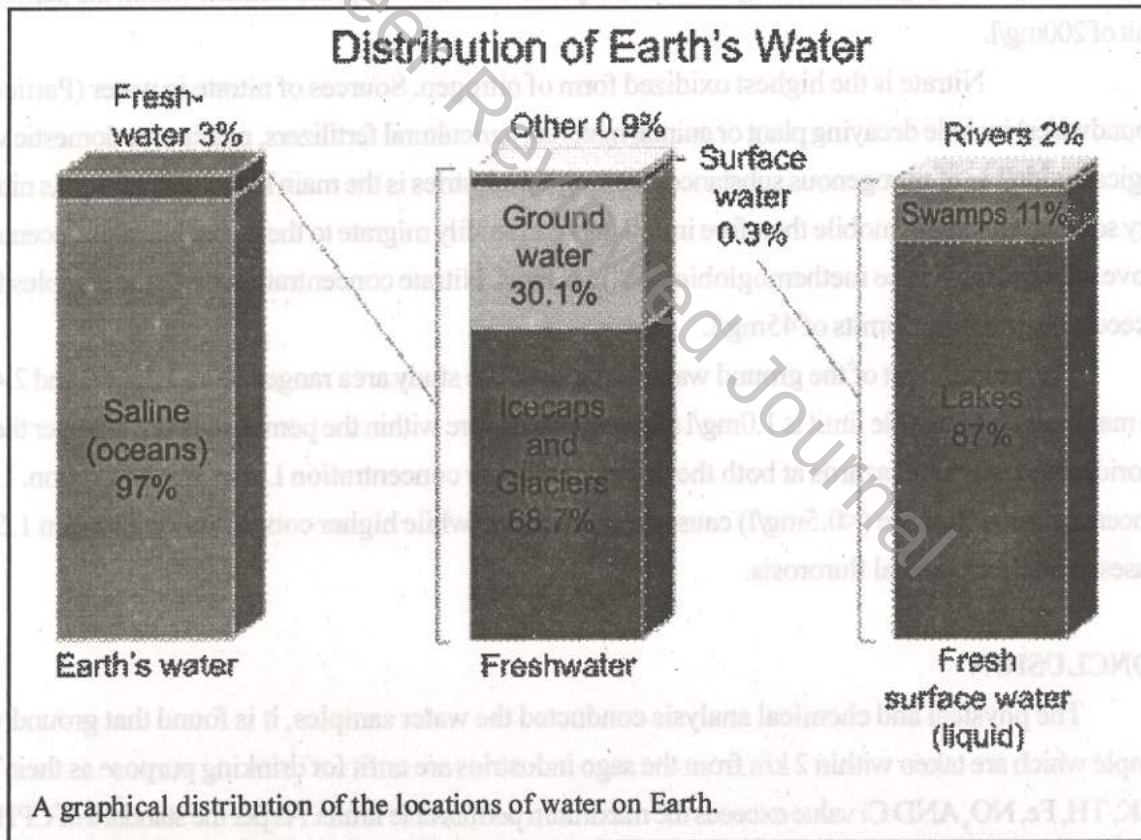
CONCLUSION

The physical and chemical analysis conducted the water samples, it is found that ground water sample which are taken within 2 km from the sago industries are unfit for drinking purpose as their TDS, ALK, TH, Fe, NO₃ AND Cl value exceeds the maximum permissible limits. As per the standard of CPHEEO water sample is physically potable and chemically not potable. Sago industries treat the wastewater for safe discharge. Hence there is ample scope for an efficient and complete treatment system which will ensure a sago effluent standard limit with potential energy recovery in the form of biogas and recycling of water for sustainable water resource management.

ASTUDY ON WATER RESOURCES OF TAMIL NADU KARUR DISTRICT

Introduction

Water resources are sources of water that are useful or potentially useful to humans. Uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water. 97% of water on the Earth is salt water, and only 3% is fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is mainly found as groundwater, with only a small fraction present above ground or in the air. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century, more than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.



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Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called “fossil water”). If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause soil salinization. Humans can also cause sub-surface water to be “lost” (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

Objectives

- The general study on classification of water (resources).
- To study about important features of water resources.
- To study on the purpose of ground water.
- To study about how will increases of ground water level.
- To study on this particular area range of ground water.

A small-scale industries do not have adequate resources, space or skilled manpower to treat their wastewater, a scheme of Common Effluent Treatment Plants (CETPs) was initiated in June 1990. The CETPs are partially funded by the GOI. Eighty-eight CETPs covering more than 10000 polluting industries have been set up during the Tenth Plan. However, the performance of these units has been generally unsatisfactory largely due to improper operation and maintenance. This calls for strengthening of enforcement. Charters, on Corporate Responsibility on Environmental Protection in respect of 17 categories of highly polluting industries have also been formulated in collaboration with the concerned industries.

Strategy for the Eleventh Plan

The country's first river action programme-Gap-completes over 20 years and the NRCP completes 10 years in 2007. The experience of the first 20 years needs to be used to design an effective and affordable river cleaning programme for the future.

- A basic objective must be to maintain minimum flows, which are threatened by withdrawal of water to meet the needs of agriculture and industry, and to ensure treatment of sewage and effluents.
- As urban sewage load is the dominant factor causing river pollution, integration of the NRCP and national Lake Conservation Plan (NLCP) with the urban development programmes and agencies is essential. It should be ensured that by 2011-12 no untreated sewage is drained into the river.

- For receiving assistance under the Under the NRCP/NLCP, ULBs should be fully involved in developing the programme along with specific statutory responsibility for operating and maintaining the treatment facilities created.
- The City Development Plans should incorporate environmental management services as the number one priority in JNNURM and Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT). Mechanisms are needed ensure that the urban areas covered under these programmes provide for full treatment of the sewage generated.
- For the plan period, the River Conservation Programme should aim at completing the projects in hand and new projects should be considered only in towns which are not covered under JNNURM and UIDSSMT.
- The NRCP should encourage installations on command area basis to facilitate investment in the treatment of maximum quantity of sewage and reuse in the vicinity. In other words, decentralized systems of wastewater treatment need to be encouraged as against centralized, large, end-of-pipe treatment units.
- The wastewater management strategy needs to emphasize the use of state-of-the-art Geographical Information System (GIS)-based decision support systems.

Ground Water Resources Assessment

Quantification of ground water resources is one of the major input in planning ground water development and management, at the same time, it is one of the basic input for funding ground water development projects by financial institutions such as NABARD. The resource assessment and the categorisation of assessment units forms a basis for implementing various ground water management plans and programmes.

In order to standardize methodology for computation of ground water resources various special studies have been carried out in different hydrogeological conditions throughout the country. In this regard, Central Ground Water Board undertook water balance studies between 1974 and 1985 through 3 domestic and 9 bilateral projects with assistance from UNDP, SIDA, UK and Canada. These projects covered both soft and hard rock formations in various places throughout the country. Various R&D studies/ collaborative projects on ground water assessments were also executed by the NABARD, Academic Institutions, State agencies. Findings of these projects helped in better understanding of the ground water system and led to formulation of methodology for estimation of annually replenishable ground water resources of the country.

The National Water Policy, 2002 envisages assessment of dynamic ground water resources of the country at periodic intervals. The Methodology for estimation of ground water resources was reviewed and modified from time to time by different Committees constituted by the Govt. of India.

Karur district is divided into 4 taluks. The taluks are further divided into 8 blocks, which further divided into 203 villages.

S.No	Name of taluk	Area in ha.	No.of villages	No.of blocks	Area in ha.	No.of villages
1	Karur	60643	52	1.karur 2.thanthoni	24335 36308	26 26
2	Aravakurichi	97616	58	1.aravakurichi 2.paramathi	43689 53927	22 36
3	Kulithalai	49081	45	1.kulithalai 2.thogamalai	18903 30178	24 21
4	Krishnarayapuram	82217	48	1.krishnarayapuram 2.kadavur	39503 42714	28 20
	Total	289557	203		289557	203

Source: Department of Statistical, karur.

The river Cauvery is flowing on the northern and eastern boundaries. The river Amaravathi is flowing through Kparamathi, Aravakurichi, Thanthoni and Karur blocks and joins with Cauvery at Nerur. Kodavanar, which is one of the important tributary of Amaravathi River, drains the western part of the district. Originating in Rangamalai hills located in the boarder of Karur and Dindigul district,. It flows from south to north and joins with the river Amaravathi at Karuvadampatti. The Nanganji river, flowing in the western part of the district, has its origin from the Kottaivali hills in Dindigul district. It flows towards north through Aravakurichi and K.Paramathi blocks

Basin and sub-basin

Karur district is falling in Cauvery river basin as per the Irrigation Atlas of India. The district is divided in to three Minor basins, namely Kulithalai, Amaravathi and Thiruchi minor basin.

Drainage

Major part of Karur district is drained by Cauvery River. Amaravathi, Kodavanar andPungar are the important rivers draining the western part of the district and the river Pungar drains in eastern part of the district. The drainage pattern, in general, is dendritic. All the rivers are seasonal and carry substantial flows during monsoon period.

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The Nanganji river, flowing in the western part of the district, has its origin from the Kottaivali hills in Dindigul district. It flows towards north through Aravakurichi and K.Paramathi blocks and joins with the river Amaravathi at Ariyur.

The Pungar river, flowing across the eastern part of the district, has its origin in the Kadavur hills located in the southern part of Karur district. It flows towards north through Kadavur and Krishnarayapuram blocks and joins with the river Cauvery at Timmachalapuram.

Irrigation Practices

The nine-fold lands use classification for the district is given below.(2005-06)

S.No	Classification	Area (Ha)
1	Forests	6187
2	Barren & Uncultivable Lands	2901
3	Land put to non agricultural uses	37264
4	Cultivable Waste	67831
5	Permanent Pastures & other grazing lands	10801
6	Groves not included in the area sown	1278
7	Current Fallows	4774
8	Other Fallow Lands	46802
9	Net Area sown	111719
Total		289557

The data available indicate that an area of about 54709 ha, which is about 18.89 percent of the total geographical area of the district is under irrigated agriculture. Dug wells are the major source of water for irrigation in the district, accounting for about 59.97 percent of the total area irrigated in the district. Tube wells accounting for about 9.48 percent of the total area irrigated in the district. Of the net area irrigated, the canal irrigated area is only 29.45 percent. The area irrigated under tank is 1.10 percent. It is observed that the well irrigation is the highest in Thogamalai block followed by Kadavur block. Canal irrigation is highest in Kulithalai block followed by rishnarayapuram, Karur and K.Paramathy blocks

Block wise and source wise net area irrigated (2005-2006)

Sl. No	Name Of Block	Net Area Irrigated by					Total Net Area Irrigated
		Canals	Tanks	Bore wells	Dug wells	Other Sources	
1	Aravakurichi	0	39	1032	2908	0	3979
2	K.Paramathy	1605	0	864	1801	0	4270
3	Kadavur	0	140	954	5716	0	6810
4	Karur	2825	0	480	3458	0	6763
5	Krishnarayapuram	3225	163	460	5845	0	9693
6	Kulithalai	7654	104	140	1331	0	9229
7	Thanthoni	207	45	847	3918	0	5017
8	Thogamalai	598	110	410	7830	0	8948
9	Total	16114	601	5187	32807	0	54709

(Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

Studies/Activities carried out by CGWB

Hydrogeological studies were taken up in composite Trichirapalli district during 1959–1960 as part of the regional systematic ground water surveys by the Geological Survey of India (GSI). The erstwhile Ground Wing of the Geological Survey of India in collaboration with erstwhile Exploratory Tube well Organisation had undertaken the ground water exploration by drilling.

Central Ground Water Board is also carrying out systematic Hydrogeological and Ground Water Management studies and ground water monitoring. Geophysical investigations for assessing the geo-electric characteristics of sub-surface litho-units have also been done by Central Ground Water Board for selection and pin-pointing of sites for exploratory drilling.

Central ground water Board took up ground water exploration for delineation of quifers and for assessing their yield characteristics by drilling of exploratory wells during 2002-2003, 2003-2004 and 2006-2007. 48 Exploratory wells and 9 observation wells, ranging in depth from 115.00 m. to 200 m.bgl. were drilled in the district. In additions, Central Ground Water Board has also carried out a number of short – term water supply investigations in the district for various government agencies.

RAINFALL AND CLIMATE

The district receives the rain under the influence of both southwest and northeast monsoons. The northeast monsoon chiefly contributes to the rainfall in the district. Most of the precipitation occurs in the form of cyclonic storms caused due to the depressions in Bay of Bengal. The southwest monsoon rainfall is highly erratic and summer rains are negligible. Rainfall data from three stations over the period 1901-2000 were utilised and a perusal of the analysis shows that the normal annual rainfall over the district varies from about 620 mm to 745 mm. It is the minimum around Aravakurichi (622.7mm) in the western part of the district. It gradually increases towards eastwards and attains a maximum around Kulithalai (744.6mm).

The district enjoys a tropical climate. The period from March to May is generally hot and dry. The weather is pleasant during the period from November to January. Usually mornings are more humid than afternoons. The relative humidities are generally between 40 and 80%. But in the period from February to July the air is comparatively drier in the afternoon. The mean maximum temperature ranges from 26.7 to 38.56 °C and the mean minimum temperature ranges from 18.7 °C to 29.3 °C. The daytime heat is oppressive and the temperature is as high as 43.9 °C. The lowest temperature recorded is of the order of 13.9 °C.

GROUND WATER SCENARIO

Hydrogeology

Karur district is underlain entirely by Archaean Crystalline formations with Recent alluvial deposits occurring along the river and streams courses. Weathered, fissured and fractured crystalline rocks and the recent alluvial deposits constitute the important aquifer systems in the district.

The porous formations in the district are represented by river alluvium. These alluvial deposits are confined to the Major River and stream courses only. Ground water occurs under phreatic conditions. The maximum saturated thickness of these aquifers is up to 10 m depending upon the topographic conditions. The hard consolidated crystalline rocks of Archaean age represent weathered, fissured and fractured formations of gneisses, granites, charnockites and other associated rocks. Ground water occurs under phreatic conditions in the weathered mantle and under semi-confined conditions in the fractured zones. The thickness of the weathered mantle of the hard rocks is varying from less than a meter to as much as 20.10 m. It is within the depth of 15 m in major part of the district. The Specific capacity of large diameter wells tested in crystalline rocks from 31 to 200 lpm / m. of drawdown. The yield characteristics of wells vary considerably depending on the topographic set-up, lithology and the degree of weathering.

The yield of bore wells drilled down to a depth of 70 to 100 m, by various state agencies mainly for domestic purposes ranged from 100 to 600 lpm. The yield of successful bore wells drilled down to a depth of 200 m bgl during the ground water exploration programme of Central Ground Water Board ranged from 0.50 to 14.00 lps. The aquifer and well parameters of the wells show wide variation.

The depth to water level in the district varied between 1.97 – 7.80 m bgl during pre monsoon period (May 2006) and varied between 1.35 – 6.83 m bgl during post monsoon depth to water level (Jan 2007).

The seasonal fluctuation shows a rise in water level, which ranges from 0.46 to 1.98 m. The piezometric head varied between 3.53 to 5.34 m bgl (May 2006) during pre monsoon and 2.04 to 7.59 m bgl during post monsoon.

Ground Water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground & Surface Water Resources and Development Centre (PWD, WRO, Government of Tamil Nadu) as on 31st March 2004. The salient features of the computations are furnished below. The computation of ground water resources available in the district has been done using GEC 1997 methodology.

Name of Block	Net Ground Water Availability	Existing Gross Draft for Irrigation	Existing Gross Draft for Domestic and Industrial Water Supply	Allocation for Domestic and Industrial Requirement supply upto next 25 years (2029)	Gross Ground Water Draft for all Uses	Net Ground Water Availability for future Irrigation Development	Stage of Development (%)	Category as on January -2004
Azavakurichi	2637.91	2014.62	183.44	190.59	2198.07	432.70	83	Semi Critical
K. Paramathy	5258.25	1001.01	197.63	205.32	1198.64	4051.92	23	Safe
Kadavur	3642.16	4345.52	158.08	164.23	4503.59	-867.59	124	Over Exploited
Kurur	3598.31	1976.24	308.61	320.63	2284.85	1301.44	63	Safe
Krishnamayapuram	4978.99	4024.42	263.07	273.32	4287.49	681.25	86	Semi Critical
Kulithalai	5062.39	1319.03	231.22	240.22	1550.25	3503.13	31	Safe
Thanthoni	3096.50	3629.81	256.17	266.15	3885.98	-799.46	125	Over Exploited
Thogamalai	3870.52	1939.74	166.34	172.82	2106.09	1757.96	54	Safe
	32145.03	20250.39	1764.56	1833.28	22014.96	10061.36		

Suggestions:

Water efficiency in flushes and gadgets should be planned in order to reduce wastewater generation. Recycling/reuse of treated sewage in cities should be promoted. Resident groups should be sensitized to wars water conservation, recycling, and reuse.

- All the rivers will be joined in India.
- People's are protect to the rivers areas.
- One of the individual people's will be getting awareness for water resource development.
- Textile wastages not included to the water resources.
- Rain water will be saved by all the houses, schools and colleges.
- Dams and ponds will be provide to save in the water resources.

Conclusion:

Sub-surface water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, sub-surface water storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source. The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.

WATER POLLUTION

Introduction:

Water is most important natural resource. It is vital for the maintenance of all forms of life and vegetations. We depend on water for irrigation, industry, domestic needs, drinking purpose for sanitation; and disposal of waste. Our water bodies are ponds, lakes, sea, rivers, oceans which have become polluted due to industrial development and urbanization.

70% of the Earth is covered by water and that is why it is called the 'Blue Planet'. Only 2.5% of the world's water is fresh while 97.5% is found in our oceans. Only 0.3% of fresh water is available from rivers, lakes and reservoirs: 30% from ground water the rest is stored in distant glaciers, ice sheets and inaccessible areas.

Meaning and Definition of Water Pollution:

"The contamination of water with soluble sewage and industrial waste is called water pollution". Water pollution may be defined as alteration in physical, chemical and biological properties of water which may cause harmful effects on human and aquatic life

Sources of Water Pollution:

There are two main sources of water pollutions as follows:

Natural sources:

Such water pollutants include soil erosion, volcanic eruption, land slides, coastal and cliff erosion, floods, decomposition of plants and animals.

Man-induced sources:

Water pollutants include industrial development, urbanization, agricultural sources, cultural sources (religious fairs and pilgrimage).

The main sources of water pollution are:

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- i) Sewage and other wastes in cities.
- ii) Industrial effluent and waste products.
- iii) Agricultural discharge, chemical fertilizers used, and
- iv) Thermal power plant and nuclear plant waste.

Measuring Water Pollution:

Polluted water will be either acidic or alkaline in nature. Water is acidic due to the excess of hydrogen ions (H^+). In the absence of hydrogen ions (H^+), water is alkaline. It is measured in P.H. scale. The P.H. value of water is measured by 'Calorimetric' method. The P.H. value of drinking water ranges 6.50 to 9.20 pure water is a poor conductor of electricity. If the P.H. value is lower than 7, then the water is acidic. The quality of water depends on quality of oxygen in it. The quantity of oxygen in water can be measured by 'Oxygen meter'.

Water Pollution – Related Legislation

Unless there have been some environment related acts in India as early as the nineteenth century, the first significant laws regarding the protection of environmental resources appeared in the 1970's with the setting up of a National Committee on Environmental Planning and Coordination, and the enactment of the Wildlife Protection Act, 1972.

Since then, three main texts have been passed at the central level, that are relevant to water pollution : the Water (Prevention and Control of Pollution) Act, 1974, the Water (Prevention and Control of Pollution) Cess Act, 1977 and the Environment (Protection) Act (1986).

The Water Act 1974 established the Pollution Control Boards at the central and state level. The Water Cess Act 1977 provided the Pollution Control Boards with a funding tool, enabling them to charge the water user with a cess designed as a financial support for the board's activities. The Environment Protection Act 1986 is an umbrella legislation providing a single focus in the country for the protection of environment and seeks to plug the loopholes of earlier legislation relating to environment. The law prohibits the pollution of water bodies and requires any potentially polluting activity to get the consent of the local SPCB before being started.

Institutional Set-Up the Pollution Control Boards

Composition: Each board is composed of a chairman and five members, with agriculture fisheries, and government-owned industries having representation.

The Central Pollution Control Board (CPCB)

The CPCB has oversight powers over the various state boards. It sets emission standards, and lays down ambient standards. The CPCB also conducts nation wide surveys about the status of pollution, and of pollution mitigation.

Two programs of inland water quality monitoring have been set up so far, leading to the spreading of 480 measurement stations over the main river basins of the country. These two programs are the Global Environment Monitoring System (GEMS) and Monitoring of Indian Aquatic Resources (MINARS).

The State Pollution Control Boards (SPCB)

The implementation of the national environmental laws and the enforcement of the standards set by the CPCB is decentralized at the level of each state, with the SPCB in charge of this role. The SPCB can demand information from any industry about the compliance with the Act. Non-compliance can be punished with fines up to Rs. 10000, and imprisonment up to three months. In case of continued non-compliance, an additional daily fine of 5000 Rs. can be imposed. Until 1988, the only enforcement tool of the SPCB was criminal prosecution. This was revised by the 1988 amendment to the Water Act of 1974. The boards now have the power to close non-compliant companies or to cut their water and power supply.

The ultimate recourse remains public interest litigation in front on the Supreme Court. During the last decade, the Supreme Court has been involved several times in large scale environment related measures. Under the Water Cess Act of 1977 state boards may charge industries and municipalities with a water cess calculated on the volume of water consumed, and for consent fees.

Assessment of the action of SPCBs.

In 1996, a survey of India's pollution regulatory structure was conducted by the World Bank (Shaman 1996). It shows that SPCBs have suffered from a lack of efficiency during their formative years. One plausible cause for this inefficiency might be the low rate of return of the funds sent by the SPCBs to the central government. By 1987-88, all the state boards had filed a total of only 1,602 cases for prosecution under the Water Act. Of these, 288 had been decided and 1,314 cases were still pending. Recent signs indicate more vigilance by government officials toward violators. In 1994, Indian courts closed almost 1,000 factories for pollution problems. In addition, the Supreme Court fined 15 plants, including some multi-nationals.

CHANGING FACE OF LAND USE PATTERN IN TAMILNADU : AN ANALYSIS

Agriculture for centuries, has been playing an instrumental role in shaping the through, the outlook, the culture and the economic life of the people of India. Though the contribution of agriculture and allied sectors to the GDP has declined to 22% the percentage of population engaged in agriculture and allied activities continues to be 67%. Rapid growth of agriculture is essential to achieve self-reliance at national level and to bring about equity in distribution of income and wealth resulting in rapid reduction in poverty levels. Agricultural production in the country depends upon millions of small farmers.

Agriculture is a gross-root economic activity for further associated activities like agro-based industries- sugar, cotton-textiles, food products vegetable oils etc. Further mechanization in agriculture is the out come from an industry. Where agriculture is sustainable, definitely it could be a considerable share in trade and allied activities also. Thus it can be said that unless, there is a co-ordination and considerable growth among the three sections of an economy, it is highly impossible to achieve the over all development.

In India agriculture has been providing raw materials to so many important industries like- sugar, jute, cotton-textiles, rubber, tea, etc. Besides, certain other small and medium scale industries like handloom, edible oils, rice housing are rely on agriculture is the bank bone of our economy had prosperity of Indian economy making imperative that a strong base in agriculture is very essential for rapid socio-economic development. Besides, there are other aspects of agriculture self-reliance at the national level food security to individual households, raw materials to industry, income distribution, reduction of labor force, facilitation of exports and ensuring ecology.

Agriculture in some way determines the country's fate and thus, if agriculture grows wrong, nothing else would go right for the country and this cannot be ignored virtually all the aspects of the country's life and economy bear the stamp in such a way that the very existence of all economic activities of the nation is tied up with the state and health of this sector. It is also observed that the growth of agriculture and growth of GDP go simultaneously in the planning era. That means the overall GDP growth was high or low whenever agricultural growth was high or low. Thus unless agricultural growth is improved, the country cannot archived annual GDP growth of 8% and reduction of poverty unfortunately the performance of agriculture has been going down in recent decades and is a matter of wrong of the country. According to our honourable Prime Minister Dr. Manmohan Singh the present Agriculture also losses its dynamism mostly due to lack of buoyancy its product price lower profitability and falling income.

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Agriculture depends upon variables like sufficient irrigation facilities, timely credit availability, pesticides, manure, seeds and effective farm management are essential. Among all those variables credit has its own influence on agricultural output. Right time credit helps the cultivators in India are financially unsound ultimately dependent on credit. Further more finance available to cultivators to take up other income generating activities in rural areas is also meager. It is the intensity of their effort and efficiency of the technique adopted by them, which will help in quashing productivity. Because of inadequate financial resources and absence of timely credit facilities at reasonable rates, many of the farmers even though otherwise willing are unable to go in for improved goods and manures or to introduce better methods or techniques.

The government is aiming to achieve cent percent Food Security in the state and also to create avenue for export of agricultural produces for economic upliftment of the farming community, it is aiming an annual growth rate of 4% in agriculture and 8% in the horticulture crops for sustenance agricultural development, employment generation and poverty alleviation. The government is focusing on overall development of agriculture sector in terms of increasing the cropping intensity by bridging every piece of land under cultivation, increasing productivity, maximizing natural resource use with parallel effort to conserve them. Because of various efforts of the government the Land Use Pattern in the state has undergone rapid structural changes over a period of time. The present paper aims to study the Dimensions of Variation in the Land Use Pattern in Tamil Nadu during the recent decade. To facilitate the analysis, the required data were collected from various issues of Tamil Nadu – An Economic Appraisal and Season and Crop Reports.

The related aspects of Land Use Pattern – total geographical area, Area under Forest, Barren and Uncultivable Land, Cultivable Waste, Non-Agricultural Land, Permanent Pastures and other Grazing Land, Gross Cropped Area, Net Area Sown, the factors influencing the land utilization pattern such as rain fall distribution, credit access and availability, chemical fertilizer applications etc have been taken for analysis.

Some Ramifications:

Needless to say that, the desirable level of area under forest is essential for advisable level of sustainable economic development of an economy. There have been a number of policy measures enunciated by the government of India to conserve forest. But it is observed that the area under forest in Tamil Nadu has come down from 21.34 lakhs hectares to 21.11 lakh hectares and its negative growth rate is registered in the forest development. Further, the area under forest to total geographical area is registered only around 17 per cent, it is very low to the desired level of 33%.

In spite of periodical measures on conservation of land and soil in the state the Barren and Uncultivable Land distribution has increased from 4.76 lakh hectares to 5.03 lakh hectares and which is registered 5.7% growth during the study period, its share to the total geographical area is around 4%.

Now a days the mushroom growth of real estate business in the state which virtually affects the area under agricultural operations and unattractive remuneration in the agricultural occupation and monsoon

risks, the area under land put to non agricultural uses in the state has also registered to 7. % growth as it has increased from 19.86 lakh hectares to 21.39 lakh hectares during the study period. However, its share to the total geographical area is found to 17 % and further the annual rate of change has increased at increasing rate.(form 0.10 % to 0.65 %)

It is also depicted that the culturable waste has also marginally increased from 3.52 lakh hectares to 3.69 lakh hectares which registered a 4.8 % of growth rate in the state. On the other side, due to encroachment of the local politicians the land categorized to Permanent Pastures and other Grazing Land has come down from 1.23 lakh hectares to 1.1 lakh hectares which witnessed to negative growth rate of 10.8 % in the state.

Similarly, the Land under Miscellaneous Tree Crops and Groves has registered to 7.5 % growth which was increased slightly from 2.5 lakh hectares to 2.74 lakh hectares in the state. Its share to the total geographical area is only around 2.1 %

Land under the category of Current Follows has sharply come down from 11.34 lakh hectares to 7.59 lakh hectares, which registered a negative growth to 33.07 % and its share to the total geographical area of the state has also reduced from 8.3 % to 5.8 % during the decade. On the contrary, the other Fallows land has registered and increasing trend, witnessed to 23.62 %, it has increased from 12.28 lakh hectares to 15.18 lakh hectares in the state and its share to the total geographical area is also found an impressive attributes to around 11.7%.

Though there have been a number of provisions including agricultural credit, insurance, marketing, irrigation, extension services, etc periodically arranged by the government they have not influenced on the agricultural development since, there is not much variation found in the Net Area Sown and it is registered to a negative growth rate of 1.11, it has declined form 53.03 lakh hectares to 52.44 lakh hectares. However, it can be appreciated that its share to the total geographical area is found an impressive i.e 40.3 %. But, though the percentage is 40.3 the annual rate of change was not impressive i.e only 2.88 %.. On contrary, the area sown more than once was registered a negative growth of 23.77 %, it has declined from 10.35 lakh hectares to 7.89 lakh hectares and its share to the total geographical area is only 6.1. per cent. Similarly the distribution of Gross Cropped area is also not found impressive since it has registered a negative growth rate of 4.81 % (come down from 63.88 lakh hectares to 60.33 lakh hectares). The area under food crops in the state has come down from 45.35 lakh hectares to 43.98 lakh hectares which registered a negative growth rate of 3.02 % and its share to the total geographical area is only 4.07 % which is come down from 13.66 % of the share of the previous year. The area under Non- food crop also registered a high negative growth of 9.37 % as the area come down from 18.03 lakh hectares to 16.34 lakh hectares in the state.

The food grain production has also fabulosely declined in the state from 86 lakhs tons to 61 lakh tons which registered a negative growth of 29 %. In order to increase the agricultural productivity, under the Rainbow Revolution Strategy, there have been a number of packages introduced by the government

through providing High Yielding Varieties of Seeds, Chemical fertilizers, pesticides, insecticides, fungicides, etc in the state.

The cropping intensity has also marginally reduced from 119.5 to 115, registered a negative growth of 3.76%; the total area under seed certification registered an appreciable trend i.e from 32447 hectares to 36260 hectares which accounts to 11.6 % of growth rate during the study period.. Similarly the production of improved seeds has not increased – it is slightly declined from 24282 tons to 23674 tons.

With regard to the consumption of chemical fertilisers, the total consumption has increased from 9.63 lakhs tons to 11 lakh tons. Further among the three major components of chemical fertilizers – Nitrogen, Potash and Phosphorous more than 55 % was shared by Nitrogen followed by potash and phosphorous . However , 14.22 % of growth rate was registered in the total fertilisers' consumption.

Conclusion

Most importantly growth rate of agriculture is not only low but also very fluctuating over the years particularly in the reforms era of 1990's. Its share along with allied has been steadily declining from 32.2% in 1990-91 to 20% now and continues to provide employment to about 58% of country's labour force and sustains over two-thirds of population. The major factors that effecting low performance of agriculture are ,slackening of public investment in agriculture, slow use of modern inputs inadequate irrigation coverage and unbalanced use of agriculture inputs use poor drainage system etc. All in all, there is need of boosting agriculture and thus, the fundamental question is how to achieve the same and can act as a view of life for Indians. The basic requirements are besides, most of other factors, modernization of agriculture, diversification of agriculture volatility in prices and incomes an improvement in rural infrastructure. Among all, rural infrastructure is a very outstanding factor and is considered as first and foremost requirement for agriculture development. It simply represents basic system and services in the rural areas, which are very essential for agriculture production. It involves wide spectrum of activities and can be broadly grouped under three heads such as economic infrastructure, social infrastructure and institutional infrastructure economic infrastructure is primarily oriented towards direct productive activities of economic goods and these include irrigation transport, power telecommunication, water ways, water treatment and its distribution systems etc. Social infrastructure is principal by filling to enhance human capital and consists of social services such as education health, family welfare, sanitation human resource development. Institutions infrastructure is primarily oriented to build financial and administrative setup in the rural areas and that includes banking and other financial institution, research institutions and other institutions\ organizations that would provide support services like marketing warehousing industrial estates etc.

A number of researches advocated that though we have achieved a high boost in the cereals production and food grains production, attained self sufficiency, vast improvement in the commercial crops cultivation, significance changes in cropping pattern, employment generation, strengthened both

forward and back ward linkages still agriculture is a gamble of monsoon; growing attributes of capitalistic farming, poor institutional reforms packages, widening disparities in agricultural income, incidence of increasing socio economic problems, incidence of labour displacement and so on. The major thrust areas to be concentrated in agriculture for its sustenance are coarse- cereals, pulses and grains , edible oils ,irrigation system, concentration on dry land farming ,etc. It is suggested that the New Strategy in Irrigation System use of Bio Fertilizers, Farmers Education, Enhancement of Soil Quality, Improving Water Conservation, Credit Reforms with Insurance, Application of Science and Technology, Creation of Risk Stabilization Fund, Minimum Support Price and Market Intervention Scheme may be of highly useful for effective land utilization pattern in the state. In a nutshell, if the recommendation, Action Plan of National Commission on Farmers are properly followed the land utilization pattern will not be a hard task.

It is also suggested that the advisable government policy concerned with long term agricultural export policy, provision of special incentives to farmers, creation of infrastructure, consolidation of land holdings, removal of restrictions in trade, setting up of cold storage and other infrastructures, enhanced budgetary support, and so on. To conclude, the effective land utilization pattern to facilitate the Ever Green Revolution rather Rain Bow Revolution in the state a combined efforts of the Governments, Local Bodies, Agricultural Extension Offices and Farmers are to be followed systematically.

Educated Women and Household Water Conservation

Introduction: Biodiversity is the foundation of life on earth. It provides us with oxygen, food, fresh water, fertile soil, medicines, shelter, stable climate and recreation. We depend upon it for our security and health. Although nature occupies a central place in our lives, we very often take it for granted, rarely taking into account its value or the cost of the ongoing biodiversity crisis. As a result, we have been consuming natural resources at an alarming rate, contributing enormously to the degradation of ecosystems and to the loss of biodiversity. So it is essential that public awareness of the individual's impact on biodiversity should be raised and as well as people must be taught to identify areas where individual action can make a positive difference. Human emissions of greenhouse-gases contribute to excess global warming, a dreadful phenomenon. There is a proverb in Tamil: "Don't spend money like water," as people used to utilise water carelessly and excessively. "Waste not; Want not;" is the "mantra" for conservation of biodiversity. Excess degradation of biodiversity will lead to extinction of natural resources, especially non-availability of pure water and will slowly result in the annihilation of mankind. We should all endeavour for the conservation of biodiversity to the maximum, so that we may leave a world to our progeny, with plenty of natural resources to lead a safe and comfortable life. Women, especially educated women, who are the best home-makers, are crucial for this noble task and the future of the world is in their hands.

Biodiversity: Biodiversity is a term used to describe the variety of life on Earth. It refers to the wide variety of ecosystems and living organisms: animals, plants, their habitats and their genes. Biodiversity is the foundation of life on Earth. It is crucial for the functioning of ecosystems which provide us with products and services without which we cannot live, such as oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation, as all have their source in nature and healthy ecosystems¹. We depend on it for our security and health. It strongly affects our social relations and gives us freedom and choice. But no other feature of the Earth has been so dramatically influenced now, by man's activities. By changing biodiversity, we strongly affect human well-being and the well-being of every other living creature².

Value of Biodiversity: Many ecosystem services have no price tag attached to them. The monetary value of nature, especially the goods and services it provides us such as water, food, medicine, fuel or building materials, is enormous, many times the total of the world's gross domestic product. Although nature occupies a central place in our lives, we very often take it for granted, rarely taking into account its value or the cost of the ongoing biodiversity crisis. As a result, we have been consuming natural resources at an alarming rate, contributing enormously to the degradation of ecosystems and to the loss of biodiversity. So it is essential that public awareness of the individual's impact on biodiversity and ecosystems should be

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Role of Educated Women: Conservation of biodiversity is the prime importance of the world, and of all nations. As are the people, so are the nations. So every household should contribute its best for this global welfare as "United we stand; Divided we fall". Degradation of biodiversity will slowly lead to extinction of natural resources, availability of pure water and at last to extinction of mankind³. So it should be the prime concern of each and every family, in the interest of the nation at large, should do its best for the conservation of biodiversity. Women, the most important and active household managers of the families, should contribute their best for this global cause, for the welfare and happy life of our posterity, and for saving them from extinction. As less educated women will not be aware of the impending catastrophe; it is the necessary duty of educated women, not only to adopt methods and use things for the conservation of bio-diversity, but also guide the less fortunate uneducated women to follow their ways of life to keep up the welfare of the society.

Household Management:

In Indian society, women, called as "Griha Lakshmis", however highly educated and highly employed, are the custodians of household affairs, even if they get help from their husbands and children. As they are involved in cooking, cleaning, washing and purchasing household articles, they should be well aware of conservation of bio-diversity in all aspects of their work.

Water Conservation: Water conservation begins at home and we can all do bits of our share. A step to conserve water is the step to secure the future. The most essential among all the natural resources on earth is water. A drop of water is worth more than a sack of gold for the thirsty man. If each one of us makes efforts to save water today, it will save us later. Water conservation is the most effective and environmentally sound method to fight global warming⁴. Water conservation is what that can reduce the scarcity of water. It aims to improve the efficiency of use of water, and reduce losses and waste. It refers to improved water management practices that reduce or enhance the beneficial use of water. A water conservation measure is an action, behavioural change, device, technology, or improved design or process implemented to reduce water loss, waste, or use⁵. Water efficiency is a tool of water conservation. That results in more efficient water use and thus reduces water demand. The value and cost-effectiveness of a water efficiency measure must be evaluated in relation to its effects on the use and cost of other natural resources, such as energy or chemicals. It should ensure availability for future generations, the withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate. Water pumping, delivery, and wastewater treatment facilities consume a significant amount of energy, which should be reduced considerably. Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructure.

Water conservation has become an essential practice in all regions, even in areas where water is abundant. In addition to saving money on your utility bill, water conservation helps prevent water pollution in nearby lakes, rivers and local watersheds. Conserving water can also extend the life of our septic system by reducing soil saturation, and reducing any pollution due to leaks. Overloading municipal sewer systems can also cause untreated sewage to flow to lakes and rivers. The smaller the amount of water flowing through these stems, the lower the likelihood of pollution. Water conservation comes naturally when everyone in the family is aware of its importance and parents should take time to teach children some of the simple water saving methods around the home, which can make a big difference. Ultimately, the fresh water available to us as a user depends upon the amounts of rainfall, local hydrology and the geology of our area. If we take more water than the normal system will allow, then this leads to a lowering of water table and possible dramatic effects upon water quality, future water supplies and agriculture.

Goals of water conservation:

Sustainability: To ensure availability for future generations, the withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate.

Energy conservation: Water pumping, delivery, and wastewater treatment facilities consume a significant amount of energy.

Habitat conservation: Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructure.

Benefits of Conserving water: If we save water, it can save our money bills. Reduction in interior water use cuts waste water flows, especially overflowing of gutters which contaminates the environment. Environment benefits include eco system and habitat protection. Water conservation helps in improving the quality of our drinking water.

Rainwater Harvesting:

Rainwater harvesting is the gathering and collection of water from the rooftop. The traditional method of rain water harvesting is the most effective and simple way to conserve the water. It means utilization of rain water for the domestic as well as agricultural purposes. There are three technical methods of rain water harvesting such as Catchment, Conveyance and storage. Rainwater harvesting avoids wastage of water going to the sea and helps to keep the ground water level at a lower depth in that area.

Water-saving technology for the home:

Water conservation begins at home and we must do our bits. A man may live without food for several weeks, but cannot live more than a week without water. This shows the importance of water for the survival of mankind. In many places, women walk long distances to bring the drinking water. So water should be saved to the maximum. A tap leaking one drop of water per second wastes more than 25 litres of water per day and about 9000 litres of water per year. So water gadgets should be maintained in a perfect condition to avoid losing water, with no use to anyone. Taps should be turned off tightly, so that they don't drip. In short, much conservation of water at home is common sense. There are a number of ways to save water, and they all start with us.

Kitchen:

Only 10% of the home water supply is used in the kitchen as drinking water, but a whopping 65% out of it is used for other purposes. Women should not run the water continuously while thawing food, hand washing dishes or while washing fruits and veggies. They should use a partially filled sink instead, with a quick rinse afterwards. Faucet aerators break water flow into fine droplets to maintain "wetting effectiveness" while using less water. An additional benefit is that they reduce splashing while washing hands and dishes. We should use low flow taps in wash basins.

Bathroom:

About 75% of indoor home water use occurs in our bath rooms, and toilets are the largest water users. Toilets use over 40% more of water than needed. We should have showers instead of tub baths. Low flow shower heads can be fitted to maximise water coverage and minimise water volume. A five minute shower with a standard head uses 100 litres of water, whereas a five minute shower with a low shower head uses only 35 litres of water. We can also use a bucket filled with water and a mug for an economical bath. We should turn off the water while brushing the teeth or washing the hands with soap. Hot water pipes should be insulated to prevent running the tap for long periods waiting for hot water.

Toilets:

Low-flush toilets and composting toilets have a dramatic impact in the developed world, as conventional western toilets use large volumes of water. Dual flush toilets have two buttons or handles to flush different levels of water. Dual flush toilets use up to 67% less water than conventional toilets. Saline water or rain water or grey water can be used for flushing toilets. Replacing an 18 litre per flush toilet with an ultra-low volume (ULV) 6 litre flush model represents a 70% savings in water flushed and will cut indoor water use by about 30%. To cut down on water waste, we should put an inch or two of sand or pebbles inside each of two plastic bottles to weigh them down, fill the bottles with water, screw the lids on, and put them in the toilet tank, safely away from the operating mechanisms. This may save many litres of water per day. To find out if a toilet is leaky, we should put a little food colouring in the toilet tank. If,

without flushing, the colour begins to appear in the bowl within 30 minutes, there is a leak that should be repaired immediately. Most replacement parts are inexpensive and easy to install.

We can also install a compost toilet, and we can do away with using water to flush away wastes. The added benefit to this simple technology is the rich compost we get at the end of the process, and returning nutrients back to the soil that would otherwise end up in rivers. We should drop our tissue in the trash, instead of flushing it, to save water every time.

Dish Washer and Washing Machine: We should use dishwasher and clothes washer for only full loads. Automatic dishwashers and clothes washers should be fully loaded for optimum water conservation. Most makers of dishwashing soap recommend not pre-rinsing dishes which is a big water savings. If dishes are washed by hand, using one bowl for washing and one for rinsing, it consumes less water than it takes to fill the sink. With clothes washers, we should avoid the permanent press cycle, which uses an added 20 litres of water for the extra rinse. For partial loads, we should adjust water levels to match the size of the load. It is better to buy a water saving, front loading washing machine.

Car Cleaning: We should not run the hose while washing the car or bike. We must clean the car using a pail of soapy water and use the hose with a spray nozzle only for rinsing. This simple practice can save much as water when washing a car. We can also clean the car in the garden, so that the washed water goes to the plants.

Yard and garden: If we are planting a new lawn, or over-seeding an existing lawn, we must use drought-resistant grasses. Many beautiful shrubs and plants thrive with far less watering than other species. We should replace herbaceous perennial borders with native plants as they will use less water and be more resistant to local plant diseases. Plant slopes will retain water and help reduce runoff. We should also put a layer of mulch around trees and plants, as mulch will slow evaporation of moisture while discouraging weed growth. We should avoid over-watering plants. When hand watering, we can use a variable spray nozzle for targeted watering. We should water our lawn only when it needs it. We should water the plants during the early morning, as early watering will reduce water loss to evaporation. Watering early in the day is also the best defence against slugs and other garden pests. We should not water when it's windy as wind can blow sprinklers off target and speed evaporation. We must use a broom, not a hose, to clean driveways and sidewalks.

Finally, it should be noted that installing low-flow aerators, showerheads, tank banks and other water-saving devices, is a very simple operation which can be done by the homeowner and does not even require the use of tools. Water conservation at home is one of the easiest measures to put in place, and saving water should become part of everyday family practice¹⁰.

Re-using Water:

All the water used in the home, except flush water, can be re-used to some extent. Used water can be collected from main sources in the home-Shower, Bath tub, and Bathroom Sink. These three together

aggregate to 75% of non-flush water consumed in the home and contain less than 10% of particulates. The grey water can be used to top up the toilet system, or used selectively in the garden.¹¹ We can wash the car with collected rain water.

Household Wastage Management:

The house, in which we live, needs to be clean and tidy as well as hygienic too, for the good health of our family. The Household Waste management promotes the safe use, storage and disposal of materials by educating women as well as men, to identify and avoid potentially hazardous products and to buy only what is needed, use it up completely and dispose of leftovers with someone who can recycle those materials. Studies indicate that on an average, each person in urban areas produces half a kilogram of garbage each day. Ten percent of Indians live in urban areas. This calculates to more than 20 million tonnes of garbage each year in cities alone. This garbage takes up precious land and is a major source of disease. Every year, landfills across the world are packed with thousands of tons of unnecessary trash. This leads to less seepage of rain water into the earth and lowers the existing underground water level. They also stop free flowing of drainage water. Moreover the trash pollute the atmosphere and naturally the air, and is a cause for diseases as we breathe the polluted air. Women can cut down on the amount of trash their families produces in a few simple ways that only take a little bit of thought and effort. It is important to reduce the amount of waste we produce, so that we send less to landfill.

Conclusion:

Conservation of existing natural resources is better than searching for alternatives and we may not succeed all the time. It is the prime duty of all the governments to concentrate on inventing alternatives for the depleting natural resources by spending on research without limits. Research should be carried out whether the sea waves and the sunlight may be utilised for producing electricity on a large scale and it may considerably reduce the consumption of natural resources. Trees, the natural fans, planted in the open space surrounding the house give shade and fruit, keep the atmosphere cool and pure, as carbon-di-oxide in the air is consumed by the trees for photo-synthesis, and they also induce rainfall. Population control is a must as population increases, consumption of food, water, and energy increases and naturally wastage and pollution increase and natural resources decrease rapidly, leading to high damage of biodiversity. Indian tradition is that we leave our property and saved money for our future generations. In the same way, we must leave our country's natural resources to our posterity by utilising them as little as possible, especially by not wasting and overusing the present materials and energies, for a day may come when the future generations may be deprived of these facilities. So, the fate of the future generations is in the hands of our educated women, who are the most efficient home ministers, to save them from annihilation.

WATERSHED MANAGEMENT IN TAMILNADU

Water is the most precious natural resources and it is an essential content in every part of life on the earth. Everything is originated from water and everything is sustained by it. "water is the best of all things" said by the eminent greek philosopher Pindar. water has an economic value in all its competing use and should be recognised as an economic good. The total amount of water on the earth is fixed and has a volume of 32.6 crore cubic miles. It is estimated that 97.2% of water occurs in oceans, 2.2% as ice caps of glaciers and only 0.6% is liquid fresh water. In India the total precipitation is around 400 M.hectare meters. The surface water availability is 178 M.hectare meters and ground water potential is about 42 M. hectare meters. At present it is reduced to a greater extent due to the activities of human beings.

Among all, water shed management occupies an important place to preserve the water for our multiplicity of uses. Keeping this view, an attempt has been made to study the Water Shed Management in Tamil Nadu.

METHODOLOGY

This present study is mainly based on secondary data which is collected from journals, magazines and websites etc.

OBJECTIVES

The main aim of this study is

- to analyse the types of watersheds in Tamil Nadu.
- to analyse the components of watershed management.
- To analyse the progress of watershed management in Tamil Nadu.

DELINEATION OF WATERSHEDS IN TAMIL NADU

Tamil Nadu had been divided into 34 river basins. These had been created in considerations of the river and distributaries as a base. Some of interstate river basins covers under TN State is explained in table no.1.

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Table No.1
Interstate river basins covers Tamil Nadu State

No.	Basin Code No.	Rivers covered by the Basin	Area Sq.Km.	States covered
1	4A	All rivers draining in Bay of Bengal from Kanyakumari Dist. below Cauvery basin	38,740	Tamil Nadu and Kerala
2	4B	Cauvery	72,000	Tamil Nadu, Pondicherry, Karnataka and Kerala
3	4C	All rivers draining in Bay of Bengal	146,000	Tamil Nadu, Karnataka, Andhra Pradesh, Pondichery
4	5A	All rivers draining in Arabian Sea	56,200	Tamil Nadu, Kerala, Pondichery, and Karnataka

Source: Secondary data

The river basins had been further divided into watersheds, sub-watersheds, macro, micro and mini watersheds. It is shown in table no2.

Table No.2
Types of size wise watersheds

Sl.no	Hydrologic unit	Size ranges (Ha)
1.	Macro - watersheds	50,000 – 2,00,000
2.	Sub – watersheds	10,000 – 50,000
3.	Micro – watersheds	100 – 1,000

Source : Secondary data

The types of watersheds are based on availability of wasteland in the Districts. A watershed could be described as fanshaped (or) fen shaped (elongated). Hydrologically the shape of the watershed is important because it controls the time taken for the runoff to concentrate at the outlet. watersheds may also be categorized as hill or flat watersheds, humid (or) arid watersheds, red soil watersheds (or) black soil watersheds based on soils, climate, slope and topography of lands amount of precipitation and storm patterns, drainage and type of vegetative cover etc., Depending on the land use pattern watershed could again be classified as high land watersheds, tribal settlement of watersheds in areas of settled cultivations

WATERSHED MANAGEMENT IN TAMILNADU

Watershed management is a vital significance because 95% of the surface water and 70% of the ground water in the state have already been used. The demand for water for non – agricultural uses due to industrial growth and improvements in the standard of living is an ever increasing phenomenon. There is limited scope for further exploitation of water from available sources.

The availability of water for agriculture may even dwindle in future years. Rainfed agriculture is undertaken for more than 60% in the country. While same forms about 55% in Tamil Nadu. According to the national commission on agriculture, even after harvesting all the surface and ground water sources for irrigation by 2025 A.D., the irrigated area would be around 50% of the cropped area in Tamil Nadu which would depend upon the erratic and undependable rainfall distributed over a short period of 3- 4 months. The owners of the dry lands are poor . Therefore resource base for future agriculture development lies in the proper use of land. So the Government of Tamil Nadu is engaged in the conservation , Development and management of the agricultural land and water resources of the state. Watershed Management and Water Management are the two major strategies of the state in contributing to the sustainable increase in agricultural Production . With the average annual rainfall of 930.7mm as the major source of water, in the absence of any perennial source of water it is essentially to manage the water resource by the way of watershed management.

Watershed Managemnet in Tamil Nadu:**DROUGHT PRONE AREAS PROGRAMME**

This is an integrated programme based on the optimum use of land and water to take advantage of the watershed community interms of checking the adverse effects of droughts, preventing ecological degradation, generating non-farm employment opportunities. This programme has been in implementation in many parts of Tamil Nadu from 1972-73. Presently 80 notified blocks of 17 districts viz., Coimbatore, Dharmapuri, Dindigul, Karur, Krishnagiri, Namakkal, Perambalur, Pudukkottai, Ramanathapuram, Salem, Sivagangai, Tiruvannamalai, Thoothukudi, Tiruchirappalli, Tirunelveli, Vellore and Virudhunagar have been identified by the Government of India as drought prone areas and efforts are on to mitigate the adverse effects of drought conditions.

NATIONAL WATERSHED DEVELOPMENT PROJECT FOR RAINED AREAS (NWDpra)

Restructured NWDpra is implemented in 23 Districts of Tamil Nadu except Thanjavur, Nagappattinam, Tiruvarur and Kanyakumari. This scheme is implemented in 763 watershed areas having less than 30% assured means of irrigation in arable lands and having slope less than 8%. In Tamil Nadu 15898 micro watersheds have been identified and nearly 4324 watersheds have been taken up for treatment under various watershed development programmes. The minimum area for a watershed is 500Ha. The cost is shared by centre and state. The works being taken up under this programme are Land Development, Water Resources Development and Plantation Activities.

INTEGRATED WASTELAND DEVELOPMENT PROJECT

This scheme mainly aims at sustainability, equity of environmental conservation to meet the timber, fodder and fuel needs and to increase employment opportunities in rural areas for SCs and STs and other down trodden communities. The basic theme of the programme is to harvest the rainwater and to bring the degraded lands into productive use. At present, this programme is being implemented in 99 blocks of 24 Districts

Viz., Coimbatore, Cuddalore, Dharmapuri, Dindigul, Erode, Kancheepuram, Karur, Krishnagiri, Madurai, Namakkal, Perambalur, Pudukkottai, Ramanathapuram, Salem, Sivagangai, Theni, Tirunelveli, Tiruvallur, Tiruvannamalai, Thoothukudi, Tiruchirappalli, Tirunelveli, Vellore, Villupuram and Virudhunagar. This programme has been under implementation since 1993-94 onwards.

INVESTMENT PROMOTIONAL SCHEME

This scheme mainly focuses the soil, water conservation measures including land smoothing, need based irrigation including wells and pumpsets, plantations, inter-cropping development of non-forest wastelands etc.,

COMMUNITY ORGANIZATION

Without community organization these measures taken by the govt is not a successful one This programme can only succeed when the community is motivated enough to realize that the programme is not only for eco- restoration through watershed development but also to address their other pressing socio – economics needs. The activities under this community organization include organizing SHGs and User groups, Participatory Rural Appraisal (PRA) exercises, awareness camps, exposure visits & programmes on literacy, family welfare, social services, income generating activities etc.

INSTITUTIONAL ARRANGEMENTS

To make the programme successful, proper institutional arrangement has been provided in the guidelines from state land to village level. These institutions help in making the programme broad based, sustainable & equitable. The institutions which are engaged in the proper implementation of the programmes are

1. State Watershed Programme of Review committee.
2. Zila Parisadas / DRDAS
3. Watershed Development Advisory committees
4. Project Implementation Agencies (PIA)
5. Watershed Development Team (WDT)
6. User Groups
7. SHGs
8. Watershed committee.

CONCLUSION

Increasing population of higher levels of human activities, including effluent disposal to surface and ground water sources, have made sustainable management of water resources. The watershed management and watershed development approach ensures productive and sustainable use of natural resources and conserve them for the future generation. It can be successful only if proper implementation and people's participation in all the works is necessary to get good results.

METHODS OF WATER MANAGEMENT AND INDUSTRIAL WASTE WATER TREATMENT SOLUTIONS

Introduction:

Water resources are sources of water that are useful or potentially useful to humans. Uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water. 97% of water on the Earth is salt water, and only 3% is fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is mainly found as groundwater, with only a small fraction present above ground or in the air. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century, more than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems. The framework for allocating water resources to water users (where such a framework exists) is known as water rights.

Objectives:

1. To know the methods of water management and waste water treatment solution.
2. To analysis the effectiveness of these methods.

Important Methods in Water Management:

Rainwater Harvesting System: Rainwater harvesting system is collection of rainwater from the surface which directly receives rainfall. Rainwater harvesting system can be rooftop rainwater harvesting or artificial groundwater recharging. Rooftop rainwater harvesting is quite popular since it can either be stored in a tank or diverted to artificial recharge system.

Groundwater recharge: Groundwater recharge is a hydrologic process where water moves downward from surface water to groundwater. Recharge occurs both naturally and artificially. In natural groundwater recharge, groundwater is recharged naturally by rain and snow melt and to a smaller extent by surface water such as rivers and lakes. Artificial groundwater recharge is a successful method in order to purify surface water and to improve the water management. Artificial groundwater recharge is the infiltration of surface water into shallow aquifers to increase the quantity of groundwater. The volume-rate abstracted from an aquifer in the long term should be less than or equal to the volume-rate that is recharged.

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Greywater System: Greywater is wastewater from non-toilet plumbing systems such as hand basins, washing machines, showers and baths. Most Greywater is easier to treat and recycle than black water, because of lower levels of contaminants. The method and standard of treatment in a Greywater system will vary with the size of the system. Pipes and supply points on the Greywater system must be clearly labeled in order to avoid confusion with the mains drinking water. Greywater systems can help you save 35% to 40% on your annual water bill.

Recycling wastewater/ STP system: Recycling wastewater involves Greywater system and black water system. Greywater is easier to treat and recycle than black water. Black water contains bacteria that can cause disease. That's why communities build wastewater treatment plants and enforce laws against the release of raw sewage into the environment. Sewage Treatment plant system are used to recycle blackwater. In recent years, there has been growing interest in waste-water reuse as a major component of water demand management.

Invent new water conservation technologies: In areas where aquifers are drying up and rainwater is increasingly unpredictable, innovation is needed. But as we attempt to cope with freshwater scarcity and develop conservation technologies, energy consumption is an important consideration.

Develop energy efficient desalination plants: To date, desalination has been an energy-intensive solution to water scarcity. Typically the Middle East has capitalized on its large energy reserves to build desalination plants. But Saudi Arabia could be fostering a new kind of desalination with its recent announcement to use solar-powered plants. Britain has taken a different approach with small-scale facilities for agriculture. But these innovations bring to light another needed resource—the capital for technological experimentation.

Build international frameworks and institutional cooperation: Binding international accords for natural resource issues are hard to achieve. The 2009 United Nations Climate Change Conference in Copenhagen is evidence of that point. And that's not just because the freshwater crisis, arguably the most visible and dire of the climate change risks, was ignored. Regional agreements regarding trans boundary or shared water bodies such as the Great Lakes Compact in the U.S., and Nile River basin agreement in Africa are just as difficult to ratify. But policymakers and advocates need to keep trying. Humanitarian-oriented treaties, such as the U.N.'s drinking water Millennium Development Goals, indicate that comprehensive global strategies are possible.

Climate change mitigation: Climate change and water scarcity go hand-in-hand to cause some of the biggest contemporary challenges to the human race. These issues have a reciprocal relationship, identified by the Intergovernmental Panel on Climate Change (IPCC), in which, "water management policies and measures can have an influence on greenhouse gas (GHG) emissions." As renewable energy options are pursued, the water consumption of these mitigation tactics must be considered in producing alternatives ranging from bio-energy crops to hydropower and solar power plants.

Population growth control: Because of the accelerating growth in global population, parts of the world could see a supply-demand gap of up to 65 percent in water resources by 2030. Currently, more than one billion people don't have access to clean water. And with 70 percent of the world's freshwater used for agriculture, water's critical role in food production must be considered as climate and resource conditions change

Industrial Water and Wastewater Treatment Solutions:

Water and wastewater treatment are critical to every industry. Each industry has its own set of requirements which determine treatment needs, from process water to wastewater. Siemens Water Technologies is ready to help you meet these requirements.

Waste-water Treatment Methods:

Water is available to anyone for no cost. It can be found in so many places. The earth is comprised of mostly water. Human depend on water for everyday things and it is up there with needing food. Some of the daily chores that we must complete cannot be done without water to help.

Waste-water Filtration:

The method for treating wastewater that is known as filtration, takes out the particles in the wastewater by grabbing the particles and letting the remaining water flow through a membrane. The filter sifts the water and the particles causing them to separate from each other. More than one filter type is available for the filtration method. Simple filters that resemble fine nets are also utilized for the smaller particles in the water.

Waste-water Aeration:

Industries use the aeration method of treating wastewater more than the residential sectors do. Aeration simple means that air is brought to the water. The water becomes oxygenated by the air. This process is completed to get rid of the foul odor creating chemicals.

Conclusion:

Today, innovative wastewater treatment systems have become the norm in printed circuit board shops across the nation because they are both economical and reliable to operate. The right wastewater treatment solution, custom-designed for each facility, will help manufacturers meet current and future environmental standards and provide significant relief from burdensome costs resulting from printed circuit board manufacturing. Local soil with high carbonate content is efficient in removing several heavy metals that commonly occur in industrial wastewater bringing their concentrations well below the allowed limits. The application of this effective and inexpensive technique may encourage polluting industries to be more environment-protective.

Assessment of Water Resources of the Tamirabarani River Basin, Tamil Nadu

Introduction

As water resources become increasingly scarce in India, the need for the use of economics to aid in decision-making and management becomes apparent. Indeed, global experience shows that economic approaches are increasingly becoming useful in water management issues. Water is the basis of the economy as well as essential for human life and biodiversity.

It has also been realized now that ground water quantity and quality are declining and deteriorating rapidly. This has implication on per capita availability of fresh water. The available water per capita per year is 2384 cubic metre in the year of 2000 as against 6008 cubic metre in 1947. This shows a drastic decline in per capita availability of water. It has been projected that per capita per year water availability of water.

Tamirabarani River Basin

The Tamirabarani, a medium river basin in India is a major river system in Southern Tamil Nadu with a catchments area of 5482 Km². It takes its origin from Podihai hills of Pabanasam mountain ranges of Western Ghats (8° 42' N and 7° 24' E) at a height of 2074m. The river meanders through a distance of 120 Km. (24 Km in hilly terrain and 96 Km in plains) in Tirunelveli and Thoothukudi Districts and drains into the Bay of Bengal at Punnaikayal Village. The major tributaries of this river basin are Servalar, Manimuthar, Varahanathi, Pachayar and Chittar. The river system is highly regulated with three major reservoirs namely Pabanasam, Manimuthar and Servalar in the upper reaches and eight check dams or weirs in the middle and lower reaches. The river consists of eleven channels and eight anicuts (Kodaimelalagion anicut, Nadiyanni anicut, Kannadian anicut, Aryanayakapuram anicut, Palaver anicut, Suthamalli anicut, Marudur anicut and Srivaikundam annaicut). The first seven anicuts were constructed between 1356 and 1731 A.D. and the eighth one was built during the colonial regime.

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Study Methodology

A study was conducted in Tamirabarani River Basin to provide estimates of the value of water in different uses and review various issues and economic tools pertaining to water resource allocation and financing mechanisms in the basin. The study was carried out in January-April 2010. Information on the study area was collected through literature, interviews and visit to the study area. The part of secondary data was obtained from the statistical department and Public Work Department. Water use was described on the basis of data from the Tamirabarani River Basin Office (PWD – Tamirabarani Division).

Water Consumption in Tamirabarani River Basin for Various Purposes

The River basin is more economical in terms of water usage because it maintains the irrigation reservoirs and flood structures in its natural state. River water is extensively used for generation of hydroelectric power, irrigation, industries, pot ability bathing and fishing. Water for the above said uses are received directly from the river or indirectly through channels. In the Tamirabarani basin double crop paddy is prevailing. The first crop season is called Pishanam season extending from October to March. After Pishanam paddy, pulses are cultivated with the residual moisture. In favorable locations a summer paddy crop called, advance kar is cultivated during April to July to utilise the summer flow of water from Pabanasam Power House. The annual crop requirement of water from the river is 13,000 to 14,000 mcft. The river water is also utilized by industries.

Irrigated Agriculture

Agriculture plays a viral role in the food front of the nation. Majority of the rural population depends on agriculture for livelihood. Irrigation is the artificial application of water to the soil for growing crop plants. Water is the single most important factor in crop production. Intensive and extensive cultivation of lands depends on the availability of water alone.

The major land use pattern beyond the riparian zone in the upper reaches is paddy cultivation. Paddy is the major agricultural crop, comprising 75.5% of the total cultivation land use. Besides paddy cultivation, commercial crops like plantain, sugar cane, coconut farming, betal-vine and pulse are planted in the middle and the lower reaches. Totally about 1,30,000 acres of land are irrigated of which Pishanam cultivation is made in 86,107 acres and Kar variety cultivation takes place in 70,000 acres. In the Ambasamutharam taluk, 98% of the total irrigated land are used for paddy cultivation and the remaining 2% is used for commercial crops particularly plantain.

Table: - 2, Water Requirement of crops in Tamirabarani River Basin

S. No.	Crops	Water Requirement (in mm)
1.	Paddy	1350
2.	Maize	500
3.	Cholam	500
4.	Cumbu	500
5.	Ragi	500
6.	Groundnut	500
7.	Cotton	650
8.	Tomato	550
9.	Sunflower	500
10.	Chillies and Turmeric	850
11.	Sugarcane	1800
12.	Banana	1800
13.	Pulses	400

Domestic Consumption

The population of Tamirabarani River basin area has been increasing as shown by the table below.

Table: - 3, Population Growth in Tamirabarani river basin area

S. No	Name of the District	Area in Sq. Kms	Total Population 1991	No. of persons Per Sq. Kms	Total Population 1991	No. of persons Per Sq. Kms	Level of Increased (in %)
1.	Tirunelveli	6810	2501832	367	2801194	411	10.68
2.	Thoothukudi	4621	1455920	315	1565743	339	7.01

Source: Statistics Departments from Tirunelveli and Thoothukudi Districts, 2001

As per the population growth in Tamirabarani river basin area the drinking water demand is expected to increase by 2011 as shown in the following table.

Table: - 4, Water Demand in Tamirabarani River Basin

River Basin	Water Demand	Population (1991)	Population (2011*)	Water Demand in 2011*
Tamirabarani	22028.75	483632	527158	24011
Other Eight Tributaries	20206.25	791367	862591	22024

*Projected by 8.5% Population Growth Rate

Water Consumption by Industries

More than 70% of Indian population is engaged in agricultural sector, but the per capita out-put is lower when compared with developed nations. Though industrial development lead to economic development, it also causes negative effects of the environment. Industrialization leads to pollution of air, water and soil. As pollution adversely affects the agricultural sector, a study was made on Tamirabarani River Basin to find out the various industries which are situated near the tributaries, channels, ponds and other water sources and their impacts on the water bodies. Though some of the industries draw water from wells and borewells, others use river water. The following table lists the Industries, which use water directly from the river.

Recommendations for solving the water crisis

1. A large share of water to meet new demands must come by saving water from existing uses through comprehensive reform of water policy.
2. New strategies for water development and management are urgently needed to avert severe national, regional and local water scarcities that will depress agricultural production, damages the environment and escalate water related health problems.
3. Major institutional policy and technological initiatives are required to ensure efficient, socially equitable and environmentally suitable management of water resources.
4. In facing the enormous challenge of meeting the requirements of water supply for domestic, irrigation and industrial uses, it is natural to expect that the R&D sector should play an important role.
5. Clear-cut water rights system is indispensable for the sustainability of our agriculture.
6. Above all, a strong political will of government to frame appropriate water policy and equally important indomitable conscience of water users to utilize water judiciously are absolutely necessary for sustainable utilization of water.

WATER MANAGEMENT

Inter Linking of Peninsular Rivers – A Mammoth Project of 21st Century

Food and water are the prime requirements of humanity. The water sustains life where soil acts as the medium. These natural resources are too precious to mankind as they meet all the needs and protect the environment as well as civilization. The growth of population resulting in increasing demand, over exploitation of ground water and inefficiency, in tapping the surface runoff water crested imbalance which ultimately affects sustained food production and eco development.

The total surface area of India is 329million ha. The annual average rainfall is 1200mm. Based on this, we get 4000 km cube of water. Out of 4000dams constructed all over India, we are capable of storing only 180 km cube(less than 5%).But in TamilNadu more than 95% of the rainfall is stored in 39000 tanks and 100 dams, still a water deficit state. Hence to mitigate the flood in one area and drought in another area, Interlinking of rivers is essential and is considered as one of the best possible solution. This paper attempts to explain the river linking projects, a best water management tool with the following objectives:

- To pinpoint the need and necessity of interlinking of rivers.
- To bring to limelight the water resources potential available in or country.
- To highlight the proposed plan of interlinking of river project.
- To enumerate the problems in execution and to provide suitable solution.

Interlinking of rivers is the India's largest water management project. It is the proposal of government of India to link 37 rivers through 30 links. It is planned to be the largest water project in the world wide as it connects dozens of large dams and thousands of miles of canals. The main emphasis of this project is to provide a permanent solution to the paradox of flood and drought.

Probable implementation proposal

The NWDA has identified divertible surplus only in the Mahanadi (Orissa) and the Godavari Basins (AP). The Krishna, Pennar, Cauvery, Vaigai and Tamiraparani basins are all found to be deficit by the year 2025 AD.

In order to balance this surplus and deficit the following project proposals has been formulated. The project proposes to have National water ways covering the entire nation just like National Highways. But the task of tapping Ganga water at Patna (Point of surplus) and conveying it to over the Vindhya was found to be both technically not feasible as well as a costly proposal. There fore it was decided that the interlinking of the Himalayan Rivers could be considered independent of the linking of the Peninsular Rivers.

Thus the ILR plan was proposed to be taken up in 3 parts

- Linking the North West Rivers
- 2 Linking the North eastern rivers

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- **3 Linking the Peninsular Rivers**

Accordingly the National waterways project by networking of the rivers in India consists of

- The Himalayan Water ways (HWW)
- The Central Water Ways (CWW)
- The Southern Water Ways (SWW)

The HWW runs almost the entire country from west to east on the Northern side where as the CWW and SWW covers almost all the States in the centre and south up to Kanyakumari.

To be more precise and sustentative the following link canals are also proposed.

Benefits of the project

India will get rid of Poverty, flood, drought and unemployment problems.

- 1. Employment** : Jobs will get created for all the jobless.
- 2. Poverty** : As sufficient is made available for Irrigation in right time in right quantity and in right place food production will be increased and there by eradicate poverty.
- 3. Flood** : ILR acts as better flood mitigation tool. Government of India has formed National disaster Management board and spends a huge amount on flood which can be used for productive purpose.
- 4. Drought** : Drought affected areas will get water for irrigation and drinking. Farmers will get sufficient quantity of water for them even when the rain fall is below average.
- 5. Drinking water:** According to National Water Policy 1986 and revised 2000 drinking water is the top most priority in the water sectoral demand. If ILR is implemented, uninterrupted drinking water supply will be made available to 600 million people.
- 6. Agriculture** : Agricultural will be increased to meet our demands of the year 2050 (Expected food production in 2050 for the anticipated 164 crore population is 500 million tons).
- 7. Navigation** : National water ways acts as a medium of transport for medium ships and boats by providing eco friendly and economical transport. Carbon deposit in the space is thus reduced to greater extent.
- 8. Hydro Power** : 60,000 MW of pollution free hydroelectric power will be generated throughout the country because of the implementation of the project.
- 9. Oil** : Import of oil will be reduced by Rs.65000 crore every year.
- 10. Irrigation** : 150 million acres will get additional irrigation through out the year.

Conclusion

The decision to proceed with project of Indian rivers being interlinked is an epoch making landmark in the development of this country. It is the bound duty of every citizen to extend a supporting hand with a welcoming note and with a oath for judicial usage of water.

CORPORATE ENVIRONMENTAL RESPONSIBILITY: AN ENVIRONMENTAL ASPECT OF CSR

Citizens, environmental organizations and leadership companies state that corporate environmental responsibility as the duty to cover the environmental implications of the company's operations, products and facilities; eliminate waste and emissions; maximize the efficiency and productivity of its resources; and minimize practices that might adversely affect the enjoyment of the country's resources by future generations. The **Corporate Environmental Responsibility [CER]** is defined as "Continuing commitment by industry to act in [an] environmentally friendly manner and contribute to overall environmental improvement while carrying out its business". In the emerging global economy, companies are more and more frequently judged on the basis of their environmental stewardship. The challenge is to create a commonly respected CER framework that would allow a detailed assessment of business practices.

A growing number of companies in a wide range of sectors and geographic regions have discovered concrete value and competitive advantages from taking environmental initiatives in areas such as pollution prevention, energy efficiency, environmentally oriented design, supply-chain management and industrial ecology. For instance, cement production requires intensive use of natural raw materials and energy. It also results in emissions to the atmosphere, the most significant being carbon dioxide.

THE BROAD PRINCIPLES OF CER

The corporate environmental responsibility which is practiced by the corporates with the motive of creating a healthy environment exists with the three broad principles:

1. The Grandparent Principle,
2. The Minimal Impact Principle,
3. The Good Neighbour Principle.

Hence, CER, as an initiative must be undertaken with a courtesy to:

- a) leave a positive environmental legacy for future generations;
- b) pursue a degree of responsible development; and
- c) engage in dialogue with stakeholders.

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PERCEIVED BUSINESS VALUE (ADVANTAGES)

There is a common consensus from corporate participants that environmental responsibility does contribute directly to the economic viability of the firm. Generally, by contributing both to a company's reputation and operational efficiencies, they believe that environmental responsibility ultimately saves a company time and money. Specifically, some companies evolve direct business practices that are designed with environmental sustainability in mind.

This design leads to the creation of new market and service opportunities, which provided them with a competitive advantage over their peers. The results which are suggested by Kyla Fisher stand as an evidence for the values gained by a corporate through the implementation of good environmental practices.

1. Good Environmental Performance
2. Positive Corporate Reputation
3. Social License to Operate
4. Faster / Increased Production
5. Company & Shareholder Value

MOTIVES OF CER

1. Strategic Advantage

It is often claimed that being environmentally cleaner can bring cost savings. Pollution prevention can pay through saving resources, recycling materials at a lower cost than using new materials, and reducing clean up costs.

2. Avoiding Disadvantage

Companies may voluntarily raise their environmental standards because of the perceived danger of not doing so. This disadvantage may be a loss of market share if the strategies of competitors prove effective or it may be a loss of reputation or standing.

3. Acting Responsibly

Legitimacy is being defined as "a generalized perception or assumption that the actions of an entity are desirable, proper or appropriate". There is a need for business to establish legitimacy in the eyes of consumers, the public at large and government.

VOLUNTARY ENVIRONMENTAL INITIATIVES AND SELF-REGULATION

Across many areas of social concern, there has long been a debate about the desirability of voluntary compliance as an alternative to government regulation. In practice, voluntary action can be closely dependent on regulatory enforcement for three reasons:

- (i) Participation in so-called voluntary initiatives is frequently determined by the efforts of third parties, including government regulators;
- (ii) Government regulation may form a benchmark against which voluntary efforts are designed; and
- (iii) Conversion of voluntary measures into legislation is possible and not necessarily opposed by first movers.

PERCEIVED CHALLENGES WITH CER

As Specific challenges included distinguishing perceptions from action, and integrating CER values and expectations across an organization.

1. Walking the Talk

Corporate representatives feel that there is often a disconnect between a company's branded image, and its actual level of environmental stewardship in its activities. There is a sentiment that a corporate image, which could be purchased through marketing, public relations and sustainability reports, is fundamentally different from a company's reputation, which is said to be earned through a proven track record of responsible development and community engagement.

2. Integration

It is identified that the integration of CER commitments throughout the company is necessary for CER leadership to take root, but a difficult process to implement. Making sure that employees at all levels of the corporation have understood the company's environmental management systems and policies and could articulate them as they apply to their daily responsibilities is an ongoing struggle for many corporate participants.

3. Maintaining Consistency and Positive Reputation

Maintaining consistency and positive reputation as the corporate operate under varying environments and amongst diverse stakeholder groups, all with different needs and expectations, is a real challenge.

CONCLUSION

The companies are bound by laws protecting the environment, human rights, etc. But these only extend to the activities of companies based or operating in those countries, and not to the overseas activities. But the fact of CSR and CER concepts should never be forgotten that only the voluntary and activities beyond the regulatory framework amounts to corporate social as well as environmental responsibility and any enforcement by law will make it just an obligation on the part of the corporate. Therefore, in inculcating the self-regulating environmental services among the corporate, the government should play the role of a motivator and not a regulator.

WATER QUALITY AND ITS IMPACT ON HEALTH IN TIRUCHIRAPPALLI TOWN

Introduction:

Water is an important renewable resources. It is not only an essential element for our survival but is also an important vehicle for economic development of the nation. In recent years, water crisis has become a major problem in around the world. In India Cherrapunji is receiving the highest rainfall in the world. But India also faces water shortage. India is one of the few countries where the total precipitation is around 4000 million hectare meters, surface water availability is 178 million hectare meters and ground water potential in about 42 million hectare meter. Since there is temporal variation in rainfall and floods, mismanagement in some parts and population pressure, India is classified under the categories of countries having water scarcity / water stress.

Water quality is an important parameter in all aspects of ecosystem and human well being such as the health of a community, food to be produced, economic activities, health and biodiversity. Therefore water quality also is influential in determining human poverty, wealth and educational levels. Water quality is defined as "its desired end use. According to United Nation /ECE 1995, water quality is defined as the physical, chemical and biological characteristics of water necessary to sustain desired water use. Worldwide water quality is declining mainly due to human activities, Increasing population growth, rapid urbanization, discharge of new pathogens and new chemical from industries are key factors that contributed to deterioration of water quality. In addition, climate change will further affects water quality. Poor water quality threatens the health of the people and ecosystems. Water quality is reduced due to contamination of water. This reduces the availability of safe drinking water and cause a number of health problems. So an attempt is made to study the impact of water quality on human health in Tiruchirappalli town.

OBJECTIVES

1. To find out the water requirement in India and Tiruchirappalli Town.
2. To bring out the cause for contamination of water in Tiruchirappalli Town.
3. To analyze the various waterborne disease that affects human health in Tiruchirappalli Town.
4. To find out the major issues in water quality problems.

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Table.No: 1
Water Requirements in India (in Billion cubic meter)

Different uses of water	1990	2000	2010
Domestic	32	42	56
Irrigation	437	541	688
Industry	-	8	12
Energy	-	2	5
Other	33	41	52
Total	502	634	813

Source : Secondary data.

CAUSES FOR CONTAMINATION OF WATER

- Organic loading (sewage).
- Pathogens (waste streams from human & animals)
- Agricultural runoff.
- Human waste loaded with nutrients (nitrates & phosphates)
- Oxygen strewns in water ways.
- Salinization from irrigation.
- Water diversions.
- Oil pollution.
- Synthetic.
- Persistent engineered chemical (plastic & pesticides)
- Medical drug residues.
- Hormone mimetics & their by products.
- Radioactive pollution.
- Reservoir operation.
- Change of hydrological pattern.

MAJOR ISSUES IN WATER QUALITY

- Non availability of drinking water during critical summer due to excessive extraction of ground water.
- About 10% of rural & urban population does not have access to regular safe drinking water.
- Chemical contaminations – fluoride, arsenic and selenium pose a serious health hazard in count. It is estimated 70 million people in 20 states use at risk due to excess fluoride.

- 10 million people are at risk due to excess arsenic in ground water.
- Ingress of seawater into coastal aquifers as result of over – extraction of ground water. It made more saline in water and unsuitable for drinking & irrigation.
- Pollution of ground and surface water from agrochemical and industry which poses a major environmental health hazard.

SUGGESTIONS TO PRESERVE WATER QUALITY

1. Better effective communication and education through monitoring.
2. More effective communication & education through cultural, social, economic and ecological ways.
3. Modern financial & economic tools should be used.
4. Deployment of effective methods of water should be used .
5. Ecosystem should be restored.
6. Effective application and enforcement of legal and institutional arrange should be made.

CONCLUSION

Water has always been at the center of healthy ecosystems and human societies. In recent years, every year more people die due to consequence of unsafe water than from violence like war. The fresh water resources which we depend on contaminated due to pollution. This contaminated water affects the human health directly and has its impact on biodiversity. So in recent years at global and national level attention are taken to improve and preserve the quality of water. As the human being we should follow the slogan,

GROUND WATER MANAGEMENT IN TRUCHIRAPPALLI DISTRICT - THE STRUCTURE AND CURRENT SCENARIO

Water is a sine-qua-non for sustaining life on earth. Due to hydrological conditions, the country receives water. Only 25 percent of the rain water so received & utilizable. Demand for water in future for agricultural, industrial, municipal and other domestic purposes is undergoing a change in use due to industrialization, urbanization and greater agricultural activities to feed the ever increasing population.

The role of government and its policies in making the efficient utilization of available water resources is the need of the hour. The proper assessment of the availability of water resources for different purposes and the efficient management of the resources in order to full fill the demand depends on the basis of political, social and other factors.

In Tiruchirappalli District well irrigation is the most important source of irrigation, out of 110054 Ha, 57883 Ha of Net area are irrigated by ordinary wells. Efficiency of canal, tank and well irrigation can be improved by adoption of proper irrigational methods. Therefore, the present paper aims to study the structure of Ground water facilities, stages of ground water development and the supply-demand gap of water resource management in Truchirappalli district.

OBJECTIVES:

1. To study the structure of Groundwater facilities in Tiruchirappalli District
2. To discuss the different sources of ground water irrigation in the study area.
3. To find the sectoral water demand.
4. To analyse the supply – demand gap of water resource management.
5. To explain the stages of ground water development in Tiruchirappalli Municipal Corporation.

METHODOLOGY:

The present study is based on secondary data. The data has been collected from various records, reports & studies published in magazine, articles, research reports of Government officials and other organizations & Web portals.

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GROUND WATER POLLUTION IN TRICHIRAPPALLI DISTRICT:

The generated effluents that have found their way into the groundwater. These effluents came from badly constructed drains, from waste dumps and, in a few outrageous cases, were deliberately injected by the industry into the ground. The polluted water groundwater in now, at an average velocity of about 30 metres a year, migrating to the well field which houses the main wells for the district's water supply. To deal with the issue, water quality monitoring is now continuous and proposals have been made to drill a few wells for extraction and treatment of the contaminated groundwater.

Table No- 1
Irrigational Practices in Tiruchirappalli District

Sl.No.	Classification	Area(Ha)
1	Forests	36246
2	Barren & Uncultivable Lands	13599
3	Land put to non agricultural uses	84791
4	Cultivable Waste	8856
5	Permanent Pastures & other grazing lands	659
6	Groves not included in the area sown	1931
7	Current Fallows	21141
8	Other Fallow Lands	81812
9	Net Area sown	191347
	Total	440383

Source: Department of Economics & Statistics, Govt. of Tamil Nadu)

The nine fold land use classification for the district is explained above table. Out of it the chief irrigation sources in the study area are the canals, followed by tanks, wells and tube wells.

Table No - 2

Block wise and source wise net area irrigation in Trichirappalli district (2005-06)

		Canals	Tanks	Tube Wells	Ordinary Wells	Other Sources	
1	Andanallur	3700	0	1850	1342	0	6892
2	Manikandam	2913	561	2144	599	0	6223
3	Tiruverumbur	5218	1210	580	535	0	7543
4	Manaparai	0	481	27	4824	0	5332
5	Marungapuri	0	570	36	8214	0	8820
6	Vaiyampatti	59	257	98	4609	0	5023
7	Lalgudi	8228	40	2685	1538	0	12491
8	Pullambadi	3579	888	934	1733	0	7134
9	Manachanalur	2647	350	677	4228	0	7900
10	Musiri	1924	819	173	5073	0	7689
11	T.Pet	0	0	1474	5355	0	6829
12	Thottiam	2960	320	163	4449	0	7892
13	Thuraiyur	430	2009	80	6968	0	9487
14	Uppiliyahapuram	741	1280	60	8418	0	10499
	Total	32399	8791	10981	57883	0	110054

Source: Secondary data

The above table shows that the block wise and source wise net area irrigation. Among the 14 blocks canal, tank, tube well and ordinary well irrigation is carried on. When compared with the above 4 sources of irrigation, ordinary well irrigation is taken greater percentage, that is out of 110054 Ha net area irrigated 57883 Ha ordinary well irrigation is carried on in the study area. The next is in canal irrigation, tank and tube well irrigation is carried on nearly 8791 Ha – 10981 Ha. There is no other source of irrigation is carried on here. It implies that the need and usage of Ground water is very important in the study area.

Table No.3
Projection of Sectoral Water Demand in Tiruchirappalli District

Sl. No.	Sectors	2001	2010	2025	2050	% of the total in 2050
1	Domestic	78.46	86.09	98.56	122.18	6
2	Irrigation	1764.82	1764.82	1764.82	1764.82	86.58
3	Industries	54.91	57.66	62.04	70.09	3.44
4	Power	4.17	4.87	5.72	6.36	0.31
5	Live Stock	18.33	18.33	18.33	18.33	0.9
6	Aquaculture	0.07	0.07	0.07	0.07	---
7	Recreation	0.04-	0.04	0.04	0.04	---
8	Navigation	-	-	-	-	---
9	Minimum flows	-	-	28.26	56.52	2.77
	Total	1,921	1,932	1,978	2,039	100

Source: Secondary source.

The above table shows that the projection of sectoral water Demand in Tiruchirappalli District. When we compared all the sectors the demand for water is continuously increasing from 2001-2010. So, we can say that it may continue greater % in future. Since we compared all the sectors the demand for water from the year 2001 -2050 is same in irrigation, live stock, aquaculture, recreation ie., the agricultural sectors. Because of the gambling of monsoon since Indian Agriculture sectors water demand is increasing.

Findings:

- The entire district forms part of Cauvery river basin.
- Based on the data on ground water abstraction structures and area under irrigation from ground water, the average unit draft of dug wells and bore wells have been computed as 0.47 ha.m and 0.86 ha.m respectively.
- On the basis of experimental, it has been found that desilting of existing tanks followed by percolation pond with recharge wells/recharge shafts are economical.
- Computations have been made for Drought Prone Area Programme (DPAP), over exploited and critical blocks in the districts warranting immediate attention.
- All the sectors demand for water is continuously increasing from 2001-2010.
- The need & usage of groundwater is very much important in the study area, hence out of 110054 Ha net irrigated, 57883 Ha is carried on ordinary wells.
- Only canal, tank, tube well and ordinary well irrigation is carried on the study area.

Remedial measures:

- Regulating the construction of tube wells and the extraction of ground water
- Issues of ground water clearances only to non water based industries.
- Farmers are encouraged, by means of subsidies, to switch to drip-irrigation techniques and renovate unused shallow wells for harvesting rainwater.
- The construction of roof top rainwater harvesting structures in private and industrial buildings is eligible for subsidy.
- The treatment and recycling of waste water for re-use in agriculture and industry
- To make rainwater harvesting mandatory for all government buildings.
- To empower communities to own and manage their tank system and stimulate surface water usage.
- Involvement of the major stakeholders, the rejuvenation of the irrigations tanks and related drains.
- Planned long term water management system.

Conclusion:

In the existing scenario of competing demand for water, both surface and ground water should be tapped and conserved to the optimum level. Increasing rain-water harvesting techniques, water conservation, modernization of tank and other irrigation systems, exploitation of minor irrigation and adaptation of micro irrigation techniques, water use efficiency and irrigation management should receive high priority in the coming years. Restoring public irrigation sources such as tanks and canals back to their original position along with suitable water management practices.

Gender Impact on Common Property Resources in Thottiyam Taluk of Tiruchirappalli District (A Case Study)

Introduction

Common Property Resources (CPRs) play a significantly role in the Life of Rural Poor, Particularly the Rural Women. Since the historical past, the resources contributing lot of benefits to the village economies. There is growing evidence that common pool resources at the village level are on the decline quantitatively and qualitatively across the regions of developing countries.

Objectives

1. To study about the significance of the common property resources in general.
2. To discern the extent of access of CPRs to rural women in and around of Thottiyam Taluk.
3. To analyse the impact of CPRs on women employment and empowerment in study area.
4. To suggest suitable measures for optimum utilization CPRs and to create awareness on CPRs protection and development

Methodology

The present study is on common property resources in Thottiyam taluk in Tiruchirappalli District. It is also one of the predominant of agricultural and backward areas. Fifty households were chosen and enquired on the nature of CPRs, their dependence on CPRs etc were collected, from entire study area. It is located 52 K.M away from Tiruchirappalli district. The entire villages CPRs have been collected for the purpose of the study.

Period of the Study

This study covered the period for ten years from 2001 to 2010, and the secondary data collection was undertaken during the month of September to October 2010.

Analysis and Discussion

No of years of dependence on CPRs by respondent Household

The dependence of households and CPRs sources and it has been taken in years. It has been divided into 4-class interval that is 5 – 10 years, 11 – 20, 21 – 30, and above 30 years. Majority of the

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respondents i.e., 28 house hold are using CPRs sources between 11 – 20 years, and following by 11 respondents are using CPRs sources for more than 30 year's right from the of beginning. The average number of years of dependence on CPRs is 19. It is to be mentioned that nearly 2/3rd of them depend of CPRs for needs more than 15 to 20.

Fuel Wood collections of the respondents from the CPRs sources

The fuel wood collection of both the male and female respondents forms the CPRs sources of the respondent's households. Particularly male respondent are collecting more quantity of fuel wood as compare with female folk.

Utilization of CPRs for various purposes

The utilization of the CPRs from various sources. They are using it for two purposes (I) self use and some respondents are using CPRs collected resources for making up their living.

Income derived from CPRs sources by the respondent Households.

CPR provides employment opportunity the rural peoples. These employment opportunities is very important in other opportunities the content of non – availability from this table income from CPRs related activities gives higher income to male than female. Here standard deviation is higher in male income. So the female income is more relevant and useful to their households due to low standard deviation.

Value of the Houses of the respondents

Out of 50 households 64 percentage of the respondent are having above Rs. 40,000 value of houses. Parts of them are having (36%) below of Rs. 40,000 as their value of houses. It reflects the status of the respondents. They depend on CPRs for their survival. Low value of houses is due to the roof of titles for which they more. Hence right from the food, shelter, the dependency on CPRs is very high for the respondent households.

Land Holding Size of the respondents (in area)

The land holding size of the respondent land size has been divided into different size class interval in which 14 respondent out of 50, has a share of 28% it is to be mentioned that majority of them have only less than 2 acres majority of them being marginal farmers, they depend on agricultural seasonal operations during peek seasons and in the off season they have to partly depend on CPRs for livelihood needs says collecting fuel wood and selling in the market. Thus and making up their

WATER POLLUTION

Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support a human use, such as drinking water, and/or undergoes a marked shift in its ability to support its constituent biotic communities, such as fish. Natural phenomena such as volcanoes, algae blooms, storms, and earthquakes also cause major changes in water quality and the ecological status of water.

How is Water Pollution Caused?

Although certain natural processes may cause some of the water pollution, however, human activity is the largest cause of our seas, rivers and lakes getting polluted. We need to use water everyday both in our industries as well as our homes. We get this water from groundwater sources, rivers, and lakes, and after using it, and often contaminating it, most of this water gets back into the rivers, lakes, and oceans.

The used water from agricultural and industrial practices and household use create wastewater, also referred to as sewage. If this is allowed to flow back into water systems without being treated, it causes pollution, which results in harming both humans as well as animal life. Water also gets polluted when there is a runoff of rainwater from industrial, agricultural, and urban areas, which flow directly through storm water drains into water systems without any treatment.

The disposal of sewage is a major problem in developing countries where there isn't adequate sanitation in large areas, thus carrying disease causing bacteria and viruses into sources of water. In countries that are developed, people often flush pharmaceutical and chemical products into their toilet.

Some of the other causes of pollution are oil spillages and dumping in oceans, dumping litter into streams, rivers, and oceans such as cardboard, newspaper, foam, Styrofoam, plastic packaging, aluminum, glass, and so on. Some of these take a very long time to degrade, e.g., plastic packaging can take 400 years, Styrofoam takes 80 years, foam takes 50 years, and aluminum takes 200 years.

Nuclear waste, atmospheric deposition and underground storage leakages are some of the other causes of water pollution.

Water Pollution Statistics

According to the data compiled by the World Water Assessment Program (WWAP), 2 million tons of human waste is disposed in water bodies every single day. The developing countries have a major share in water pollution, as 70 percent of the industrial waste which is dumped untreated in the water bodies comes from these developing countries of the world. The problem of groundwater pollution is also

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quite prominent in the United State, and agriculture is considered to be the underlying factor for this. A study carried out in the 49 states of the US revealed that nitrate was the principal contaminant of groundwater in this region. Along side groundwater, agriculture also plays a significant role in the pollution of larger water bodies in form of surface run off. In fact, the traces of DDT, which was banned in the United States way back in 1970s, are still found in the waters of the Atlantic and the Pacific oceans. As a result of this incessant pollution of water, around 20 percent of the world population is left without proper water to drink. A study about the effects of water pollution, undertaken way back in 90s, revealed that 1,200 million people are affected the world over due to this problem. Things have changed drastically since then, and therefore it is assumed that the number of the affected people has also increased. The same study also revealed that water pollution is one of the major factors for the death of children under five every year.

Chemical and other contaminants

Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts. Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases in the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations. Muddy River polluted by sediment. Photo courtesy of United States Geological Survey.

Inorganic water pollutants include:

- Acidity caused by industrial discharges (especially sulfur dioxide from power plants)
- Ammonia from food processing waste
- Chemical waste as industrial by-products
- Fertilizers containing nutrients—nitrates and phosphates—which are found in storm water runoff from agriculture, as well as commercial and residential use. Macroscopic pollution—large visible items polluting the water—may be termed “floatable” in an urban storm water context, or marine debris when found on the open seas, and can include such items as:
- Trash or garbage (e.g. paper, plastic, or food waste) discarded by people on the ground, along with accidental or intentional dumping of rubbish, that are washed by rainfall into storm drains and eventually discharged into surface waters

Thermal pollution

Thermal pollution is the rise or fall in the temperature of a natural body of water caused by human influence. Thermal pollution, unlike chemical pollution, results in a change in the physical properties of water. A common cause of thermal pollution is the use of water as a coolant by power plants and industrial manufacturers. Elevated water temperatures decreases oxygen levels (which can kill fish) and affects

ecosystem composition, such as invasion by new hemophilic species. Urban runoff may also elevate temperature in surface waters.

Thermal pollution can also be caused by the release of very cold water from the base of reservoirs into warmer rivers.

Measurement

Environmental Scientists preparing water auto samplers.

Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological. Most involve collection of samples, followed by specialized analytical tests. Some methods may be conducted *in situ*, without sampling, such as temperature. Government agencies and research organizations have published standardized, validated analytical test methods to facilitate the comparability of results from disparate testing events.

Save Water

How can saving water reduce water pollution? If you save water, there is lesser contaminated water to treat, and the pressure of the same on the resources becomes minimal. Save water with simple steps like turning it off when washing vessels or brushing your teeth, not using the washing machine when the load is not high, using a mop or cloth to wash the yard instead of a hose pipe and the like.

WATER RESOURCES MANAGEMENT

Introduction

Water is the most important natural resource. It is manageable resource because of its capability of diversion, transport, storage and recycling. Water Resource Management refers to economics applied in the usage of water be it ground water or surface and ensures a judicious distribution of water to as many uses as possible. In Asia, 86% of fresh water use is for agriculture, 8% for industry and 6% for domestic purposes. According to a United Nations estimate, by the year 2025 two-thirds of humanity will face shortage of fresh water. In this backdrop an attempt was made to highlight different issues relevant to water resource management in India.

Demand

The demand for water is direct and also indirect demand. The demand for households, industry and irrigation is increasing due to the escalation of population, large-scale industrialization and for producing needed food for increasing population

Supply

The total water resources of the country are approximately four percent of the world's fresh water resources, whereas the country's population is more than 16 percent of the global population. As per the estimate of National Commissioner for Integrated Water Resources Development, total annual water resources of the country is 1953 cubic kilo meters. However, the quantities of water for use, drawable from the annual resources are only 1086 km³ which is the sum of 690 km³ drawable from surface water resources and 396 km³ drawable from ground water sources.

Per capita Availability

According to United Nations estimates, generally, if the water availability is 1700 Km³ per person per year, the region/state will experience periodic water stress. The per capita availability of water in India is about 2200 km³ per year.

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Uneven Distribution

The availability of water is very unevenly distributed across the country. There are regions with acute water scarcity. The number of drought affected districts in the country during 1999-2000 at 126, spread over 11 states. The economic survey of 1999-2000 stated that only 90 percent of urban areas and 92.5 percent rural areas have access to drinking water. In India drinking water supply has assumed special significance because of the vast rural population flung apart in isolated and scattered villages numbering nearly 6 lakh.

Water Resources Management.

Irrigation and water use efficiency has to be improved for conservation and optimization of utilization of the available water resources. In as much as most of the available water resources have been almost fully exploited, special attention has to be paid to conservation, management and optimization of utilization of the available resources.

Strategies for Managing Water Resources

Most sustainable as well as efficient strategy to manage the water resources is to increase the supply, mostly by building dams and reservoirs, diverting surface water from one to another and tapping groundwater.

Ground Water Management: - There is need for caution in regard to ground water development and exploitation; drawl of ground water is more than recharge in many areas. Water users' organization and on-farm development help in Judicious water allocation and management. Thus the measures necessary are listed below.

- Improvement of the water use efficiency by progressive reduction in conveyance and application losses
- Adoption of better water management practices/ techniques through farmers' organizations
- Promotion of adaptive research and development to ensure more cost effective and efficient execution and management of irrigation systems through better water management practices.
- Implementation of the conjunctive use of ground and surface water towards optimal utilization of water resources and to have its development environmentally sustainable as well. The ground water should be utilized to the maximum during the monsoon period and surface water can be used when the water level goes beyond certain limit below ground level.

WATER RESOURCE IN INDIA

Water scarcity is now the single biggest threat to global food production. Just two decades ago, serious water problems were confined only to small pockets of the world. Today, it exists in every continent and is spreading rapidly 22 of world's countries at present have renewable water supplies of less than 1000m³/year. The World Bank estimates that by the year 2025 one person in three or 3.25 billion people in 52 countries will live in conditions of water storage. The supply of water for human use entails not only the problem of quantity but also one of quality, since all human activities impair the natural quality of water. Beyond a usable water and problems with the disposal of the polluted water. Under these circumstances, to overcome the demand of water is crucial in the coming years.

Water Resources and water demand:

India is blessed with good rainfall and water resources, but it is not uniformly distributed. Further it is a monotonous country and hence it is erratic failure of rainfall and droughts and floods occur in some parts of the country every year.

The demand (pattern) of water is changing at a rapid rate with increase in population, urbanization and fast industrialization. The National Commission for Integrated water resources development (1999) has estimated the requirements of water for diverse uses such as irrigation, domestic, industry, power, navigation for low and high population estimated in 2010, 2025 and 2050 some provision of maintaining ecology has also been made. The demand of water for Tamil Nadu is different. The demand has been calculated by various scientists including the author for 2010/2015 the details are given below:

Purpose	Water Required in	
	MHM	BCM
Irrigation	5.00	50
Drinking/ Animals	0.5	5
Industries	1.4	14
Others	0.1	1
Total	7.00	70BCM

The demand is increasing day by day but the availability is constant. In fact large quantity of water is polluted due to sewage and effluents coming from municipalities and industries respectively. Hence the problem is how to manage the water demand in all sectors in the coming year's respectively. Hence in Tamil Nadu where most parts of the state, the ground water level has gone beyond 1000. The following measures are suggested to argument water supply and to mitigate water problems.

- A) Water harvesting, water conservation and water management.
- B) Use of brackish water for agriculture.
- C) Desalination of sea water for drinking and industries in the coastal areas.

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- D) Waste water utilization –sewage and effluent water – reclaiming and reusing in industries, using for irrigation and recharging ground water.
- E) Prevention of I) leakage in municipal areas II) seepage percolation while transporting water and III) evaporation losses from water bodies.
- F) Judicious use of water in all sectors especially in irrigation as it consumes more than 80% of all the water.

If all the above mentioned methods are implemented at appropriate places, it will be possible to overcome the demand of water for all sectors in the coming years. Water actually utilized was 38 million hectare meters in 1974, which is expected to rise to 105 million hectare meters by the year 2025. It has been estimated uses account for products of agriculture and industries, the demand for water will continually rise.

Government policy on water resources:

The British rules in India did not evolve a clear-cut and definite policy on the utilization of India's water resources before 1947. During the Second World War, India had to suffer serious food shortage, ultimately resulting in the Bengal famine. The partitions of the country worsened the food situation and grow – more- food and self – sufficiency in food becomes the most important short –term objectives of the Government at that time. At the same time, rapid industrial development launched soon after 1951 necessitated two things: the increased of electricity on the other. To these were added as an important objective of management of water resources.

Thus, India's water policy since Independence or more specifically, since 1950-51, consisted of the construction of huge dam's reservoirs, distribution canals, etc., all of which were designated as major and medium irrigation works. Some were also known as multi – purpose projects, since they were designed to generate electric power, provide irrigation water to agriculture and drinking water to cities and control floods/

Conclusion:

India is one of the wettest countries of the world but it is not able to hold all the water it receives. Because of deforestation and denudation, a large portion of monsoon water disappears into the sea as surface run-off. Community resources such as ponds, tanks and rivers are misused and continuously neglected. Rivers are increasingly getting polluted as urban and industrial wastes are dumped into them. India's water policy has concentrated on gigantic river systems and reservoirs and despite huge investments on them; their productivity continues to be low. They have not helped in controlling or moderating floods. Nor are they cost effective, or ecologically desirable.

Ground water table has gone down dramatically in more intensely cropped areas, clearly indicating the need to increase recharges or to regulate pumping. In some areas, there is serious pollution danger to ground water due to industrial wastes.

WATER USE PATTERN IN INDIA

India is one of the wettest countries in the world with average annual rainfall of 1100 m.m. Water resources are sources of water that are useful or potentially useful to humans. Uses of water include agricultural, industrial, household, recreational and environmental activities. Virtually all of these human uses require fresh water. 97% of water on the Earth is salt water, and only 3% is fresh water of which slightly over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is mainly found as groundwater. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily decreasing. Water demand already exceeds supply in many parts of the world and as the world population continues to rise, so too does the water demand. Awareness of the global importance of preserving water for ecosystem services has only recently emerged as, during the 20th century. More than half the world's wetlands have been lost along with their valuable environmental services. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land ecosystems.

Annual water resources of India, 1974 and 2025

	(million hectare meters)	
	Year	
	1974	2025
Total precipitation	400	400
a. Immediate Evaporation	70	70
b. Run off to surface water bodies	115	115
c. Percolation in the soil	215	215
Water utilization	38	105
Ground water contributes	13	35
Surface flows	25	70

Source: The state of India's Environment, (1984-85)

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Water is an essential requirement for living not only for human beings, but also for cattle and plants. It is the elixir of life, and an essential ingredient of agricultural and Industrial development. India is blessed with one of the largest water resources in the world. The geographical factors are also conducive to the development of irrigation. The soil is very fertile enough to make the optimum use of water. The sub soil is deep enough to provide big reserves of the rain water which seeps underground and is tapped by digging wells in that area.

In India, we have to feed a huge population, surface water flow alone is insufficient to meet the total water requirements of both the rural and urban areas and also for irrigation purposes. Unfortunately accurate survey on ground water resources of the country has not yet been conducted. In a guess work, it had been estimated around 3,700 million hectares which is nearly 10 times the annual precipitation. The annual exploitable ground water potential has been estimated at 45 million hectare meters. However, only 13 million hectare metres are being exploited at present

Water supply

Depleting ground water table and deteriorating ground water quality are threatening the sustainability of both urban and rural water supply in many parts of India. The supply of cities that depend on surface water is threatened by pollution, increasing water scarcity and conflicts among users. For example, Bangalore depends to a large extent on water pumped since 1974 from the Kaveri river, whose waters are disputed between the states of Karnataka and Tamil Nadu. As in other Indian cities, the response to water scarcity is to transfer more water over large distances at high costs. In the case of Bangalore, the 3,384 crore (US\$734.3 million) Kaveri Stage IV project, Phase II, includes the supply of 500,000 cubic meter of water per day over a distance of 100 km, thus increasing the city's supply by two thirds.

Uses of water:

Agricultural: It is estimated that 69% of worldwide water use is for irrigation, with 15-35% of irrigation withdrawals being unsustainable. In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. **Industrial:** It is estimated that 22% of worldwide water use is industrial. Major industrial users include power plants, which use water for cooling or as a power source (i.e. hydroelectric plants), ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent. The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural- **Drinking water:** It is estimated that 8% of worldwide water use is for household purposes.^[6] These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated by Peter Gleick at around 50 liters per person per day, excluding water for gardens. Drinking water is water that is of sufficiently high quality so that it can be consumed or used without risk of immediate or long term harm. **Recreation:** Recreational water use is usually a very small but growing percentage of total water use. Recreational

water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Environmental: Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water usage includes artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders, and water releases from reservoirs timed to help fish spawn.

Water stress

The concept of water stress is relatively simple: According to the World Business Council for Sustainable Development, it applies to situations where there is not enough water for all uses, whether agricultural, industrial or domestic. Defining thresholds for stress in terms of available water per capita is more complex, however, entailing assumptions about water use and its efficiency. Nevertheless, it has been proposed that when annual per capita renewable freshwater availability is less than 1,700 cubic meters, countries begin to experience periodic or regular water stress. Below 1,000 cubic meters, water scarcity begins to hamper economic development and human health and well-being. Population growth: In 2000, the world population was 6.2 billion. The UN estimates that by 2050 there will be an additional 3.5 billion people with most of the growth in developing countries that already suffer water stress. Thus, water demand will increase unless there are corresponding increases in water conservation and recycling of this vital resource.

Government's policy on water resources:

During the British period, i.e., before 1947, not much attention was paid towards water resources policy and India had to face several famines. After independence, the government realized the importance of water resources for purposes of agricultural development and also industrial expansion. The water policy of the country consisted of construction of huge reservoirs and dams distribution canals, construction of barrages which were prepared as major, medium and minor irrigation works. The Government put much emphasis on the intensive utilization of ground water resources through minor irrigation. Too much reliance on huge and expensive dams and reservoirs has resulted in little benefits and positive harm to environment and society as well. Water pollution may be analyzed through several broad categories of methods: physical, chemical and biological. Most involve collection of samples, followed by specialized analytical tests. Some methods may be conducted in situ, without sampling, such as temperature. Government agencies and research organizations have published standardized, validated analytical test methods to facilitate the comparability of results from disparate testing events.

Women and Water Management: Towards Sustainable and Equitable Development

“When there is water scarcity, women are worst affected,”

Introduction

Water is essential for all forms of life and crucial for human development. Water systems, including wetlands, coastal zones, surface waters and aquifers, provide a vast majority of environmental goods and services, including drinking water, transport and food. As the world's population has tripled over the last century, the use of renewable water resources has grown six fold. But water's sustaining role in ecosystems remains undervalued, despite the fact that minimum flows in water bodies are needed to support environmental, health and increasing human demands. Faced with shortages and a grim future if current trends continue, there is a growing understanding that sustainable water management requires water governance. Worldwide, the demand for water is growing rapidly, and in many countries the cost of developing new supplies is becoming prohibitive. Simultaneously, increased water pollution is worsening the imbalance between water supply and demand. For these reasons, water resources development and irrigation are of critical importance in efforts to improve food security and sustainable agricultural production. Awareness is growing of the importance of a gender approach to water supply and management issues.

Water Supply in India:

Continuous water supply is the requirement of every industry in India. India being a primarily agriculture-based society requires huge amounts of water sources for regular irrigation of the farms as the monsoons are not a reliable water source considering the vast geographical as well as climatic variations in India. Also safe drinking water supply is another area where the government needs to emphasize more as groundwater is not an everlasting water resource. The water quality is tested at regular intervals and only if the water quality standards fulfill certain quality parameters, the water is certified to be safe for drinking.

Future Requirements of Water

The requirement of water for various sectors has been assessed by the National Commission on Integrated Water Resources Development (NCIWRD) in the year 2000. This requirement is based on the assumption that the irrigation efficiency will increase to 60 percent from the present level of 35 to 40 percent. The Standing Committee of MoWR also assesses it periodically. These are shown in the following Table.

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Projections of Water Requirements of Various Sectors of the Indian Economy

Table

Sector	Water Demand in km ³ (or BCM*)					
	Standing Sub-Committee of Mo WR**			NCIWRD***		
	2010	2025	2050	2010	2025	2050
Irrigation	688	910	1072	557	611	807
Drinking Water	56	73	102	43	62	111
Industry	12	23	63	37	67	81
Energy	5	15	130	19	33	70
Others	52	72	80	54	70	111
Total	813	1093	1447	710	843	1180

*Billion Cubic Metre; ** Ministry of Water Resources; ***National Commission on Integrated Water Resources Development.

Source: Government of India, Planning Commission, Eleventh Five Year Plan (2007-12), Vol., III, p. 46.

The role of women in water management:

In many societies, water is at the core of women's traditional responsibilities: collecting and storing water, caring for children, cooking, cleaning, and maintaining sanitation. These tasks often represent a whole day of work; in some regions, women spend up to five hours a day collecting fuel wood and water and up to four hours preparing food. In Africa, 90% of the work of gathering water and wood, for the household and for food preparation, is done by women. Providing access to clean water close to the home can dramatically reduce women's workloads, and free up time for other economic activities. For their daughters, this time can be used to attend school. Better sanitary conditions are of greatest importance for women, providing greater privacy, convenience, safety and dignity and safe hygiene practices in the family.

Since the early 1980s more and more attention has been devoted to the relationship between women and the environment, and in particular in relation to water. Women play a key role in educating children to water. Their interest in water awareness is major, since it is they who look after the household, and whose children diseases, often fall sick due to contaminated water or lack of hygiene: each year, nearly two million children die from diarrhoeal diseases. Yet educating children always to wash their hands after using the toilet and before preparing food is a very simple and effective means of preventing such illnesses.

In 1995, during the Fourth World Conference on Women (Beijing, China), governments committed themselves in the **Beijing Declaration** to: "promote knowledge of and sponsor research on the role of women, particularly rural and indigenous women, in irrigation, watershed management, sanitation, focusing particularly on indigenous women's knowledge and experience." During the International Conference on Freshwater held in Bonn, Germany, in December 2001, gender was given a prominent place in the

Ministerial Declaration: "Both men and women should be involved and have an equal voice in managing the sustainable use of water resources and sharing of benefits. The role of women in water-related areas needs to be strengthened".

The Johannesburg Summit (28 August-04 September 2002) has issued several main commitments related to women in its **Political Declaration**. Among them to:

- Promote women's equal access to and full participation, on the basis of equality with men, in decision-making at all levels, mainstreaming gender perspectives in all policies and strategies...'
- 'Improve access to land and property, to adequate shelter and to basic services for the urban and rural poor, with special attention to female heads of households'
- 'Facilitate access to public information and participation, including by women, at all levels in support of policy and decision-making related to water resources management and project implementation'.

Thus women play an important role in water management. They are most often the collectors, users and managers of water in the household as well as farmers of irrigated and rainfed crops. Because of these roles, women have considerable knowledge about water resources, including quality and reliability, restrictions and acceptable storage methods, and are key to the success of water resources development and irrigation policies and programmes.

Women and Water: Indian case

*"She sends me to fetch water
very early in the morning
Oh! Grandfather, it is very
difficult for me
My pot never fills up fully
The water is so deep
that my rope hardly reaches it
The sun rises and also sets
by the time I return
Unable to collect
even one potful of water."*

- A folk song of Rajasthan

Improving water resources

Gender analysis can help irrigation planners and policy-makers to improve the performance of irrigation schemes. There are three broad areas in irrigated agricultural production systems that require particular attention, and where a more thorough, gender-based analysis of local situations will help to create more effective, equitable and sustainable irrigation policies and programmes.

Irrigation design.

In order to accommodate the water needs and requirements of both male and female farmers, it is necessary to identify who will be using water, the amounts needed, at what times and for what purpose. For this, local participation in project design activities is essential, and thorough discussions should be held during each phase of project planning with different segments of rural communities (village leaders, male irrigators, adult women, youth, and men and women from poorer households).

Implementation

Water delivery schedules should be devised in such a way as to accommodate both men's and women's needs with respect to quantity, timing and quality of water. Also, training in water control and management, cropping calendars, and system maintenance should be extended to women as well as men. Given that women's incomes are considerably lower than men's and that the capital requirements to invest in irrigated crops can be quite high, access to credit systems should be made available to women irrigators. Access to credit will also facilitate women irrigators' access to technology.

Conclusion

It is now recognized that the exclusion of women from the planning of water supply and sanitation schemes is a major cause of their high rate of failure. International initiatives, such as the International Drinking Water Supply and Sanitation Decade and the United Nations Conference on Environment and Development (UNCED), have been instrumental in promoting the role of women in water management. Women in poor countries are often better at managing water resources and should therefore play a bigger role in policy-making to ensure access to safe drinking water and sanitation services. Women need to be more involved in water policy-making, because they are the ones who care. They are the ones who are responsible for fetching the water. Women are often in charge of fetching water, they have considerable knowledge about water resources, including location, quality and storage methods. The Indian government provided the masses with adequate water supply but the management of the water supply systems was not undertaken efficiently. This has resulted in deteriorating condition of the water supply network. Thus majority is forced to pump out ground water to fulfill the water requirements that has in turn created a huge drop in the ground water levels. Thus an effective strategy for water conservation is the need of the hour. The steps taken in this regard include water treatment plants, water pollution control so as to keep the water resources safe for other usage, careful scrutiny of water supply division and projects. The water supply department by adopting timely conservation methods can help solve the water shortage problem in India and deal with the ongoing water crisis in India. Rainwater harvesting can also provide a solution to the water crisis in India. Certain areas in India receive plenty of rainfall and thus creating huge rainwater harvesting. Water tanks can help in accumulation of natural water and then after some treatment can be utilized as a drinking water substitute.

WATER RESOURCES OF INDIA – AN OVERVIEW

Introduction

India is a land of many rivers and mountains. Its geographical area of about 329 MHa is criss-crossed by a large number of small and big rivers, some of them figuring amongst the mighty rivers of the world. The rivers and mountains have a greater significance in the history of Indian cultural development, religious and spiritual life. It may not be an exaggeration to say that the rivers are the heart and soul of Indian life. India is a union of states with a federal set up. Politically, the country is divided into 28 States and 7 Union Territories. A major part of India's population of 1,027,015,247 (2001 census) is in rural and agriculturally oriented for whom the rivers are the source of their prosperity.

Water Resources of India

The average annual rainfall in the country has been estimated to be about 1170 millimeters (mm). The total of average annual rainfall, snowfall and glacier melt in terms of volume works out to about 4000 billion cubic meters (bcm). However, due to losses through evaporation and evapo-transpiration, the water availability has been assessed to be about 1869 bcm. Even this available water cannot be fully utilized due to topographical constraints and hydrological features and utilizable water has been estimated to be about 1123 bcm comprising of 690 bcm of surface water and 433 bcm of replenish able ground water. Further, very large temporal and spatial variations are observed in rainfall and hence in the water availability. Most of the water is available during monsoon period and that too, through a few spells of intense rainfall, resulting in floods in major rivers. While the average annual rainfall of the country is about 1170 mm, the rainfall varies from 100 milimetre in the western parts of Rajasthan to over 10000 milimetre at Cherrapunji in Meghalaya.

Drinking Water Supply

The access to safe drinking water sources in urban areas of India was about 90% in the year 1990 and 93% in the year 2000 and this has improved to about 96% by the year 2008. In rural India, access to safe drinking water sources has increased from about 58% in 1990 to about 73% in the year 2008. Similarly, as per the reports of the Joint Monitoring Programme of World Health Organization and UNICEF, the use of improved sanitation coverage in rural areas of India was 7% in the year 1990 and this increased to about 21% in 2008. The urban sanitation coverage was 49% in 1990 and increased to about 54% by

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the year 2008. The current coverage of sanitation facilities in the rural areas is more than 65%. Thus, a lot more works are required to be completed in respect of supply of safe drinking water and sanitation programmes. The millennium development goal (MDG) of improved sanitation facilities in the rural areas is planned to be achieved by the year 2013.

Projections for the Future Water Requirements

As per an estimate, the overall demand for water resources by the year 2050 would be around 1447 bcm including 1072 bcm for irrigation. The "National Commission for Integrated Water Resources Development (NCIWRD)" has assessed that about 83% of water is used for irrigation and remaining for domestic, industrial and other purposes. The Commission has assessed the projected demand as 1180 bcm for the high demand scenario for the year 2050. While making the assessment, NCIWRD has assumed improvement in the efficiency of both surface water and ground water systems and also in the efficiency of water use in agriculture and other sectors. Although the requirement for irrigation water would increase over the time, the share of irrigation water in the overall demand has been estimated to reduce from the present level of about 83% to about 69% by the year 2050.

Conclusion

In view of the vital importance of water for human and animal life, for maintaining ecological balance and for economic and developmental activities of all kinds, and considering its increasing scarcity, the planning and management of this resource and its optimal, economical and equitable use has become a matter of the utmost urgency. Concerns of the community need to be taken into account for water resources development and management. The success of the National Water Policy will depend entirely on evolving and maintaining a national consensus and commitment to its underlying principles and objectives. To achieve the desired objectives, State Water Policy backed with an operational action plan shall be formulated in a time bound manner say in two years. National Water Policy may be revised periodically as and when need arises.

NATURAL RESOURCE MANAGEMENT (LAND & WATER)

(I) **Water Resource : A Foundation for Indian Agriculture, Livelihoods & Food Security**

Indian agriculture has constantly made an ardent effort to remain ever responsive with a view to manage the change and meet the growing and diversified needs of different sectors. It has tried to capitalize on its opportunities by converting its weaknesses into opportunities by identifying, strategies and programmes to commensurate projects and relevant activities coinciding with the Plans. Realizing this vision, has further ensured fulfillment of this mandate and in making Indian agriculture locally, regionally and globally competitive. There has been a modest beginning in the development of location-specific, multi-commodity and integrated farming system models for rain-fed, irrigated and water stagnated and flooded ecosystems in this sector. Despite this, declining trends in the per capita land & water availability, increased population pressure, accentuated pressure on natural resources, changing food habits, life styles, livelihoods and socio-economic scenarios have become grave considerations for developing future perspectives.

The demand for water for food production has been rising rapidly. According to the International Union of Food Science & Technology, during the last 50 years food production many a times even surpassed population growth but could not be at par with fulfilling the demand for water needed for food production. The combination of key scientific developments responsible for green revolution and large scale investments in water infrastructure such as dams and irrigation systems have played a significant role in the success of meeting food demand. However, today's world witnesses an unprecedented demand for food brought about by the ever increasing population levels and rising incomes in developing countries. Many of the successes of the past originated at the expense of the environment and equitable food distribution while today for many of the world's poor, water is not even available or accessible due to lack of physical or institutional infrastructure. Continued adoption of current techniques of agricultural water management may tend to have dire consequences on the environment and may not be appropriate to help alleviate poverty.

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Changing Diets and the Demand for water

As income levels rise, food habits change in favor of more nutritious and diversified diets. Higher incomes correspond with a change in eating habits towards higher calorific and more nutritional food. This tends to bring about a shift in consumption patterns from among cereal crops towards livestock products and high-value crops such as fruits, vegetables, sugar and edible oils. According to a recent survey conducted by the International Union of Food Science & Technology, although, there exists many factors that point towards changes in the demand for food and feed, projections for future demand indicate that by 2050 cereal demand could range from 2800 to 3200 million tons, the demand for meat, which is highly related to rising incomes, is estimated to rise to between 375 and 570 million tones by 2050, also the demand for sugar, oil, vegetable and fruit demand is projected to rise substantially. The changes in diet have important implications on agricultural water use. Livestock products and the production of sugar and oil typically require more water per unit output than staple grains. Without improvements in productivity crop water requirements may increase as much as 70 to 110% by 2050. The rise in food prices thus exhibits that there is a need to focus greater attention on agricultural productivity. A renewed emphasis on agricultural water management is now imminent following a long period of stagnating investment in agriculture and irrigation infrastructure.

(III) Suggestions & Recommendations

- ✓ The need for a fresh perspective on water and food management is imminent in light of the concerns of rising incomes and changing diets, urbanization, and population growth in developing countries.
- ✓ Surface water management requires heavy investment including meeting technical needs and environmental concerns.
- ✓ Groundwater management must reduce excessive pumping and address inadequate recharge of the watertable.
- ✓ Though there exists simple, well-known technical and economic solutions to the problems, but institutional arrangements are complex and need support.
- ✓ To improve the productivity of available water, research on water saving irrigation methods, including micro irrigation are necessary to sustain the emerging water needs for different crops.
- ✓ There is a need to develop and innovate multiple water use models for different agro-hydrological conditions to suit various categories of small and marginal farmers to improve their livelihoods.

- ✓ Considering the shortage of water, the cost involved in water storage and conveyance to the users, it is necessary to adopt innovative methods of conjunctive use of water for agricultural production using water effectively and efficiently.
- ✓ There is a dire need to focus greater attention on agricultural productivity.
- ✓ A renewed emphasis on agricultural water management is imminent following a long period of stagnating investment in agriculture and irrigation infrastructure.
- ✓ Present and future availability of water is increasingly determined by changing precipitation patterns, temperature levels and other climate related changes. These changes must sternly be incorporated in the Five year plans.
- ✓ For poor farmers living in rural areas, must be further aided by corporates and private sectors in making huge investments into construction of water storage and their control.
- ✓ There is a need to maintain equilibrium between elements of natural ecosystem of vegetation, land or water and man's activities to ease the pressure on natural resources like land and water.
- ✓ A Proper check or control is a must on the ever-increasing population and livestock.
- ✓ Significant improvement can be expected only with people's participation and cooperation.
- ✓ Management rather than the mere use of land must be the central theme.
- ✓ Effective watershed management techniques must be devised to protect the natural resources such as soil, water and vegetation from degradation.
- ✓ Sustainable development should seek to maintain an acceptable rate of growth in per capita real incomes without depleting the national capital asset stock or the natural environmental asset stock.
- ✓ Equitable access to the benefits of development must be aimed at by players.

HUMAN RESOURCES WILL HAVE TREMENDOUS POSSIBILITIES FOR SURVIVAL AND PROGRESS THROUGH PROTECTION OF NATURAL RESOURCES: YET FUTURE LOOKS BLEAK!

“The environment is a concept of wholeness, the nature, with living and non-living components interdependent among themselves. it is aptly defined as “the sum total of all conditions and influences that affect the development and life of organisms”. This comprehensive definition stresses totality and every living organism from the lowest to the highest, including human being, has its own environment. The word ‘Nature’ in the Holy Gita resonates the idea that it does not belong to any one but every one belongs to it, like a family does not belong to anyone but everyone belongs to the family. A holistic Shloka from Isha Upanishad says-”the whole universe together with its creatures belongs to thy Lord (Nature).”

The purpose of being born in this universe is to live and of living, to live more abundantly. As with other creatures, the human being can only live fully in harmony with the principles of his own being. Some of these principles which arise from his vary nature are general to human race, while some are specific to individual. Unlike other creatures, however, human beings do not live instinctively according to the principles of his being, but exercise a wide choice as to how and where one lives-so much so that he may attempt to live in defiance of the principles of his nature and condemn himself to decadence and death. Every moment of the day he is choosing, what he will do, and in his choosing, his life may be at stake. The power of choice is at once a challenge and an opportunity.

NATURAL RESOURCES

Natural resources are often classified into renewable, flow and non-renewable resources.

Renewable Resources :

Renewable resources are those which can be used on renewal basis. These resources may be living and non living. Examples are forests, woodlands; crops, live stock, marine lives, water soil etc.,

Flow Resources :

The tides, wind, solar power can be classified as flow resources. They are renewable but they do not need regeneration.

Non Renewable Resources

Non renewable resources are those which cannot be replaced once they are used up. This includes coal, petroleum, minerals fossil-fuels etc.

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Protection of Air

The Air is a composition of gases which are as follows :

Name of Gas	Relative % by Volume
NITROGEN (N ₂)	78.09%
Oxygen (O ₂)	20.93%
Argon (A)	00.93%
Carbon (CO ₂)	00.03%
Misc.	00.02%
Total	100.00%

Air is an inexhaustible nature resource essential for the survival of all living organisms on earth. Scientific studies have indicated that a normal human being requires about 250-265 k.g. of air each day. Air is also an essential component to grow crops, plants and to support animal and marine lives. Air pollution by pumping in excessive carbon or other damaging gases endanger human, animal and plant lives. The living beings will breathe poison in air to shorten their lives on earth. According to Plant Scientist Sri Dulal CH. Paul, former Director of Botanical Survey of India, one tree is instrumental to maintain 750 lives. By destroying trees and forests recklessly, we stop supply of essential ingredients of life. More forestation will not only provide air for human life but also help in maintaining ecological balance and harmony.

Protection of Water

One of the most abundant compounds, water covers 75% of Earth's surface. The other name of water is Life. Life is believed to have originated in water as mediums for carrying out biological processes. The water of the oceans, seas, rivers, lakes swamps as well as underground water makes up the hydrosphere, a discontinuous water enclosure of the earth between the atmosphere and the solid earth's crust. Resources of river, lake and underground water are distributed unevenly through the continents. At present where rain/surface water is insufficient, ground water is used for irrigation. Over use of ground water in countries like USA., Australia, Libya, Israel have caused serious concern because of depletion of ground water resources. Population growth and rapid development of industries have increased the consumption of water as well as the pollution of water.

Water pollution is more wide-spread in under developed countries. Recently the countries have set up Pollution Board to check up water and air pollution. Water is mostly polluted by sewage, garbage and industrial toxic elements. All countries have to stop water pollution by appropriate laws and creating awareness that polluting water tantamounts to polluting life. Countries should address the issue of water conservation by disciplining use of water and conserving rain water for future use. Talents should be directed to enhance this resource for future generation and creating awareness on pollution.

Protection of Land Resources

The use of land results in changes in structure and functioning of ecosystems and their ability to interact with atmosphere and water bodies (Vitousek, et al.1997 a) Land degradation has taken place due to soil erosion, unrestricted use of chemical fertilizers etc., The degraded land has reduced capacity to

supply products of direct use such as food, seed, biomass, fibre, timber etc., Land degradation is required to be checked for following reasons:

- ◆ For producing more food, biomass and other similar goods.
- ◆ For proper biogeochemical cycles that regulate green house gas fluxes and determine earth's total energy balance.
- ◆ For preserving biodiversity.
- ◆ For maintaining sustainable growth and social structure.

In the past, forests were spread over half the world's land surface. A study by FAO in 2001 shows that land area enveloped by forests in Africa about 22%, Asia 18%, Europe 46%, North & Central America 26%, South America 51% and Oceania 23%. Forests are still being recklessly destroyed around the world for mining underground minerals which is polluting the biosphere. Reference to ecological concerns is also found in **Charka Samhita, Vimansthan, 3.2**. 'The destruction of forests is most dangerous for the nation and human beings. Vanaspati has a direct relation with the well-being of society. Due to the pollution of the natural environment and the destruction of forests, many diseases crop up to ruin the nation'.

CASES PROVOKING THOUGHTS

- ❖ The limestone industry in the Doon valley has caused severe damage to the environment – loss of topsoil, lowering of the water table, deposition of dust on plant surfaces, emission of gases from the kilns. Processing of limestone in the kilns leads to the emission of CO_2 , CO and SO_2 gases. Plants show defoliation, chlorosis, necrosis, etc. The entire area of this valley which was part of scenic beauty once upon a time has turned into place of deadly polluted zone.
- ❖ The border of Andhra Pradesh and Karnataka in Bellary belt has been ceased by unscrupulous mining endangering lives of people there, land and forest resources and terribly disturbing ecological balance of the area.
- ❖ Seven hundred tribal families in Orissa were dislodged by leasing forest area to a Korean multinational for mining iron ore. Mining in forest will destroy several hundred acres of forest land. It will not only destroy precious forest resources and lives of several hundred people directly, it will have a deleterious impact on the ecological balance which we now prefer to ignore in this commercial world!
- ❖ The Bhopal gas tragedy took lives of several thousand people of the then generation and several thousand lives of future generation who born after the incident. It was a classic case of air pollution in the world.

SUGGESTIONS

- 1) The steadily growing impact of anthropogenic activity on the environment calls for the consciously directed restructuring of the existing ecological system starting from local to global platform. It is only by way of such a deliberate pre calculated change that we can with a fair degree of certainty, avoid adverse effects on the natural environment.
- 2) Till today only economic value of natural resources is given priority for its decision to use. According to R. Costanza (The Value of the world's ecosystem services and Natural Capital: Nature : 1997)

environmental managers today has to realize that all values and ecosystem services must be considered for environment management so that the future generations may have access to natural resources.

- 3) Environment has to be maintained as health friendly for all creations of nature, else the future of nature will bring more disaster than we are witnessing now.
- 4) Finally, to realize the objectives of conservation, it is necessary to involve every section of our society. Sustainable development has to percolate into our lifestyle. Minimizing pollution, avoiding wastage, and conserving non-renewable resources must become both personal and public goals. Getting this message across to the people requires mobilization of public opinion. It has to be reflected in our education to create consciousness in the coming generations.

END NOTE :

Nature is the Gift of God;

Let us Preserve it.

Natural Resources are the Wealth of God;

Let Us Protect it.

Let us be part of our nature;

And not be apart from nature.

We have stretched the bio-capacity of Mother Earth to breaking point by our insatiable lifestyle/demands. The need of the hour is to realise that in making sure that other species survive we will be ensuring the survival of our own. Whether we have obligations for future generations will depend on what we do for the present.

It must govern our thoughts and regulate our lives. Kindly remember them always and then we cannot go wrong. This is not a sentimental ending, but I really feel that we must make up our minds to protect the natural resources-which will have its beneficial effect upon our lives, and upon our nature. If we fail to do so, we will be deprived of sustainability of all boon of natural wealth, bestowed by our Nature itself.

IMPACT OF MISUSE OF NATURAL RESOURCES

INTRODUCTION

Natural resources are those resources that are available in the nature for human needs that are important for survival. It refers to the untamed natural essence of the environment. Natural resources viz., sun, wind, soil, fossil fuels, wood, forest, flora and fauna are the basic requirements for the development of an economy. Land, forests and water provide livelihood to millions, help in raising food crops and other natural food items, export of minerals helps to earn foreign exchange to the country, forests help to prevent soil erosion, the natural surroundings add more beauty to our environment and developing countries depend a lot on its natural resources for their economic development.

These resources are available in limited quantity and hence the preservation of natural resources is of paramount importance not just for the sake of the production of commodities, but more so for maintaining ecological balance and for environmental reasons. Due to its geographical location, India is bestowed with rich natural resources arraying from dense stretches forestry to a number of water bodies. Today, due to the huge increase in population these resources are depleting and will eventually run out if not utilized efficiently because these resources cannot be reproduced by humans.

EFFECTS OF GLOBAL WARMING ON NATURAL RESOURCES

Global warming raises the sea level and India faces terrific problems as earth's temperature keeps on increasing. Not even a single Himalayan glaciers will be there if the situation continues, which will lead to great flood all over north India and it will also increase the temperature in summer. The nature of the soil changes due to the acid rain. Many rivers had contaminated water due to industrial effluents. It will endanger the underwater life. The current problems of global warming and the reduction of Earth's natural resources such as fossil fuels, fresh water and topsoil are the most difficult challenges humankind has ever faced.

Combustion of fossil fuels not only gives out carbon dioxide into the air, it also releases many other harmful acidic substances like sulfuric acid and carbonic acid and causes air pollution. When in air, these gases undergo some chemical changes and return to the surface of the earth in the form of acid rain which has a huge impact on the entire environment. It affects soil and plant life and causes water pollution. Moreover, large areas of land surfaces are dug up for the purpose of extraction of fossil fuels from their deposits under the earth. After the removal, this land becomes unusable and thus causes a permanent damage to the land and causes frequent earthquakes. Fossil fuels are transported from one place to another by tankers

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and ships. Any leakage in these tankers causes oil spills. This not only leads to water pollution but also poses a serious threat to marine lives.

MISUSE OF NATURAL RESOURCES

Misuse of resources shall be direct or indirect. Direct misuse refers to such situations where the resource is directly destroyed or overused. But, many times, some resources are indirectly put to misuse. Reason for Misuse of Natural Resources may be due to commercial interests like trading in products out of natural resources, ignorance on necessity to preserve natural resources, deliberate negligence on destruction of natural resource, entertainment / recreational / aesthetic interest, extreme population pressure, self interest of human beings over the interest to retain natural resources, international trade and commitments, misuse of legislation, loopholes of provisions of law, protracted legal process, food interest, luxuries required for man, increased industrial requirement, improvement of standard of living, GDP, per capita income and purchasing power and expectations of instantaneous returns.

DIFFERENT TYPES OF MISUSE OF NATURAL RESOURCES

Natural Resources	Types of misuse/ecological problems
I Ecological Resources	Excessive mining
	Loss of forest area (if mines are in forest)
	Displacement of population and their profession
	Loss of agricultural lands (if resource is in cultivated land)
	Dumping of ore or spent ore on surface leading to soil / water pollution
	Risks and health hazards to employees / population
	Directly contributing pollution to water / soil / air in petroleum exploration and processing industry

II Hydro ecological Resources	Excessive, unscientific and uneconomic ground water exploitation
	Exploration of underground water without any regard to its rate of re - change
	Displacement of human settlement during establishment of hydro-projects
	Loss of agricultural / forest area in standing water (in dam construction)
	Unscientific use / overuse of irrigation water leading to loss of fertility, increased pollution of land / water
III Atmospheric Resources	Loss of biodiversity
	Destructive use of atmospheric oxygen to burn carbon sources to produce CO and CO ₂ which in turn change the composition of air
	Deforestation on one side and polluting the atmosphere by CO ₂ loading on other side have led to increased CO ₂ levels in atmosphere
	Ozone coverage is slowly degenerating due to release of chlorine generating gases to atmosphere
IV Edaphic resources	Excessive pressure of population of land has led to intensive cultivation of land, without allowing the soil to have its natural organic process of recuperating biological potentiality
	Addition of chemicals on continuous basis (as fertilizers and pesticides) has destroyed ecological balance in soil
	Indiscriminate irrigation has led to salinity / availability of soil rendering them unfit for cultivation
V Forest resources	Continuous deforestation for commercial and fuel purposes
	Encroachment of forest area for agriculture, mining, industrial purposes
	Loss of forest area for irrigation dams
	Loss of biodiversity due to encouragement /discouragement of specific species of plants
VI Crop resources	Unnatural crosses between species
	Transgenic breeding leading to modification of original characters of plants to destroy natural plant types interfering in natural regeneration process
	Tissue culture aided cloning
VII Aquatic	Excessive fishing around the coast

ROLE OF INDIVIDUALS IN CONSERVATION OF NATURAL RESOURCES

Until fairly recently mankind acted as if he could go on forever exploiting the ecosystems and natural resources such as soil, water, forests and grasslands on the Earth's surface and extracting minerals and fossil fuels from underground. But, in the last few decades, it has become increasingly evident that the global ecosystem has the capacity to sustain only a limited level of utilization. Biological systems cannot go on replenishing resources if they are overused or misused. At a critical point, increasing pressure destabilizes their natural balance. Even biological resources traditionally classified as 'renewable' - such as those from our oceans, forests, grasslands and wetlands, are being degraded by overuse and may be permanently destroyed. And no natural resource is limitless. 'Non-renewable' resources will be rapidly exhausted if we continue to use them as intensively as at present. The two most damaging factors leading to the current rapid depletion of all forms of natural resources are increasing 'consumerism' on the part of the affluent sections of society, and rapid population growth. Both factors are the results of choices we make as individuals. As individuals we need to decide:

- What will we leave to our children? (Are we thinking of short-term or long-term gain?)
- Is my material gaining someone else's loss? Greed for material goods has become a way of life for a majority of people. Population growth and the resulting shortage of resources most severely affect people in the developing countries. In nations such as ours, which are both developing rapidly, and suffering from a population explosion; both factors are responsible for environmental degradation.

Conclusion

Today almost all natural resources are misused in one way or other. Such misuse may create natural imbalance. Many of resources are limited and can last only for few years. Misuse of some resources has gone to such an extent that resources have already become rare and near extinction. It is very important that every human being in our society should realize the importance of conserving natural resources and adopt necessary measures to preserve them during his daily routine. Natural resources can be viewed as endowment or a gift to human mankind. An overall prudent and sustainable use of resources both at individual and collective level shall benefit wide cross sections of the society.

Land and living space: The Challenge of Providing Decent Living Space to Urban Poor

Introduction

Man, being a social animal has learnt to live in settlements since ancient days. Urban settlements have been found in many ancient civilizations, such as the Indus valley civilization. Urbanisation has attracted the attention of multiple disciplines such as Economics, Sociology, Geography and Urban Planning. Each of these disciplines have studied various aspects of urbanization from different perspectives. Various problems arising out of increasing urbanization are well recognized by all disciplines. One of the key problems is providing shelter to the urban poor.

This paper attempts to study the issues and challenges in providing a decent living space to the urban poor. The paper is arranged as follows:

Section I provides a brief review of literature as to how different disciplines view urban settlements. Section II describes the magnitude of urbanization and the challenge of housing to urban poor. Section III provides an overview of policies currently being adopted. Section IV suggests alternative policies to the issues.

Section I

Magnitude of Urbanisation

Population living in urban areas has been steadily growing. The share of urban population in the total population has almost doubled in the past 60 years of Independent India. Latest estimates (2008) show that, 30% of the Indian population lives in urban areas. The urban population has recorded a growth rate of 2.7%, while the rural population has recorded a growth rate of 0.43% (2005-09). It has been estimated that, by 2025-29, urban population would continue to grow at the rate of 2.25%, while rural population would register a negative growth (-0.40%). This poses the key challenge – how is the economy going to provide a decent living space to all urban citizens?

‘Housing Completion’, is defined as the average number of houses added per 1000 people in a given period of time. Review of statistics of Housing Completion for India shows that, housing completion is about 7, less than the 8-10 range prescribed by the UN. Housing prices have been rising at a rate higher than that of households’ income.’

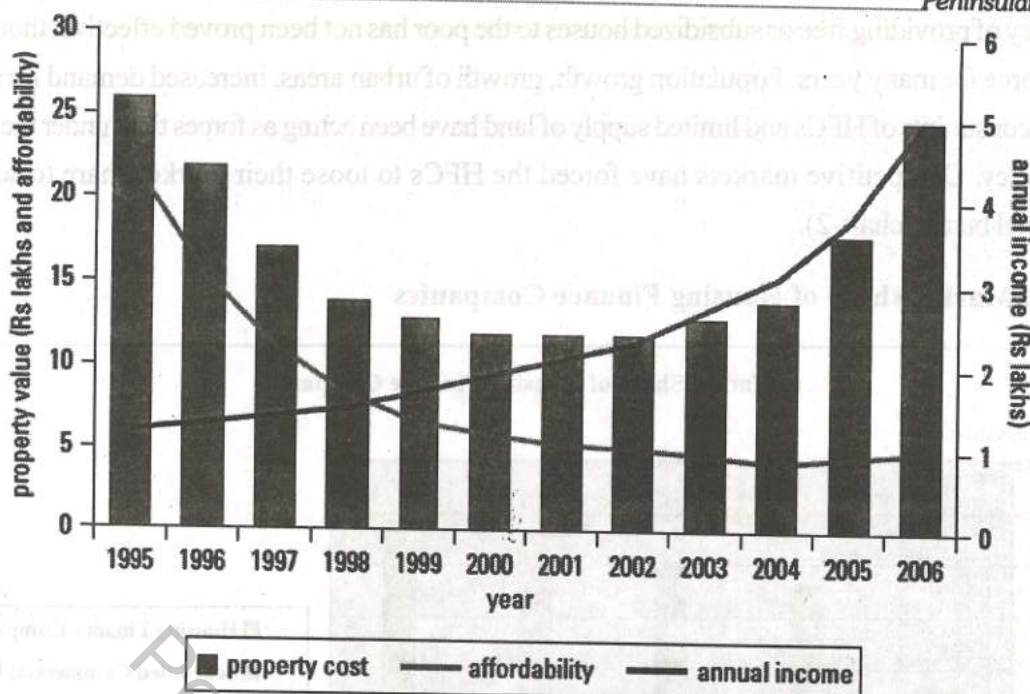
A look at the ‘Housing affordability Index’ (ratio of prices of residential property to the annual income of a borrower) shows a marked decline in housing affordability (chart-1).

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Source: The World Bank

Given this declining affordability, it is an easy guess about the housing affordability of the urban poor. According to a 2007 report of the Comptroller and Auditor General of India, as of 1997, the total housing shortage in India was estimated at 13.66 million units. Of these, 7.57 million units (55.4%) were in urban areas. Interestingly, out of these 7.57 million units, 90% of the shortage was for the poor and the low-income category.

Since the magnitude of the problem is commonly known, without deliberating too much on the statistics of urban poor, we proceed to subsequent sections.

Section II

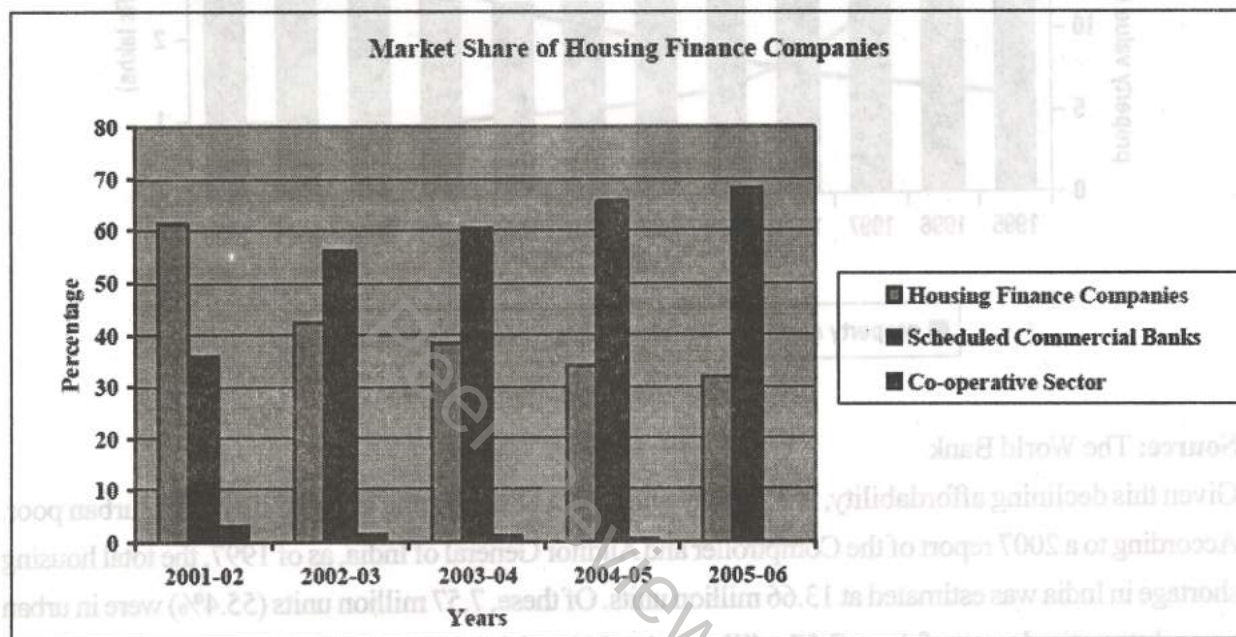
Policies adopted till now..

Throughout the world, government policies towards the housing of the poor have been from the point of view of 'ownership' and 'asset creation'. By providing housing accommodation to the poor either by free of cost or at a subsidized price, the governments have sought to create urban settlements that would ensure housing to all. One of the key assumptions of this policy is that, an own house would act as a source of security that can be used to take credit from banks. This will indirectly help the poor to raise money to further their economic opportunities.

Governments created various schemes, authorities or bodies to implement the policy of providing own housing to the poor. In case of India, many Housing Finance Companies (HFCs), under the public sector were created (eg. Housing and Urban Development Corporation – HUDCO).

This policy of providing free or subsidized houses to the poor has not been proved effective, though it has been in force for many years. Population growth, growth of urban areas, increased demand for housing, financial constraints of HFCs and limited supply of land have been acting as forces that hinder the progress of the policy. Competitive markets have forced the HFCs to loose their market share to scheduled commercial banks (chart-2).

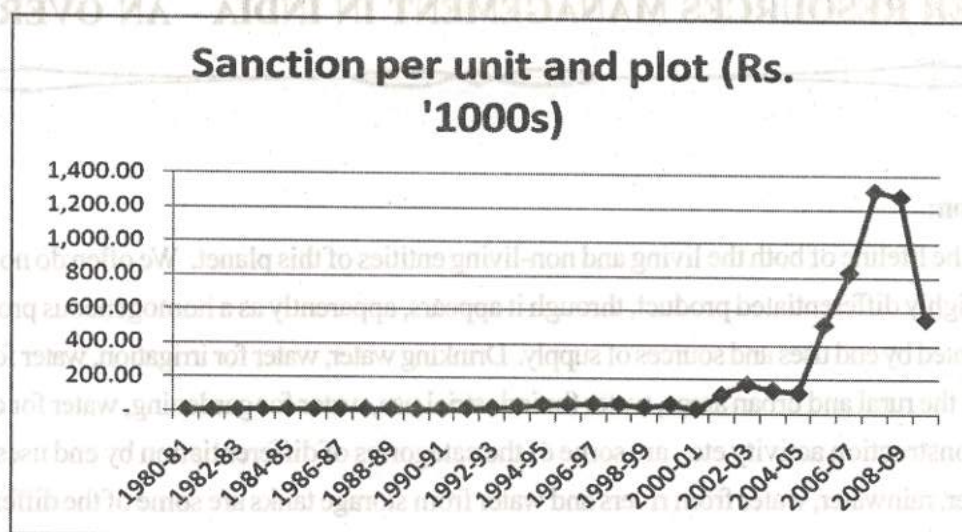
Chart-2: Market share of Housing Finance Companies



(Source: Report No. 22 of 2007, Comptroller and Auditor General of India)

The HFCs had a market share of 61.25 per cent in 2001-02 and this decreased to 31.86 per cent in 2005-06. The SCBs in turn increased their market share from 35.90 per cent to 68.14 per cent. The CAG's report attributes this changing composition of market share, to the cost of funding. Commercial banks are able to mobilize low cost deposits, whereas HFCs have to borrow at high cost and hence their lending rate is higher than that of commercial banks.

The loss of market share by HFCs to commercial banks is an indicator that the poor and low-income group, which are the target of HFCs are slowly being excluded from the housing market. This conclusion can be corroborated from the another statistics – the per unit loan sanctioned by HUDCO (Chart-3).

Chart-3: Gross loan sanctioned by HUDCO (per unit, in Rs.'1000s)

(Source: Authors' calculations based on data of yearly performance available website).

Chart-3 shows that the loan amount sanctioned per unit of house/plot has raised sharply from the range of Rs. 25,000 to Rs. 50,000 to more than Rs. 10 lakhs. This huge, sudden and sharp rise is a clear indication that, HFCs are slowly deviating from the mandate of servicing to urban poor. (The decline in 2009-10 in chart-3 may be attributed general slump in the housing market during that period). Not only in India, but also in the rest of the world, the policy of providing free or subsidized housing to the poor has not been proved effective, except that it may help in gaining political mileage. Hence, the challenge of providing a living space to the urban poor has been receiving wide attention.

Section III- Some solutions

The challenge at our hands has received various solutions from different quarters. A paper titled "Competing for Urban Land: improving the bidding power of the poor" (Mark Napier, 2008) makes an interesting reading in this context. In summary, the paper suggests that the bargaining power of the poor should be strengthened to overcome the usually higher bargaining power of property developers. This will ensure the fair share of land use by the urban poor. While it is easier theoretically, how far it can be implemented in practice depends upon various factors such as the political climate, social composition of the poor, leadership, etc.

Another solution that we would like to highlight is the much neglected rental markets. Policies adopted till now have focused exclusively on house ownership model. What is important is providing a shelter. The form in which it is provided – by ownership or by rental is a matter of subordinate concern.

However, the question is as to how rental markets can be used to solve the issue? There are two possible models:

In the first model, the state can take up the role of constructing houses and letting them out to the poor. This might put up too much burden on state finances and administrative machinery. It may also lead to situations like 'rent waivers' similar to 'loan waivers' in banks. It may also give a large room for corruption.

In the second model, the state can act as a facilitator. We can combine the South African experience of 'bargaining power of the poor' and create a power group among them. It may also be a politically motivating one. The power group of the poor, the state and its various arms, voluntary organisations and real estate developers may come forward and ensure to provide low-budget housing on rent to the poor.

How this modality needs to be designed is a matter of further deliberations. The choice of location of such housings, the spatial distributions, the social composition, the method of allotment, etc. requires detailed study. This exercise should be a joint effort of all disciplines – Economics, Sociology, Geography, Urban Planning, Political Science and other relevant fields.

WATER RESOURCES MANAGEMENT IN INDIA – AN OVERVIEW

Introduction:

Water is the lifeline of both the living and non-living entities of this planet. We often do not realize that water is a highly differentiated product, through it appears, apparently as a homogeneous product. Water is differentiated by end uses and sources of supply. Drinking water, water for irrigation, water for household purposes in the rural and urban areas, water for industrial use, water for gardening, water for car washing, water for construction activity etc., are some of the categories of differentiation by end uses. Similarly, groundwater, rainwater, water from rivers and water from storage tanks are some of the different types of sources of supply. Water is a vital resource for human survival and economic development. As population and economies grow, water demand increases while the availability of the resource remains constant. Better use and quality of water resource might also be obtained through reduction of water system losses, optimal water pricing or marketing policies, privatization, decentralization, effluent discharge regulation, water quality monitoring and enforcement, soil and water conservation programmes and water and soil conservation measures.

In view of the existing status of water resources and increasing demands of water for meeting the requirements of the rapidly growing population of the country as well as the problems that are likely to arise in future, a holistic, well-planned long term strategy is needed for sustainable water resources management in India. The water resources management practices may be based on increasing the water supply and managing the water demand under the stressed water availability conditions. Also knowledge sharing people's participation mass communication and capacity building are essential for effective water resources management. This paper deals with the objectives of water resources management, projections for future water requirements, highly alarming facts in the world, water resources management system in India, initiatives of the government of India, it concludes with suggestion.

Objectives of Water Resources Management in India:

1. To support action for sustainable and integrated development and management of water resources at national, regional and local levels in India.
2. To highlight the critical role of water for future survival of human beings and draw attention to its increasing scarcity and resulting implications for policies programmes and projects.

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3. To propagate the role of water as an economic and social good as a basic human right and support policies and programmes necessary for an economically efficient, socially acceptable and environmentally sustainable use of water resources.
4. To render assistance in promoting role of women, youth and children in water resources.
5. To generate an environment for formation of water partnerships at sub national levels and national levels.

In order to achieve these objectives government must take initiative to conserve water resources. Water conservation implies improving the availability of water through augmentation by means of storage of water in surface reservoirs, tanks, soil and ground water zone. It emphasizes the need to modify the space and time availability of water to meet the demands. This concept also highlights the need for judicious use of water. There is a great potential for better conservation and management of water resources in its various uses. On the demand side, a variety of economic, administrative and community based measures can help conserve water. Also, it is necessary to control the growth of population since large population is putting massive stress on all natural resources. Sustaining well irrigation growth is a matter of concern. Droughts cannot be mitigated only through well irrigation. Surface irrigation systems make a remarkable contribution to drought proofing in India. Therefore the need of the hour is balanced development of surface water and ground water.

Water Resources Management system in India: Policies relevant to water resources management are those that guide the planning and implementation of public and private programmes and strategies for harmonizing the supply of and demand for water to meet the efficiency, equity, and sustainability objectives of society. Examples of such policies are:

- Establishing unified national objectives and priorities for water resources management, including setting guidelines for resolving the inevitable conflicts between national economic growth and self-sufficiency, regional development, equitable income distribution and social impacts, environmental quality, and sustainability of the resource base.
- Developing constructive international agreements on water management, which entails equitable sharing of benefits and costs of development/management of international river basins, and clear definition of rights and responsibilities of affected nations.
- Guiding national investments in water resources development by means of capital investment budgets and programmes, national-local cost-sharing, international or bilateral grants and/or loans, cost-sharing by provincial, local, and private agencies, and private investment.
- Adopting project formulation and evaluation criteria involving benefit-cost analysis, risk –assessment analysis, and multiple objective (including environmental impact) analysis – to be used for project and program feasibility studies and monitoring and evaluation of performance.
- Establishing a better balance between development – the creation of new projects, such as dams and irrigation systems – and management, focusing on more efficient use of existing facilities.

- Planning for involuntary resettlement from development projects, such as storage reservoirs, so as to minimize economic and social dislocation, promote development opportunities, and mitigate adverse effects in an equitable manner.
- Adopting workable approaches to deal with water conflicts that emphasize negotiation and mediation rather than confrontation.
- Formulating procedures for allocation of water and waste assimilation capacity that take account of interdependency of water uses and the role of pricing policy.
- Establishing standards on centralization versus decentralization of water planning and implementation.
- Promoting public involvement /local participation in project planning and implementation, especially for irrigation, upstream water-shed management, and rural and urban water supply and sanitation projects.
- Providing for adequate funding of project operation and maintenance, e.g. from user charges, especially for projects to be turned over to local water users for operation and maintenance.
- Planning for effective monitoring and ex-post evaluation of projects.

Conclusion:

There is an urgent need to ensure sustainable development of the water resources and its efficient management. We need to take up necessary measures for optimal utilization of the available water resources. Apart from taking up necessary measures for comprehensive and integrated development of available resources, water management strategies are required to be carefully designed so that they lead to overall development of the country benefitting each and every member of the society. We need local and distributed water resources infrastructure. All sections of the society have to join hands and contribute to addressing the challenges in the water sector – be it the centre, the states, Panchayati Raj Institutions, Urban local Bodies, industrial houses, or the civil society – so that the demand for water by different sector can be adequately met. While doing so, it is necessary to ensure that environmental issues are properly addressed. Clearly a joint management approach combining government administration with active people participation is a promising solution.

Water Resource Management through Rain Water Harvesting in Tiruchirappalli Corporation

Introduction

Rainwater is to be harvested in Tiruchirappalli corporation to conserve and augment the storage of ground water to reduce water table depletion and improve the quality of ground water. The activity of collecting rain water directly or recharging it into the ground to improve ground water storage on the aquifers is called as rain water harvesting. This may increase the level of ground water and thereby reduce the ground water depletion. With this back drop the present study makes an attempt to identify the rain water harvesting system among the people of Tiruchirappalli Corporation and the issues related to water resource management.

Need of Rainwater Harvesting

Trichy city receives an average annual rainfall of around 824m.m. and its duration is about two months. Rainfall occurs in heavy short spells of few days or even few hours and this characteristic of rainfall force is not only to conserve large quantity of rain water during these few days, but also to store. It is happening in Trichy that the areas around houses and flat complexes are proved indiscriminately and above rainwater flow over the road and floods the area making life miserable. It can be done to put all this water into the soil below with a little effort and meager expenditure. So that this precious rain water is not lost but becomes available for the use of people subsequently

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Analysis and Discussion

Table -1:

Percentage distribution of the sample respondents by depth of bore wells

Sl. No	Feet	No of respondents	Percentage
1	Nil	16	16
2	50-100	10	10
3	101-150	34	34
4	151-200	22	22
5	201-250	12	12
6	251-300	06	06
	Total	100	100

Source: Compiled from the primary data.

Table - 1 reveals that 16 per cent of the households do not have premises for bore water and they depend fully on corporation water. It is also found from the table that 34 per cent of the respondents bore wells have been sunk up to 100 feet for water and six per cent of the sample respondents bore wells sunk at 251-300 feet. This clearly indicates the depletion of the ground water which leads to water scarcity.

Table -2: Percentage distribution of the sample respondents by depth of the wells

S.No	Depth in feet	No of the sample respondents	Percentage
1	Nil	86	86
2	01-25	4	4
3	26-50	6	6
4	51-75	0	0
5	75-100	4	4
	Total	100	100

Source: Compiled from the primary data

The above table gives the depth of the wells in the households of the sample respondents. It is evident from the table that nearly 86 per cent of the households did not have wells. This is due to the fact that almost all the wells in the sample households remain empty. However, water can be found between 1-25 feet and 75-100 feet in 4 per cent of the households respectively. This is the reason for not finding wells in so many places in Trichy Corporation.

Table -3: Details for the daily water requirements of the sample respondents;

S.No	Depth in feet	No of the sample respondents	Percentage
1	200-400	18	18
2	401-600	34	34
3	601-800	11	11
4	801-1000	20	20
5	1001-1200	6	6
	Total	100	100

Source: compiled from the primary data.

Table No - 3 gives the details of the daily water requirements of the sample respondents. It is seen from the table that nearly 34 per cent of the sample households spend only 400-600 liters of water. This is for their daily use. This shows the lack of bore wells in the sample households and people use hand pipes located in every city to supplement the shortage of water.

Table -4: Details of the Awareness of Rain Water harvesting scheme

S.No	Information	No of the sample respondents	Percentage
1	T.V	12	12
2	Radio	6	6
3	News paper	4	4
4	Self	0	0
5	Government	39	78
	Total	100	100

Source: compiled from the primary data.

Table – 4 shows the details of awareness of Rain Water Harvesting. It is noticed from the table that most of the respondent came to know about the Rain Water Harvesting scheme through Government. It is also seen from the table that there are no self-interested individuals of the sample respondents to know the Rain Water Harvesting scheme.

Findings, Suggestion and Conclusion

It is inferred from the study that Bore wells and corporation water forms a major source of water in majority of the sample households. It is observed from the study that 16 per cent of the households do not have provisions for bore water and 86 per cent of the sample households do not have wells. It is also seen from the study that nearly 20 per cent of the households using very less quantity of water, and only 6 per cent households are using more water.

As far as the awareness about Rain water harvesting scheme majority of the respondents came to know the scheme through Government. The rain water harvesting structure is properly constructed only in a few households while others have done it only to satisfy the corporation authorities. Nearly 80 per cent of the sample respondents construct Rain water harvesting pit because of the compulsion of the Government. Almost all the respondents have the awareness of water scarcity and its related problems. Majority of the people are of the opinion that Rain water Harvesting is essential for them. It is observed that 80 per cent respondents believe that the ground water potential has increased after implementing the Rain water harvesting structure.

Suggestions

- Wastage of water should be minimized.
- Rain water Harvesting structures are to be implemented in every nook and corner of the country.
- Rain water Harvesting and conservation measures are to be made popular.

Conclusion

It is concluded from the study that most of the respondents of the study area have not constructed Rain water harvesting properly and they did only for the compulsion of the state Government. Hence a follow up study by the Government is essential to know the proper construction of Rain water harvesting pit in each and every household. Infact Rain water Harvesting is a good scheme water resource management. This should be reintroduced by the state Government on War-Foot basis.

No. of the sample		Information	
			S.No
0	0	Self	4
78	39	Government	2
100	100	Total	

Common Property Resources (CPRs) and the Rural Economy in India

Introduction

Common Property Resources (CPRs) form a crucial part of environmental resources. Resources accessible to and collectively owned/ held/ managed by an identifiable community and on which no individual has exclusive property rights are called Common Property Resources (NSSO, 2000). The accessibility to a resource is convention. The rural population in general and the poor in particular depend largely on Common Property Resources (CPRs) for their life sustenance.

Importance of Common Property Resources (CPRs) in India

Since time immemorial, the Common Property Resources (CPRs) have been contributing a lot to the village economics. The local communities in general and the poor in particular survive on these resources to a large extent. A unique feature of CPRs lies in its ability to maintain eco-balance by means of aviating social erosion, deforestation and situation on the one hand and providing fuel, fodder, small timber, manure, fruits and medicinal herbs on the other.

Owing to increased pressure of human and livestock populations as well, the per capita availability of CPRs is coming down slowly. Besides population pressure, there are other factors at work. Resources base of any economy be it rural or urban can no longer be taken for granted. These are neither infinite non renewable. The CPRs have been the sources of life sustenance of the poor. Due to lack of attention and care, the CPRs in rural areas become a target of encroachment by the rural elites. Strongly the Government policies at times, turned out to be counter productive by depriving poor in having access to CPRs.

Problems of Common Property Resources in India

The current literature on CPR discusses about the increasing incidence of loss of area under CPR and declining in productivity and quality maintenance. There is large number of issues involved pertaining to CPRs. Fuel wood collection from the CPRs by the poor is one such, which received scant attention from the social scientist, despite the fact that CPRs provide life sustenance to rural household in general particular rural poor. In recent years, most of the village commons were degraded owing to open access situation with a weak property rights relation, lack of local authority systems. Since the CPRs are being used collectively and freely, a situation of no caretaker prevails, which leads to exploitation, culminating in a state of degraded condition and there by places a further stress on the rural economy. As a result, the area under CPR is on the face problems. In addition, environmental degradation caused considerable

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hardships to fuel wood collectors in rural areas in this context; it is worth probing the forces at work in discerning the access to all forms of CPRs across all sections of rural population.

Currently, the CPRs are vulnerable to host of stresses owing to human intervention. Most of the industrial wastes are being dumped in CPR lands leading to inevitable light on this and help abating such menace in the future. The contribution that would be forthcoming many not is conventional by being merely a document on a village economy, but village economy in backdrop of natural resource base. More often than not, policies bring little change owing to misconceptions about CPRs.

Objectives

The main objectives are given below:

1. To Study the importance of the Common Property Resources in India
2. To review the CPRs generate to the income and employment in rural areas.
3. To outline measure to overcome the problems relating to CPR management.
4. To assess the decline the Common Property Resources in India
5. To examine the various products collection of Common Property Resources in India.
6. To understand the CPRs through the poverty alleviation in rural areas.

Income and employment generation from CPR related activities

Income from CPRs is secondary source for their life substance in the rural poor life. The poor people collect some traditional sticks to made basket and selling in the rural areas. Each basket cost of Rs. 10 to Rs. 50 charcoal is another product, which is prepared by burning the fuel wood particularly from a sources of income to rural households. Selling of fish both fresh and dry is giving some of the additional income for the dependent community. Broomstick making is a part of the CPRs activity which yield a sum of supplementary income of the rural mass particularly the rural poor. Brick making also is one of the CPR activities.

Suggestions for Policy Improvements

- There is a need for institutional mechanism to manage local common resources, the study also fund that failure of institutional mechanism is the important reasons for reduction of general and rural poor in particular.
- There is a necessary for local awareness among the people in the rural areas; it will help them to preserve the common property resources for sustainable development of future generation.

- The local people need to initiate local level management system in collaboration with leading NGOs and SHGs to improve the environment in general and common property resources in particular.
- The government should take initiatives from the village panchayat to protect and preserve the common property resources for sustainable development of vulnerable section in particular and all community in general.
- The efficient management of natural resources led to sustainable development, poverty reduction, ensuring food security and equitable access to resources.

Conclusion

The CPRs play an important role in the sustenance of local people needs. This part gave clear idea about dependence of the local people towards the commons. Privatization of CPRs in the form of land to the land less people as well as the land given to the corporate sector in Tamil Nadu in both previous and present government are the major cause for reduction of CPR in the local areas. Common Property Resources play a significant role in the life of rural poor. The income from these resources shall be a supplementary income for the rural population.

The proportion of CPR area had declined quantitative and qualitatively year by year. When compared to the past the rate of reduction of common property is in alarming proportion due to abnormal increase in population both human and livestock. Apart from the population pressures other factors such as break down of local level institutions both formal and informal of using and governing the commons, lack of clear cut demonstration between the poverty rights, marketisation, process of commercialization and privatization of the surrounding environments have also caused the degradation of common property resources.

Knowledge and awareness of the natural base is necessary to formulate any meaningful policy towards promoting the welfare of rural poor. Breakdown of village administrative setup and collapse of local level both formal and informal management system have also been the major cause for degradation of the commons. There is dearth of policy framework for conserving CPRs, as existing development policies and programmes are counter productive vis-à-vis CPRs. Institutional arrangements need to be strengthened to ensure proper maintenance of CPRs.

DEMAND AND SUPPLY OF WATER RESOURCE IN THE STATE OF TAMIL NADU: A DESCRIPTIVE ANALYSIS

SURFACE WATER RESOURCES OF TAMIL NADU

The total surface water potential of the state is 36 km³ or 24864 M cum. There are 17 major river basins in the State with 61 reservoirs and about 41,948 tanks. Of the annual water potential of 46540 million cubic metres (MCM), surface flows account for about half. Most of the surface water has already been tapped, primarily for irrigation which is the largest user. There are about 24 lakh hectares are irrigated by surface water through major, medium and minor schemes. The utilisation of surface water for irrigation is about 90 percent.

GROUND WATER RESOURCES OF TAMIL NADU

The utilisable groundwater recharge is 22,423 MCM. The current level of utilisation expressed as net ground water draft of 13.558 MCM is about 60 percent of the available recharge, while 8875 MCM (40 percent) is the balance available for use. Over the last five years, the percentage of safe blocks has declined from 35.6 per cent to 25.2 percent while the semi-critical blocks have gone up by a similar percentage. Over-exploitation has already occurred in more than a third of the blocks (35.8 percent) while eight blocks (2 percent) have turned saline. The water level data reveals that the depth of the wells ranges from an average of 0.93 metres in Pudukottai district to 43.43 metres in Erode. According to the Central Groundwater Board, there has been a general decline in groundwater level in 2003 due to the complete desaturation of shallow aquifers. There has been a considerable failure of irrigation wells in Coimbatore district.

DOMESTIC SECTOR

Although population growth has slowed down, Tamil Nadu is urbanising rapidly. Consequently, the domestic water requirements are projected to increase by more than 50 per cent from 2222 MCM in 2001 to 3460 MCM in 2050. Water quality is also becoming a serious concern due to pollution by industrial effluents, sewage, etc. and also due to naturally occurring phenomena. The Government of Tamil Nadu has indicated that water security, i.e. provision of drinking water to the people will be the highest priority of the Government.

RURAL WATER SUPPLY

The latest survey in April 2002 indicates that there are 80,421 rural habitations in the State. A habitation is smaller than a village and includes hamlets/clusters of households which have a common water source. A fully

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covered habitation means that the entire population has access to safe assured drinking water at the level of 40 litres per capita per day (lpcd). The source should be within a distance of 1.6 kilometres of the habitation for plain areas and within an elevation of 100 metres in the case of hilly areas. Partially covered habitations provide potable water but at levels less than 40 lpcd. Non-covered habitations have no potable supply accessible to the habitation. Under this classification of coverage, 28,623 habitations were fully covered, 51,294 partially covered, and 504 habitations had no reliable source. The Tamil Nadu Water Supply and Drainage Board (TWAD) has been taking up the no source and partially covered habitations to make them fully covered. Particular attention is paid to SC/ST habitations.

ENVIRONMENTAL CONCERNS

As environmental issues are complex in nature, coordinated, interdisciplinary and holistic approach is required for addressing the environmental issues. Key environmental issues that are to be addressed in the water resources project planning as well as in evaluation of the river basins include:

GROUND WATER POLLUTION

With greater utilisation of water for industrial and domestic use and also due to the increased use of agricultural chemicals, ground water quality is deteriorating rapidly in the State. Diminished water quality also means that the quantum of fresh water available for particular uses is reduced, or that the water can be used only after treatment. Problems of water quality can be due to natural causes like geological formations or due to sea water intrusion.

- 1) In the black cotton soil areas of the State, dissolved salts are high.
- 2) In the coastal areas such as backwaters, estuaries etc. salinity levels are high.
- 3) Effluents from the leather industry have contaminated the groundwater in the Palar basin.
- 4) Effluents from the textile industry have affected the groundwater in the Noyyal basin.
- 5) Seawater intrusion has taken place in some coastal areas due to over extraction of groundwater.
- 6) Excess application of fertilisers and pesticides has affected groundwater quality in certain pockets; high levels of nitrates are observed in the Western districts.
- 7) Naturally occurring fluoride is a serious problem particularly in the Western districts of the State.

STATE WATER POLICY

Tamil Nadu adopted a State Water Policy in 1994 along the lines of the National Water Policy of 1987. Subsequently the National Water Policy was revised in 2002. The Tamil Nadu Government is in the process of revising the State Policy to include various current concerns. Some of the major aspects of the

policy are the following:

- 1) Importance of water resources in the development of the State.
- 2) Need for considering socio-economic aspects of water resource projects.
- 3) Need for basin wide planning for equitable water use.
- 4) Priorities for water use in the State.
- 5) Management and development of ground water resources.
- 6) Watershed management in rainfed areas.
- 7) Increase in demand for non-agricultural uses.
- 8) Management of water quality and environmental aspects.
- 9) Need for a hydrological database for planning and management.
- 10) Stakeholder participation in management e.g. water user associations.
- 11) Need for proper pricing of water in different sectors.

Thus the policy framework for water resources management is largely in place. The apex institution in the State at the policy level is the Water Resources Control and Review Council chaired by the Chief Minister. The primary agency charged with implementation of the policy is the Water Resources Organisation. The Institute of Water Studies is the nodal agency responsible for water planning while the Irrigation Management Training Institute imparts training to farmers and officials. Domestic water supply (urban and rural) schemes are executed by the Tamil Nadu Water Supply and Drainage Board (TWAD) for the entire State except Chennai Metropolitan Area where Metrowater is the implementing agency. TWAD executes capital projects which are handed over to the concerned local bodies for operation and maintenance. Industrial water pollution is regulated by the Tamil Nadu Pollution Control Board. Management of water quality and environmental aspects of rivers and water bodies is being monitored and coordinated by the Department of Environment.

Natural Rescores: Land Management

Natural Economy

Over the centuries, local territories of natural resource utilization diversified along a stopographical continuum running from the highest highlands, where shifting 'jhum' cultivation prevailed, to the lowest low lands, where farmers grew 'boro' rice, planted in December- January, when fields dry out enough to plant, and harvested before the floods arrived in May-July. In 1800, forest still covered much of the land, roughly in proportion to altitude. Permanent agriculture expanded and contracted, in fits and starts; and expansion only gained a firm upper hand in the 19th century. Farmers facing recurring flood calamities routinely abandoned old farm sites, allowing forest to return as they colonized new land. The 1780s brought the worst floods in memory, which destroyed farm investment in the years when the Tista River shifted its course, joined the Brahmaputra, and changed its course as well. The 1790s brought floods and earthquakes that demolished the lowest farmland behind the 18th century market town of Ajmirigani, spawning endemic malaria, which stymied new colonization until 1900. (Ramprasad Sengupa)

Nature as Source and sink

In capitalist economy human population and industrial capital have the potential for reproduction. Population grows at a rate determined by the biological and the socio-economic factors. It also supplies the labour force for economic activities. Man made industrial capital gives raise to surplus which is appropriated as profit and results in accumulation, assuming that all wages are consumed and all profits are saved. Accumulated capital in the following period gives rise to profit and causes further addition to the existing capital stock. The inanimate man-made capital also grows like biotic species through reproduction scheme of surplus generation in lab our-capital mode of production. Population and man-made capital drive the present world economic system of man which would draw material and energy from earth, produce physical goods and services with values and return waste and heat to earth after appropriating the values. A constant flow exist of inputs from the planetary sources through the human economy to the planetary sink where the wastes and pollutants end up. Limits exist on the rate of flow of resources from the sources and that of wastes to the sink so as to prevent harm to people, and damage to the economy and earth's process of absorption, regeneration and regulation of the biosphere. an interactive relationship exist between nature as source and as sink. If a lake is used as a sink for deposit of nitrogen or phosphorous fertilizer from the neighboring agricultural land being carried by runoff water, its use a source for aquaculture and fishery is restricted if not eliminated by the eutrophication of the lake. (Ramprasad Sengupa)

Land Resources

The most important natural resources of India is land which is the base for agricultural production. While population grows, the land surface is fixed and only a certain proportion of it is available for cultivation. The non-expandable land resources have to accommodate the competing demands for production of food, fodder, fiber and fuel, minerals, urbanization, non-agricultural land use etc, for the increasing human and animal population.

In the past, increase in net sown area came about by converting forest area into cultivable area. There is no such scope at present or in near future. The only alternative available is to reclaim the waste land and the land suffering from salinity, alkalinity and water logging. In reclaiming available wasteland, private sector initiative and expertise should be tapped wherever necessary.

Cropping Pattern

Cropping pattern refers to the distribution of cultivated land among different crops grown in a country. Cropping pattern reveals the nature of agricultural operations, e.g. the importance of food crops vis-à-vis cash crops. Cropping pattern is influenced by a host of factors which can be broadly classified into two categories: (a) physical factors and (b) economic factors.

Among the physical factors, the important one are soil conditions, extent of rainfall and type of climate. The economic factors include relative prices of agricultural commodities, size of the farms, availability of inputs, demand conditions, system of land holding and government policy regarding exports, imports, taxes and subsidies. There are two main agricultural seasons in India: (a) Kharif under which crops are planted at the onset of the southwest monsoon in June to July and harvested in September-October, (b) rabi under which crops are planted usually between October and December and harvested between March and May. Major kharif crops are rice, jowar, bajra, maize, cotton, sugarcane, soyabean and groundnut. Major rabi crops are wheat, barley, gram linseed, rape seed and mustard. India is a large country with diverse climatic, soil and terrain conditions. A wide variety of crops are grown in different parts of the country.

Land and Water Relationship

It is important to appreciate the inextricably close relationship between land and water management. Water, which is a renewable resource, can in fact be put to good use only if the land on which it falls, and the land to which it is applied, are properly cared for. Land, which is for all purposes a non-renewable and inelastic resource, must be managed in such a manner as to be benefited rather than suffer damage as a result of its contact with water. The key to environmental quality, therefore, lies in scientific land and water management.

Development of Wastelands

Land is the most important natural resources upon which all human activity is based. Man's inexorable progress towards development has, however, considerably damaged our land resource base. Land suffers from various kinds of soil erosion, degradation and deforestation. To harness the full potential of the available land resources and prevent its further degradation, wasteland development is of great

significance. The problem of degraded land and its management its complex and multi-dimensional and its development requires a scientific, holistic and innovative approach.

Conclusion

Wastelands can be defined as “degraded lands which can be brought under vegetative cover with reasonable efforts and which are currently underutilized, and also the land which is deteriorating for lack of appropriate water & soil management or on account of natural causes.” Several agencies have estimated the extent of wastelands in India. However, these figures vary considerably- ranging between 30 million hectares and 175 million hectares, partly because of the varied definitions of wastelands.

Updation of Wasteland Atlas was initiated in 2003 to monitor changes in wastelands. NRSA carried out mapping of wastelands across the country over a period of two years during 2003-05 using one-time IRS data (of the year 2003). The result of this exercise has been brought as “Wastelands Atlas of India-2005”. As per the latest estimates arrived through this exercise, the total extent of wastelands in the country stands at 55.27 million hectares as compared to 63.58 million hectares as per Wasteland Atlas 2000.

To accelerate the pace of development of wastelands/degraded lands and to focus attention in this regard, the Government had set up the National Wastelands Development Board in 1985 under the Ministry of Environment & Forests. Later, a separate Department of Wastelands Development in the Ministry of Rural Development and Poverty Alleviation was created in 1992 and the National Wastelands Development Board was transferred to it. In April 1999, Department Wastelands Development was renamed as the Department of Land Resources to act as the nodal agency for land resource management. Consequently, all land-based development programmes and the land reforms Division were brought under this Department.

India has paid a good deal of attention to harness its water resources by way of construction of major, medium and minor irrigation projects and the development of ground water resources. Organizations have also been set up in this field, namely Central and State Irrigation departments, Central Water Commission and the Central Ground Water Board. However, very little attention has been paid to the proper management of our land and soil resources with the result that they have suffered very serious degradation. The losses which the country is bearing on account of the continuing degradation of its land resources are of staggering dimensions and constitute one of the important threats to India's economic progress.

SUPPLY SIDE CONSTRAINS NECESSITATE THE USE OF WATER VERY PRUDENT AND EFFICIENT WAY FOR THE SUSTAINABLE DEVELOPMENT OF AGRICULTURE.

Introduction:

Agricultural performance is fundamental to India's economic and social development. Agriculture contributes 15.7 per cent of GDP (at constant 2004-05 prices) in 2008-09, 52 per cent of employment and is a primary source of livelihood in rural areas which accounts for 72 per cent of India's population. In addition about 10.2 per cent of exporting earning of country is accounted by agricultural commodities.

Nothing moves in the Indian economy unless agriculture moves and to state the agriculture can not move unless water moves into agriculture. It is found that to raise productivity of agriculture and to shift from traditional to modernized and scientific system of farming viz., use of manures and fertilizers, high yielding variety seeds, insecticides and pesticides need regular and adequate supply of water for irrigation at proper time.

The monsoon rain viz., South west monsoon and North east monsoon determines water resources of the states. But the monsoon is highly erratic and fails at times.

Tamil Nadu is the second water starved state next to the state of Rajasthan, which does not have any perennial river. Further, Tamil Nadu with 7 per cent of the population of the country and 4 per cent of land area is endowed with 4.49 million hectare metre (M.H.M) of water resources only. i.e. 3 per cent of water resources in India.

The pattern of rainfall during the past 30 years shows that the average rainfall of the state is 945.7 mm with 449.7 mm in North East monsoon (October to December) and 307.3 mm in South West monsoon (June to September), in the months of January and February 50mm and from March to May 140 mm.

In Tamil Nadu, about 78 major reservoirs, 41,260 (25,600 lake depends on rainfall) 18,32,154 wells of which 2,99,892 Tube wells and 15,32,262 open wells, which irrigate about 28,63,823 hectares out of 58,15,174 hectares of crop land in 2007- 08. The total water potential of the state is 35600mcm (1260tmc) including 830 tmc by monsoon rainfall and the contribution 12000 mcm (430tmc) from the neighboring states, viz., Kerala, Karnataka and Andhra Pradesh. Storage capacity of water in reservoirs is 235tmc and by tanks 390tmc. So, it is observed that agriculture is the gamble in the monsoon. The state's endowed irrigation potential in per capita terms is only about 0.08 hectare compared all-India average of 0.17 hectares. The per capita area sown in the state is only about 0.15 hectares compared to all-India

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average of 0.26 hectares. It is understood that agricultural sector consumes about 85 percent total water available in Tamil Nadu.

High water requirement crops like rice (1200 mm), Sugarcane (2000 mm) and Banana (2000 mm) are largely grown in Tamil Nadu from canal irrigated area, tank irrigated areas and well irrigated area. The projection for irrigation water demand basically depends on irrigated area, cropping pattern, crop evapotranspiration requirements, effective rainfall, soil and water quality, irrigation use efficiency and conjunctive use of water (Roy *et. al* 2004). In the past, surface water irrigation played a significant role in increasing the net irrigated area. However from mid sixties, the proportion of surface water to net irrigated area has decreased and in the last decade alone it has decreased largely by 23%. This is largely due to incompleteness of planned irrigation projects and poor maintenance of the existing surface irrigation infrastructure.

Groundwater expansion has been growing at an exceptional rate in the recent decades. More reliable water delivery and declining extraction costs due to advances in technology and, in many instances, government subsidies for power and pump installation have encouraged private investment in tube wells. Groundwater irrigation, due to its lesser variation in its supply and higher the reliability in irrigated water supply, reduces the risk of investment in labour, seed, fertilizers, pesticides and other inputs and induces farmers to increase the irrigation intensity. Some states have experienced fast decline in groundwater level which leads to lower productivity of water and cause a decrease in irrigation intensity. Irrigation intensity is lower among southern states where the groundwater depletion problem is severe. The most severe problem facing Indian canal irrigation, however, is the rapid deterioration of systems that have already been created. Maintenance is being woefully neglected, leading to poor capacity utilization, rising incidence of water logging and salinity and lower water use efficiency (WUE). According to the report of the Working Group appointed by the Ministry of Water Resources Govt. of India about 2.46 M.ha irrigated area is facing water logging problem and another 3.06 M.ha salinity problem and 0.24 M.ha alkalinity problem in the country (Farooq Khan, (1998)). On the whole large canal based irrigation is threatening to become unsustainable physically, environmentally as well as financially (Gulati 1999). In the absence of new large-scale surface irrigation schemes, and the availability of low cost electric and diesel pumps coupled with little or no electricity charges, the groundwater has been a major driver in the irrigated area expansion. Second, yields in areas irrigated by groundwater are often substantially higher than the yield from surface water sources. FAO research indicates that yields in groundwater irrigated areas are higher by one third to one half than in areas irrigated from surface sources, and as much as 70-80% of India's agricultural output may be groundwater dependent (FAO 2005). Higher yields from groundwater-irrigated areas are in large part due to increase in the reliability of water supply. And currently the performance of tanks is poor due to inadequate operation and maintenance, disintegration of traditional irrigation institutions, heavy siltation, encroachment and declining interest among people in proper upkeep of tank structures due to large scale development of ground water sources.

In this context India has the lowest water use efficiency of 30 – 40 per cent against 55 per cent China. The poor water use efficiency is the result of lack of scientific irrigation and cropping pattern. Though various technologies are available for efficient irrigation the practice of non-scientific and traditional methods of irrigation has led to wastages of water. According to various studies in India can augment the water use efficiency by 40 to 50 per cent by implementing better use conveyance, delivery and allocation. In India many irrigational projects have yet to reach even 50 per cent of the irrigation potential. Though participatory irrigation management is accepted in principal by all the governments but in practice it is not implemented properly. The accelerated irrigation development programmes implemented by the central government have not enhanced the irrigation potential and fail to bring additional lands under irrigation. The state government efforts to improve irrigation potential by public participation through “Namakku Namme thittam” have failed to enthuse people to participate in the irrigation development programmes.

Here an attempt is made to study the impact of canal irrigation on the agro – economic practices of the farming community in Pullambadi canal of Tiruchirappalli and Ariyalur districts. For the sake of better analytical convenience, the gross area under irrigation is divided in to three regions viz., 1. The area where the canal originates 2. The area which lying in the middle of the gross irrigated area and 3. The tail – end area of irrigation. A comparative analysis of those regions with respect to their irrigation potential and its likely impact on the farming practices were investigated to prepare a blueprint for better and efficient water use management for the study area based on the findings of the study.

1. Majority of the farmers felt that poor maintenance of canal is a primary factor for the inadequacy of water available for cultivation. The canals are not properly desilted, renovated and maintained. The frequent lands slides due to monsoon adversely impair the condition of canals and affects adversely the smooth flow of water. The bushes and other vegetations is the another major deterrent in the free flow of water. Another important factor responsible for inadequate water supply is erratic monsoon. The years 2000 to 2004 are marked by heavy droughts. Water became scanty and farmers found cultivation impossible. The some years are marked by excessive rainfall and thereby leading to water logging. Another major reason for low supply of water is low level of storage in Mettur dam. Farmers felt that only the Mettur dam breached 90 feet level the State government releases water. The government G.O. states that only the Mettur storage level 90 feet the Pullambadi canal is opened for irrigation. Mettur dam crosses 90 feet hardly one month per year and so water released through this canal is very much constrained by the existing government order. It is also relevant to note that many year the Mettur dam have not crossed even the level of 90 feet. So many years the farmers were deprived of water due to poor storage the Mettur reservoir. Farmers felt that the conditions of 90 feet and above at the Mettur dam for getting water is putting them in precarious condition to plan the cropping pattern often. They received water when the season for a particular crop is over. This actually reduces water use efficiency to generate employment and income in the study area. The untimely availability of water has led to following agrarian problems.

- i. Appropriate cropping pattern suitable to the soil and the size of the farm has not been planned properly.
- ii. Low yield of the crop due to cultivation of crops at the inopportune time.
- iii. Lack of remunerative price after the harvest and inability of the farmers to sell to the TNCSC.
- iv. The quality of the yield is also drastically reduced.

2. From the survey 38.7 per cent of the farmers felt that they always experienced water shortages and hardships in cultivating their crops. They feel the critical period especially water availability during the period of (pal cattuthal) paddy cultivation. Many crops withered due to non availability of water. Another important dimension of water use is that whatever the fertilizer and nutrient they have applied to their land is not assimilated by the crops due to non availability of adequate amount of water. But the unfortunate thing is even though they undergo periodically water crisis they are not going for alternative short duration low water consuming crops. Another saddening aspect is that they are not economizing and enhance the Water Use Efficiency. The study revealed that there is absolutely no up gradation of technology for irrigating the lands. The researcher found that the farmers are not mentioning upon sprinkler or drip irrigation to optimize the use of existing water. But majority (61.3 per cent) of the farmers feel that the critical period can be managed and tide over with better planning and execution.

4. Another finding of the survey is that the bore well depth of the pump sets owned by the farmers in the study area. In the study area 107 farmers are having power driven pump sets to irrigate their lands. The sub soil water level of the study area is good and copious flow of water is available. Majority of the farmers (61) are having the pump sets with a depth of 20 – 50 feet, 23 farmers are having the pump sets with the depth of 50 – 100 feet. The study area is characterized by abundance of ground water availability. But salinity of water in some parts of the study area is a looming threat to the farmers. It also shows that out of 300 farmers only 107 farmers are having power driven pump sets and others primarily small and marginal farmers are not owing any pump sets. For them non availability of water is a grave threat. Another disgusting future of the study area is that farmers who are using power driven pump sets over a long period of time encounter to major issues viz., 1. The water table has fallen steeply and they have to dig out water from 400 to 500 feet. The above table shows that 3 farmers are forced to go for very deep wells.

6. If there is shortage of water in the Pullambadi canal, farmers seek water from the following sources.

1. Tanks

2. Bore-wells

3. Wells

4. Purchase of water

5. Rainwater.

From the study one can show that 56.8 per cent of the farmers seek water from bore wells and 20.8 per cent of the farmers avail water from rainwater source and 13.6 per cent of the farmers purchased water from farmers owning pump sets. The table further shows that bore well is the major sources of water if canal water fails.

7. The another finding of the study is that water is not reaching every plot of the holdings in all the three regions. In the Head region 11.1 per cent of the farmers in the middle region and tail end region 44.4 per cent of respondents felt that water is not reaching every plot of holdings. The growth of weeds is the primary obstacle which hampers the flow of water from reaching the every plot of holdings. The flow of water in the field channel is also hindered by desilting and encroachments by farmers. The field channels have become so narrow due to the encroachments of some farmers in the study area.

8. The water logging is the problem faced by most of the farmers in the study area. The problem is very acute during monsoon season. The water logging affects adversely the crop yield. The crops are prone to pest attacks due to inundation of crops. The study also shows the modes of draining out excess water. The most popular method used by the farmers to drain out excess water is field to field method. But this method is absolutely inefficient. This method affects badly the growth of crops and wash away the nutrients of the soil. This method is followed by the farmers due to the absence of drainage outlets in the fields. This method is highly unscientific and time consuming. It will lead to water logging and impact the crop drastically. This analysis shows that there is a dire need for creation and maintenance of drainage outlets in the fields.

NATIONAL WATER POLICY AND ITS ASSESSMENT: SOME REFLECTIONS

Introduction

Water is an elix Natural Resources are the free gift of the nature to the human beings. The utilization of natural resources are to be made in a very scare marnner otherwise in future there is a serious imbalance the eco-system and it would affects Bio- Diversity system. The average annual rainfall in the country has been estimated to be about 1170 millimeters (mm). The total of average annual rainfall, snowfall and glacier melt in terms of volume works out to about 4000 billion cubic meters (bcm). However, due to losses through evaporation and evapo-transpiration, the water availability has been assessed to be about 1869 bcm. Even this available water cannot be fully utilized due to topographical constraints and hydrological features and utilizable water has been estimated to be about 1123 bcm comprising of 690 bcm of surface water and 433 bcm of replenishable ground water.

Further, very large temporal and spatial variations are observed in rainfall and hence in the water availability. Most of the water is available during monsoon period and that too, through a few spells of intense rainfall, resulting in floods in major rivers. While the average annual rainfall of the country is about 1170 mm, the rainfall varies from 100 milimetre in the western parts of Rajasthan to over 10000 milimetre at Cherrapunji in Meghalaya.

Challenges in Water Sector

We face challenges in the water sector in the form of reducing per capita availability of water due to increasing population, deterioration in quality, overexploitation of ground water resources leading to decline in the ground water table in some cases, sub-optimal utilization of the created facilities and relatively lower efficiency of the facilities for water utilization. The per capita availability of water in 1951 was assessed to be 5177 cubic meter. Due to increase in population the per capita water availability has been reduced to about 1650 cubic meter.

On the other hand, the demand for water for various purposes is increasing due to population growth, urbanization and industrialization. Due to unplanned development, we face the problem of overexploitation of ground water resources resulting in considerable decline in ground water 5 table. About 15% of the Blocks / Talukas / Mandals in the country are presently in the category of over-exploited blocks. Another challenge relates to over-use of surface water which has resulted in irrigation drainage problem causing water logging in some areas. Pollution of river and deterioration in the quality

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of ground water are well known. A large share of pollution is caused by untreated sewage from the urban areas and effluent from the industry. Excessive use of chemicals and fertilizers and pesticides is also a major cause of pollution. We have to address all these issues and also plan for further development of water resources to meet the growing demand of drinking water, irrigation and industrial uses with due emphasis on sustainability of environment.

Water Resources Development Potential and Achievements

There has been significant all round achievements in respect of creation of irrigation potential, in providing safe drinking water to our people, particularly the people in rural and remote areas, in meeting the industrial water demands, and in addressing the environmental issues. Similarly on siderable progress has been made in respect of flood management. However, a lot more remains to be achieved.

National Water Policy

The National Water Policy (NWP) was adopted by the National Water Resources Council during its 2nd meeting held on 9th September 1987. This policy guided the formulation of policies and programmes for water resources development and its management. Thereafter, new challenges emerged in the water resources sector, which necessitated review of the National Water Policy. Accordingly, the revised National Water 6th Policy-2002 was adopted by the National Water Resources Council in its 5th meeting held on 1st April 2002.

Consultation with State Governments

To seek the views and suggestions of the State Governments in respect of review of National Water Policy-2002, the matter was included as an agenda for the meeting of National Water Board which was constituted to review the progress achieved in implementation of the National Water Policy and to report the progress to the National Water Resources Council from time to time. The Chairman of the Board is Secretary, Ministry of Water Resources with the Secretaries of Union Ministries of Agriculture, Rural Development, Urban Development, Surface Transport, Environment & Forests and Science & Technology, Chairman, Central Water Commission, Chief Secretaries of all States/Union Territories as its Members. The 13th meeting of the National Water Board was held in September 2009, which inter-alia also discussed the agenda for the review of National Water Policy-2002. The Board broadly agreed with the suggestions proposed by the Committee constituted by Ministry of Water Resources under Additional Secretary (Water Resources).

Conclusion

The Government of India had constituted a Commission on Centre-State Relations under the Chairmanship of Justice Madan Mohan Punchhi, former Chief Justice of India, with the mandate to review a comprehensive set of issues concerning Centre-State relations and to make recommendation thereon. The Commission on Centre-State relations, inter-alia, addressed the issues related to inter-State water dispute and specific recommendation in respect of water resources are as under:

- The National Water Resources Council needs to play a greater role in integrating policy and programmes on a continuous basis. This could be done by providing the Council with a core expert body with an Adviser at its helm, so that executive action on the basis of its recommendations is monitored.
- A hierarchical but coordinated set of watershed agencies need to be set up by joint action of the Centre and States and participation of local bodies with inter- State basins as the focus. The overall responsibility for coordination would be that of the Inter-State River Basin Authority set up by the Central Government under River Boards Act, 1956.
- Tribunals constituted under the Inter-State Water Disputes Act, 1956 should be multidisciplinary bodies, presided over by a Judge. It should follow a participatory and conciliatory approach. The statute should prescribe a time limit for clarificatory or supplementary orders. Appeals to the Supreme Court should be prescribed under the Statute.

IRRIGATION IN INDIA

"Irrigation is every thing in rural India". Almost five decades ago, Sir Charles Trevelyan had made this remark. It holds true even now as much as it did before. Water in rural India is more valuable than land. When water is applied to land it increases its productivity. Water renders large tracts of lands productive which otherwise would remain uncultivated and barren.

Irrigation and Farm Productivity

Irrigation holds the embryo of higher productivity. The modern advanced inputs yield more only when their use is combined with irrigation. This is confirmed by a recent study on the subject that covered 17 States (out of 25 States of the Indian Union). The national productivity on unirrigated areas of the country averaged less than 9 quintals per crop hectare. The land productivity on irrigated lands averaged about 22 quintals, i.e., irrigated areas had an average differential of over 13 quintals per crop hectare, which is, indeed, highly significant. Further, irrigation helps in raising productivity in another way also. With the spread of irrigation there is a clear evidence of a rise in the cropping intensity, i.e., raising of two or more crops during a year.¹ Irrigation also introduces stability in cultivated area, yield and output.

Irrigation and Employment

Increasing employment opportunities hold the embryo of rural development. Development of irrigation can affect employment in a number of different ways. First, introduction of facility leads to a shift in crop pattern. Assured water supply diverts crop pattern towards more remunerative crops, which raise employment opportunities, particularly because such crops are more labour intensive in nature. consequent upon irrigation, three major changes are expected in crop pattern, namely: (i) a shift from inferior – cereals and pulses to superior cereals, (ii) a shift from foodgrain to non-foodgrain crops, both short and long-duration crops, and (iii) a shift from crops of indigenous varieties to high yielding varieties both in respect of foodgrain as also non-foodgrain crops.

Second, irrigation converts rainfed farming into irrigated farming and thereby it facilitates greater use of the so-called strategic inputs like fertilisers, insecticides and pesticides which need more labour use at the farm level. An instance of Japanese agriculture clearly supports this fact. In Japan, an arable hectare gives gainful employment to about two workers compared to less than one worker in India. This is owing mainly to larger use of the strategic inputs along with modern equipment and expensive infrastructure.

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Thirdly, irrigation leads to augmentation of area through double and multiple cropping which in turn provides more opportunities of work to the agriculturists at the farm level. Irrigation is thus the most strategic approach to agricultural development playing a positive role in employment – oriented growth strategy. The fear of greater mechanisation of different farm operations like preparatory tillage, inter-culturing, threshing and the like may reduce employment to the extent it is operated. However, judiciously selected mechanisation may help to increase agricultural production and result in a direct increase in employment. This is because labour bottlenecks at critical point of time in a season may prevent the acceptance of new crop varieties or cropping patterns which would not only increase production and income, supporting employment in other sectors of the economy, but would directly increase employment in other seasons in agriculture as well.

This aspect of employment creation capacity of irrigation becomes of crucial importance when the economy is confronted with wide-spread failure of rainfall and hence drought. Since income and employment are positively and closely related to output, preventing a fall in output during drought is an important means for achieving stability of income and employment in the countryside. While irrigation has enabled no single State in the country to acquire complete immunity from drought, evidence of partial immunity is available for several States. The vital foodgrains sector is now substantially insulated against a serious rainfall failure, such as the one witnessed during 1987-88. This insulation more than anything else has provided strength and stability to the foodgrains distribution system of the public sector. For, both procured wheat and rice that constitute the backbone of this system now mainly originate from irrigated areas.

In short, irrigation provides the necessary infrastructure for bringing about a virtual transformation of the Indian rural economy.

Review of Irrigation Development

Work on large scale irrigation projects began in the second quarter of the last century. They were commercial ventures which proved very remunerative. The great famines of the last quarter of the century led to the development of protective irrigation in famine – prone areas, Minor irrigation works like wells, tanks, etc., generally belonged to the private sector. The Grow-More-Food campaign invited the attention of policy-makers for developing minor and major irrigation works. On the eve of independence, irrigation facilities were available for 28.2 million hectares of land which constituted 24 per cent of the net cultivated area in undivided India. The partition of the country resulted in a significant cut in the irrigated area.

Growth of Irrigated Area. After Independence, Five-Year Plans accorded a high priority to the development of irrigation. A greater attention began to be paid to minor irrigation following the droughts of 1965 and 1966. The total area irrigated in the country stood at 22 million hectares in 1950-51. 9.1 million hectares from major and medium irrigation projects. As a result of massive investment made in the successive Plan periods, the total irrigation potential has multiplied by more than three times ; at the beginning of the

Eighth Plan in 1990-91, it was 79.13 million hectares which forms about 45 per cent of the gross sown area in the country.¹ 33.87 million hectares through major and medium irrigation, and 45.96 million hectares from minor irrigation. Thus, as additional irrigation potential of 57 million hectares has been created during the four decades of planning; during the first four Plans additional potential was being created at the rate of one million hectares per annum; this increased to about two million hectares during the Fifth Plan, further to 2.2 million hectares during the Sixth Plan and 2.3 million hectares during the Seventh Plan. The total potential created till now is a little above 70 per cent of the ultimate feasible which is placed at about 113.00 million hectares; it is about 60 per cent in the case of major and medium schemes, and about 75 per cent in the case of minor schemes. The irrigation target in the Eighth Plan will be 17 million hectares for completion of physical works for water delivery; of this 15 million hectares would be the target for utilisation in the terminal year of the Plan. The main emphasis will be on the completion of the ongoing projects, the need for identifying a single agency responsible for delivering water from the headworks of the canal systems to the field has been underlined. More emphasis has to be laid on the construction of field channels and alternate operation systems of canals. High priority would be given to modernisation of existing systems. Efforts would also be made to revive tank irrigation and strengthen it in dryland areas. The Government has set the target of providing irrigation to 113 million hectares by 2000 A.D. i.e., we must add additional 3.3 million hectares per annum during the coming years.

Regional variations. At the State level wide disparity prevails as far as the development of individual State's potential goes. In 8 States, the development is below the all India average, while in the remaining States it is above the average. Among the States of poor development Assam, Madhya Pradesh and Tamil Nadu are at the bottom. The development can be rated as good in Haryana, Punjab and West Bengal.

GROUND WATER POLLUTION IN TAMIL NADU

Introduction:

With the growing inter- and intra-sectoral competition for water and declining fresh water resources, the utilisation of "marginal quality water" for agriculture has posed a new challenge for environmental management. In water scarce areas there are competing demands from different sectors on the limited available water resources. Though industrial use of water is very low as compared to agricultural use, the disposal of industrial effluents on land and/or on surface water bodies make water (ground and surface) resources unsuitable for other uses. Industry is a small user of water in terms of quantity, but has a significant impact on quality. Over three-fourth of fresh water draw by the domestic and industrial sector, return as domestic sewage and industrial effluents which inevitably end up in surface water bodies or in the groundwater, affecting water quality. The "marginal quality water" could potentially be used for other uses like irrigation. Hence the reuse of wastewater for irrigation using domestic sewage or treated industrial effluents has been widely advocated by experts and is practiced in many parts of the world, particularly in water scarce regions. However, the environmental impact of reuse is not well documented, at least for industrial effluents, particularly in developing countries like India where the irrigation requirements are large.

Ground Water Pollution:

With greater utilisation of water for industrial and domestic use and also due to the increased use of agricultural chemicals, ground water quality is deteriorating rapidly in the State. Diminished water quality also means that the quantum of fresh water available for particular uses is reduced, or that the water can be used only after treatment. Problems of water quality can be due to natural causes like geological formations or due to sea water intrusion².

- In the black cotton soil areas of the State, dissolved salts are high.
- In the coastal areas such as backwaters, estuaries etc. salinity levels are high.
- Effluents from the leather industry have contaminated the groundwater in the Palar basin.
- Effluents from the textile industry have affected the groundwater in the Noyyal basin.
- Seawater intrusion has taken place in some coastal areas due to over extraction of groundwater.
- Excess application of fertilisers and pesticides has affected groundwater quality in certain pockets; high levels of nitrates are observed in the Western districts.
- Naturally occurring fluoride is a serious problem particularly in the Western districts of the State.

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Ground water pollution due to various industries:

Sl.No	District	Area	Type of Industry	Intensity of Pollution
1	Kancheepuram	Kancheepuram to Irumbulicheri	Tannery and Dyeing	Moderately polluted
2	Vellore	Ranipet Pernampet Ambut	Tanneries	Highly polluted
3	Cuddalore	Nellikuppam Moongilthuraipattu Periasevalai	Distillery, Sugar mill	Slightly polluted
4	Trichy	Senthanneerpuram Thiruvallarchipatti	Distillery Tanneries	Moderately polluted highly polluted
5	Karur	Punjaipugalur	Distillery	Moderately polluted
6	Salem	Mettur	Chemicals	Slightly polluted
7	Coimbatore	Sirumugai	Viscose factory	Slightly polluted
8	Erode	Appakudai	Sugar mill	Highly polluted
9	Dharmapuri	Palacode Marikkampalli Moornampalli Belathur	Sugarmill Chemicals Chemicals Cotton mills	Moderately Polluted Highly Polluted
10	Madurai	Pettai Irumbadi Avaniapuram	Chemicals Chemicals Sewage	Not affected Not affected Slightly affected
11	Tirunelveli	Ariyanayagipuram Vikramasingapuram	Paper mill Cotton mill	Moderately Polluted

Conclusion:

To understand the environmental impacts of industrial effluent irrigation on soil and groundwater quality of the surrounding farmlands, an extensive soil and groundwater quality study has been carried out using both primary and available secondary information for all the three industrial locations. The results show that disposal of industrial effluents on land, which has limited capacity to assimilate the pollution load, has led to groundwater pollution. Continuous application of polluted groundwater for irrigation has resulted in increased salt content of soils. In some locations drinking water wells (deep bore wells) also have high concentration of salts.

The study shows that environmental impacts of industrial effluent irrigation is different for different sites, which is mainly due to the fact that different industries have different pollution potential; and different locations have different assimilative capacities to absorb the pollutants

WATER – THE PRIME SOURCE, ITS EFFICIENT UTILIZATION AND PRODUCTIVITY IN AGRICULTURE

Introduction

Water is indispensable to agriculture production. It is available to agriculture either from rainfall or from artificial irrigation. India is a tropical country having vast differences in climate, topography and vegetation from place to place. The country, receives an annual average rainfall of 1200mm which, when multiplied by the geographical area, works out to 400 million hectare meter of this water constitutes the surface run-off. Due to the nature of the terrain and distribution of rainfall, it is estimated that only 69 million hectare meter run-off can be harnessed for irrigation 175 million hectare meter water enters soil, of which 130 million hectare meter is retained in the soil and 45 million hectare meter is added to ground water every year.

Water as an Economic Good

For the improvement of water infrastructure in the developing world, subsidies are vital. The principle of full cost recovery sometimes handicaps developing nations that are striving to provide basic needs by subsidizing their basic water infrastructure. However, water is a basic human need and access to minimum quantities of safe water (20 liters per person per day) should be everyone's right. Lack of access to safe drinking water, sanitation, and irrigation is directly related to poverty and poor health. For example, in South Asia 300million people have no safe drinking water and 920 million people have no adequate sanitation (WWC, 2000). In many developing countries, the very poor actually pay a great deal for water relative to their income, but these costs are often hidden. Water is priced by all urban societies, and the poor often have no choice but to pay high prices, spending between 5-10% of their income; however, in contrast in most industrialized countries, the lower-middleclass spends 1-3% of their income on potable water and sanitation. For example, in OECD countries, households spend about 1% of their income on water; on the other hand, in Onitsha, Nigeria, the poor spend as much as 18% of their income on water.

The application of economic principles to the allocation of water is acceptable, and provides a simple tool for the development of water services in a more efficient direction. However, water should not be treated as a market-oriented commodity when it comes to domestic use for very basic needs particularly for people in extreme poverty. More discussion, analysis, study, and commitment are needed in deciding whether water is a common or an economic good.

Government policies and Water

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Knowing the importance of water, the Indian Government has adopted the National Water Policy (NWP) in September 1987. The National Water Resources Council (NWRC), Chaired by the Prime Minister, is responsible for developing plans, determining water allocation priorities. More than 200 million (20 crore) of India's poor live in rural areas without irrigation. About two-thirds of the country's cropland currently depends exclusively on rain for needed moisture¹. At the same time it should be noted that India is having biggest rivers in the world – Ganga and Brahmaputra – delivering immense quantity of water to the Bay of Bengal. This demonstrates that we lack in necessary policies to utilize available water resource.

The “National Commission for Integrated Water Resources Development (NCIWRD)” has assessed that 83% of water is used for irrigation and remaining for domestic, industrial and other purposes. The Commission has assessed the projected demand for water for the years 2010, 2025 and 2050. NCIWRD has made assessment both for low and high demand scenario. The total water requirement as assessed by NCIWRD is 973 BCM for the low demand scenario and 1180 BCM for the high demand scenario for the year 2050. While making the assessment, NCIWRD has assumed improvement in the efficiency of both surface water and ground water systems and also efficiency of water use particularly in agriculture. Therefore, it is very important to adopt modern techniques and technologies for ensuring most efficient use of water.

Conclusion

While the network of rivers and canals, effective utilization of ground water resources and various agricultural practices like drought resistance, varieties of seeds, utilization of water saving irrigation methods like sprinkler and drip irrigation and effective utilization of rainwater through measures of its harvesting and storage have been able to meet to a great extent the ever growing demand of water by agricultural sector, it has been felt that due to ignorance and lack of awareness about the technologies and methods etc. of effective utilization of water in agricultural sector, a large chunk of water meant for this sector is lost. It was felt that farmers have to participate in any programme relating to agriculture to make it broad based and meaningful. The Ministry has therefore conceptualized Farmers Participation Action Research Programme (FPARP) for implementation. The Ministry constituted an Advisory Council on Artificial Recharge of Ground Water under the Chairmanship of Minister of Water Resources for this purpose. The first meeting of the Council was held on 22nd July, 06 at Vigyan Bhawan, New Delhi and was inaugurated by Prime Minister. In his inaugural address, the Prime Minister mentioned “We have to minimize our water use – invest in science and technology to ensure that we can grow crops which use less water. In other words, find ways of valuing the crop per drop”. To implement the suggestions of Prime Minister, a Sub-Committee under the Chairmanship of Dr. M.S. Swaminathan was constituted to prepare a report on “More Crop and Income per Drop of water.”

“Water is more precious than the Petro-Chemicals”

WATER RESOURCES MANAGEMENT IN INDIA

India is one of the wettest countries in the world, with average annual rainfall of 1100 m.m. There is, however, no accurate information about India's Water resources. Narottam Shah of the Bombay-based Centre for Monitoring Indian Economy, stated: "Unbelievable as it may seem, till now we have no arrangements in this country to compile and publish on an annual basis, comprehensive data regarding various aspects of water which are important for policy analysis and programme formulation and for monitoring the efficiency of use of our scarce water resources."

Objectives

- 1) To Analysis the Government Policy on Water Resources management In India
- 2) To Analysis the Water Resources management in Eleventh five year Plan.

Source of data

This Paper used only for secondary data. This Collected from Books, Journals, Government records and Internet Source.

Ground Water resources.

Ground water and its proper use assume great significance for a country such as India which faces continuous threat of drought and famines and "the big thirst" in less than 20 years from now. Unfortunately there is no accurate survey of ground water resources in the country but, according to one guesstimate, India's ground water resources would be about 3,700 million hectare meters, or about 10 times the annual precipitation. The annual exploitable potential is put at 45 million hectare meters but only around 13 million hectare meters are being exploited at present. With the introduction of the new agricultural strategy in the early 1960's there has been increasing use of tube-wells. In 1961, only 1 per cent of net irrigated land received tube well irrigation but 1990-91 about 30 per cent of the net irrigated land got the benefit of tube well irrigation. Actually, it is the ground water irrigation and large dams and canals which is the basis of India's green revolution.

Ruthless exploitation of ground water has also serious consequences. Since ground water withdrawal is greater than recharge, the ground water table is declining rapidly. This problem is assuming serious proportions in many states especially in Maharashtra where there has been a major shift in cultivation from rain fed coarse grains to water-intensive sugarcane. Over-exploitation of groundwater can also lead to the intrusion of saline water, making the water unfit for drinking or irrigation.

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TRIBAL AREA PROGRAMMES AND FORESTS

The Indian tribals have a symbolic relationship with the forests. Their customs, religious practices, social fabric and folklore have all been shaped by forests. They depend on forests for food, medicinal herbs, material to build houses, fuel for cooking as well as for lighting and warmth and fodder for their cattle. In famines, they depend mostly on forest products for their sustenance. Even in normal times, the roots, fruits and flowers substantially supplement tribal diet.

Programmes for Tribal Development

In the tribal development the following issues are significant :

- (a) The tribal areas are predominantly agricultural.
- (b) The economic development of these areas envisages increased agricultural production. The emphasis has, therefore, to be on introduction of improved and modern agricultural technology.
- (c) A major problem of tribal agriculture is that of inadequate provision of irrigation, the most important input for increasing agricultural production. The level of irrigation is extremely low in tribal areas, being less than 1 per cent. Most of the tribal areas situated as these are in the upper reaches of the rivers and streams are left out from the areas to be benefited while planning major and medium irrigation projects.
- (d) Tribals have been associated with forests. During the off-seasons, therefore, tribals will depend upon minor forests produce. Forest resources have to be taken up. The collection and sale of minor produce of forests by the tribals will have to be organised on co-operative lines to eliminate the middle-man.
- (e) Credit and marketing facilities in the tribal areas are being adequately strengthened. composite co-operative organisations such as LAMPS are being organised to channelise credit and to streamline marketing in the tribal areas.
- (f) To free the tribals from bondage of indebtedness, protective legislation has to be vigorously introduced.
- (g) In areas where Jhum cultivation is practised, tribals have to be encouraged to take up settled cultivation. Government waste land has to be developed and allotted to landless tribals.
- (h) The economic development is being given necessary social services support by the Government. Alongwith economic schemes steps are also being taken to improve sanitary conditions, drinking water facilities, education facilities, etc., in these tribal areas.

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Sub-Plan for Tribal Development

The concept of Sub-Plan for Tribal Development was introduced in the Fifth Five-Year Plan and continued in the subsequent Sixth, Seventh and the Eighth Five – Year Plan as a part of strategy for tribal development. Accordingly, areas having 50 per cent or more of tribal concentrations were delineated and tribal sub-plans prepared in 19 States and Union Territories. These areas are grouped into 180 integrated tribal development projects as operational units. The States and Union Territories with predominant tribal population, namely Arunachal Pradesh, Meghalaya, Mizoram, Nagaland and Lakshadweep and Dadra and Nagar Haveli were not included in the tribal sub-plan approach as their State Plans are, in fact, plans for the development of the tribal communities.

The broad objectives of the tribal sub-plan are : (i) to narrow the gap between the levels of development of tribal areas and others areas, and (ii) to improve the quality of the tribal communities.

In order to achieve these objectives, elimination of all forms of exploitation of tribals particularly in land, money lending, malpractices in the exchange of agricultural and forest produce was given high priority. The tribal sub-plans envisaged total physical and financial efforts for integrated development of the tribal areas. The investments in the sub-plan area flow from the State Plan, Central outlays from Central ministries and departments, institutional finance and special Central assistance. During the Seventh Plan, a total expenditure of about Rs. 756 crores was contemplated for the tribal sub-plan. It was proposed to extend economic assistance to 3,08,100 families during the Plan period. The main objectives of the sub-plan include elimination of exploitation of tribals, infrastructure development, upgradation of environment of tribal areas and human resources development through education and training programmes.

Tribals and Finance

The tribals are faced with the problem of indebtedness and bonded labour. Tribals borrow money from money lenders who charge them exorbitant rates of interest. Coupled with extreme poverty, heavy ritual expenses and drinking habits prompt them to borrow money from easily available and accessible sources. Indebtedness thus becomes a normal and unavoidable aspect of their existence. Various State measures have been instituted to put a stop to the exploitation of the tribals by moneylenders. For instance, a number of cooperatives have been opened in various States to advance loans to the tribals at nominal interest.

Available evidence suggests that tribals prefer to take loans from private money lenders instead of co-operative societies notwithstanding the lower interest charged by the latter. The main reasons for the failure of the co-operatives have been : (i) the co-operatives generally take too long to sanction the loans and have cumbersome procedures; and (ii) the co-operatives do not give loans to landless people.

WATER RESOURCE MANAGEMENT IN INDIA

INTRODUCTION.

In India more than 10 mha out of 40 mha irrigated land has been affected by salinity and alkalinity. Water logged areas, counted as 'water-eroded lands are estimated to be about 74 mha out of India's total agricultural area of 143 mha. According to one government figure, most of 219 irrigated projects suffer from lack of drainage of land, and are thus contributing to soil and water degradation.

Not just does the issue of scarcity of water need to be addressed, but also the conservation of water also needs to take place. Without these it is impossible for the survival of the ecosystem to take place and nature would be placed at an imbalance. The sustainability of global food production increasingly depends on efficient water use. In order to protect and maintain water sources necessary for agricultural, fisheries and agro forestry matters, water saving technology and management must be applied to all these types of activities. One way by which preservation of water can take place is through the system of water resources management. At present in India there is no central legislation by which water resource management can take place, but most of the states have legislation for their metropolitan by which water resource management can take place in those areas.

Water Resource Management in India:

Water Resources management is a very important issue with regard to the conservation and the protection of water. Water demand management is meant to manage the available water resources wisely and to deliver the necessary amount for sustainable development.

Flood management:

Among all natural disasters, floods are the most frequent to be faced in India. Floods in the eastern part of India viz Orissa, West Bengal, Bihar and Andhra Pradesh in the recent past, are striking examples. According to the information published by different government agencies, the tangible and intangible losses due to floods in India are increasing at alarming rate. After the disastrous floods of 1954 a national programme of flood management was launched. The government of India has taken a number of steps for flood management. Flood management also calls for community participation farmers, professional bodies, industries and voluntary organizations have to be aware about flood management. People's participation in preparedness, flood fighting and disaster response is required. Media like radio, Tv, news papers can also play important role in flood management.

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Drought management:

The drought prone area assessed in the country is of the order of 51.12 mha. The planning and management of the effects of drought appear to have a low priority due to associated randomness and uncertainty in defining the start and end of droughts. Necessary steps may be taken at political, administrative and technical levels to encourage people participation in the drought management for optimum utilization of the available water supply to meet the demands, strengthening of R and D and capacity building in terms of emerging information technologies and issues of damages is also called upon to bring in resilience in the drought coping strategies.

Ground water management:

To protect the acquirers from over exploitation an effective ground water management policy oriented towards promotion of efficiency, equity and sustainability is required. Agricultural holdings in India are highly fragmented and the rural population density is large. The exploitation of ground water resources should be regulated so as not to exceed the recharging possibilities, as well as to ensure social equity. The detrimental environmental consequences of over exploitation of ground water need to be effectively prevented by the central and state governments. Over exploitation of ground water should be avoided especially near the coasts to prevent ingress of seawater into freshwater aquifers. Clearly a joint management approach combining government administration with active people participation is a promising solution.

Resolve the water problems:

The policies to be undertaken should be in the following lines to overcome the above mentioned problems.

- ❖ To increase the availability of both surface water and ground water.
- ❖ To formulate better water management techniques.
- ❖ To regulate water polluting activities and thereby reducing the pollutants present in the water.
- ❖ To regulate ground water withdrawals.
- ❖ To take steps to reduce the wastage and transmission loss.
- ❖ Protection of forests, soil and water resources.
- ❖ Rain water harnessing.
- ❖ To follow a suitable pricing policy and
- ❖ To make people of all groups to participate in the maintenance of water projects.

Conclusion:

The water in rivers is wasted as it flows into the oceans and is not properly harnessed. The debate on dams as a means of harnessing water continues to make this issue politically and environmentally sensitive. No clear ecologically stable and financially viable solution has emerged. Water projects can bring many positive changes to the lives of poor people and can work particularly to improve the lives of rural women, small farmers etc. Governments play and will continue to play a critical role in rural development and resource management. Governments define the legal, policy and institutional frameworks within which water resources are managed and rural economies and societies function. Finally, for a complete and sustainable solution to water problems, integrated approach involving the use of technological advancements, optimal management of existing water resources, political will, administrative support, citizen's education, people's participation, social and legal support, effective co-ordination among various agencies involved and competitive and healthy practices are needed.

Resolve the water problems:

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- ◆ To make people of all groups to participate in the maintenance of water projects.

WATER RESOURCE MANAGEMENT IN INDIA

PROBLEMS AND PROSPECTS

INTRODUCTION

The world's population is growing at an accelerated rate and putting unprecedented pressure on earth's natural resources. A major worry today is the drying up of water resources and the deterioration in the quality of water available to us.

Sources of water are fast drying up. It is estimated that one-fourth of the population today is troubled by water shortage, poor quality of water, or both and the prospects are bleak for the future. In our unlimited quantity.

India's natural water resources have since decades been subjected to different levels of ecological stress. The increasing pace of the green revolution, the population explosion, urbanization and industrialization in public sectors, have all taken their toll on the natural reserves of water.

OBJECTIVES

1. To support action for sustainable and integrated development and management of water resources at national, regional and local levels in India.
2. To highlight the critical role of water for future survival of human beings and draw attention to its increasing scarcity and resulting implications for policies programmes and projects.
3. At the central level, the GOI first systematically introduced such reforms in rural drinking water in 67 pilot districts covering 26 states in 1999 via the sector reform programme.
4. Accelerated Rural water supply programme [ARWSP] aims at achieving the drinking water needs of the rural population. The ARWSP was launched during 1972-73. It is currently being implemented through the Rajiv Gandhi National Drinking water mission. The scheme aims at coverage of all rural habitations with population of hundred and above specially the un-reached ones.

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5. An initiative has been taken by Government of India in February 2006 by launching National Rural Drinking water quality monitoring And surveillance programme which envisages institutionalization of community participation for monitoring and surveillance of drinking water.

WATER PROBLEMS

1. Problems of Distribution:

Poor distribution of water throughout the year causes problems that are quite different from those associated with general water supply. There is hardly a year that passes without a flood or drought occurring somewhere in India. And because of a strong dependence of agriculture on the monsoons, droughts, often lead to famines in the country.

2. Problems of Competing uses:

The third major problem with respect of water is its use for a range of purposes. Water is needed for many uses, and water resources must be shared well to meet these different demands. However there are some uses of water, such as navigation, recreation, and hydroelectric power generation where water is used in a way that in no way alters its quality and quantity. as soon as the use is over, this water can be used for any purpose, including water supply, agriculture, domestic and industrial use of water.

3. Water and Health;

Two of the most troubling domestic water supply issues for policy-makers are access and health. Nearly one billion people in the world are without clean drinking-water. Providing easier access to safe drinking-water significantly improves health conditions. Personal hygiene increases when water availability rises above 50 litres per day (which generally means that it must be delivered to the house or yard). An estimated 1.7 billion persons contend with inadequate sanitation facilities. The lack of sewage collection and treatment is a major source of surface and groundwater pollution.

Health officials identify five categories of disease related to water: i) water-borne diseases (typhoid, cholera, dysentery, gastroenteritis and infectious hepatitis); ii) water-washed infections of the skin and eyes (trachoma, scabies, yaws, leprosy, conjunctivitis and ulcers); iii) water-based diseases (schistosomiasis and guinea-worm); iv) diseases from water-related insect vectors such as mosquitoes and blackflies; and v) infections caused by defective sanitation (hookworm).

The World Bank's World Development Report 1992 estimates that providing access to safe water and adequate sanitation could result in two million fewer deaths from diarrhoea among young children and 200 million fewer episodes of diarrhoeal illnesses each year. Later supply, agriculture, domestic and industrial use of water

REMEDIES

Resolving Water Problems

Water requirements and water withdrawal usually exceed, or tend to exceed, the natural water resources. In addition, effluents and excessive water consumption impair water quality, restricting its future use. These measures take into consideration minimization of wastage of water, efficient use of fresh water, and adoption of reuse and recycle mechanisms to control the over-exploitation of this limited natural resource.

Measures that are relevant to Indian conditions are;

1. Development of efficient water transport and distribution systems,
2. Recharging ground water,

CONCLUSION

Whenever there is shortage of water, the first priority should be to provide drinking water for human beings and cattle. This use should have priority over any other use, irrespective of the consequences. The second priority should be given to agriculture, which is the mainstay of the Indian economy and the very life of the people of India. Any surplus water should then be allocated to industries; however industries catering directly to the needed of the common people should be given preference over those that cater to their needs somewhat indirectly. The current rate of population growth, combined with the growing strain on available water resources, India could well have the dubious distinction of having the largest number of water-deprived persons in the world in the next 25 years. This is the scenario if the available resources are not managed judiciously and with care.

GROUNDWATER POLLUTION AND CONTAMINATION IN INDIA: THE EMERGING CHALLENGE

Introduction:

Out of the total water availability in India, 89.00 per cent used for agriculture, 8.00 per cent for domestic and 3.00 per cent for industry. Per capita availability of water in our country is 5,300 cubic metre (cu.m). in 1951 which was decreased to 1,905 cu.m. in 1999 and is likely to be less than 1,500 cu.m. by 2025. Per capita, per annum, availability of water less than 1,700 cu.m. is considered as a severe constraint on socio-economic development and environmental quality.

Water Sector in India:

The water sector in the country is faced with challenges like reducing per capita availability of water due to increasing population, deterioration in quality, over-exploitation of ground water resources leading to decline in the ground water table in many areas, sub optimal utilization of the created facilities and relatively lower efficiency of the facilities for water utilization. The per capita availability of water in 1951 cubic meter. Due to increase in population, urbanization and industrialization this has come down to about 1650 cubic meter. Unplanned development and lack of proper laws to govern extraction of ground water has lead to its over exploitation and a resultant decline in ground water table in many areas. About 15% Blocks / Talukas / Mandals in the country are presently in the category of over- exploited. Another challenge relates to over- use of surface water which has resulted in irrigation drainage problem causing water logging in some areas. Pollution of rivers and deterioration in the quality of ground water are well known. A large share of pollution is caused by untreated sewage from the urban areas and effluent from the industry. Excessive use of chemicals, fertilizers and pesticides is major cause of pollution.

Objectives

The present study is to assess technical and locative efficiency of groundwater used by the farms of different groundwater exploited areas. However, the specific objectives chosen for the study are

1. Impacts of Groundwater Contamination and Pollution in India
2. To study the surface and groundwater irrigation system available in India.
3. To identify the problems encountered by the farmers in groundwater irrigation in different groundwater exploited areas and to suggest suitable measures to overcome them.

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Impacts of Groundwater Contamination and Pollution in India:

The incidence of fluoride above permissible levels of 1.5ppm occur in 14 Indian states, namely, Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal affecting a total of 67 districts, according to some estimates. Some other estimates find that 65 per cent of India's villages are exposed to fluorine risk.

High levels of salinity are reported from all these states except West Bengal and also the NCT of Delhi, and affects 73 districts and three blocks of Delhi. Iron content above permissible level of 0.3 ppm is found in 23 districts from 4 states, namely, Bihar, Rajasthan, Tripura and West Bengal and coastal Orissa and parts of Agartala valley in Tripura. High levels of arsenic above the permissible levels of 50 parts per billion (ppb) are found in the alluvial plains of Ganges covering six districts of West Bengal. Presence of heavy metals in groundwater is found in 40 districts from 13 states, viz., Andhra Pradesh, Assam, Bihar, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal, and five blocks of Delhi.

Non-point pollution caused by fertilizers and pesticides used in agriculture, often dispersed over large areas, is a great threat to fresh groundwater ecosystems. Intensive use of chemical fertilizers in farms and indiscriminate disposal of human and animal waste on land result in leaching of the residual nitrate causing high nitrate concentrations in groundwater. Nitrate concentration is above the permissible level of 45 ppm in 11 states, covering 95 districts and two blocks of Delhi. DDT, BHC, carbamate, Endosulfan, etc. are the most common pesticides used in India. But, the vulnerability of groundwater to pesticide and fertilizer pollution is governed by soil texture, pattern of fertilizer and pesticide use, their degradation products, and total organic matter in the soil.

Pollution of groundwater due to industrial effluents and municipal waste in water bodies is another major concern in many cities and industrial clusters in India. A 1995 survey undertaken by Central Pollution Control Board identified 22 sites in 16 states of India as critical for groundwater pollution, the primary cause being industrial effluents. A recent survey undertaken by Centre for Science and Environment from eight places in Gujarat, Andhra Pradesh and Haryana reported traces of heavy metals such as lead, cadmium, zinc and mercury. Shallow aquifer in Ludhiana city, the only source of its drinking water, is polluted by a stream which receives effluents from 1300 industries. Excessive withdrawal of groundwater from coastal aquifers has led to induced pollution in the form of seawater intrusion in Kachchh and Saurashtra in Gujarat, Chennai in Tamil Nadu and Calicut in Kerala. There are no estimates of the public health consequences of groundwater pollution as it involves methodological complexities and logistical problems. Nevertheless, levels of toxicity depend on the type of pollutant. Mercury is reported to cause impairment of brain functions, neurological disorders, retardation of growth in children, abortion and disruption of the endocrine system, whereas pesticides are toxic or carcinogenic. Generally, pesticides damage the liver and nervous system. Tumour formation in liver has also been reported. The presence of fluoride in water cannot be detected

without the help of water quality testing equipment. High fluoride content is often detected from such symptoms on human beings as yellowing of teeth, damaged joints and bone deformities, which occur from long years of exposure to fluoride containing water. Due to this reason, by the time the community realizes the "menace", a large section of the population is already affected. A recent survey by the International Water Management Institute (IWMI) in north Gujarat showed 42 per cent of the people covered in the sample survey (28,425) were affected; while 25.7 per cent were affected by dental fluorosis, 6.2 per cent were affected by muscular skeletal fluorosis and 10 per cent by both.

Emerging Challenges:

The available treatment systems work on the principles in physics and chemistry. Hence, their efficiency depends heavily on maintaining certain specified operating conditions. This would call upon qualified technical manpower for system operations, and regular operation and maintenance, which are mostly absent. The Gujarat Water Supply and Sewerage Board set up 28 desalination systems since 1989. All of them became dysfunctional within a very short span of time. Most of the 117 desalination plants commissioned in eight states by government agencies became non-operational due to lack of technical manpower for maintenance and improper selection of membrane.

Most of the treatment systems for drinking water have to be tried out at the community level to be cost effective and affordable. With no major revenues being accrued by government agencies from domestic water supply services, any additional investment for provision of safe water for drinking and cooking purposes would induce unprecedented financial burden. Therefore, it will be more appropriate to build and operate water treatment systems on the principle of full cost recovery. The water supplied from the system has to be affordable to all classes of the society as drinking is essential for survival. Therefore, unit cost of production should be minimized for commercial viability.

Suggestions and Conclusions:

Groundwater recharge is the best accomplished way of water resources development. Construction of check dams, minor irrigation works, etc., enhances the groundwater storage and improves the water table.

Rainwater harvesting is a measure of water recharge by adopting suitable method. The harvested water can be utilized directly or it can be recharged into ground and it will improve the quantity and quality of groundwater, reduce water table fluctuation and avoid water logging and thereby controlling the formation of cracks on walls.

Conjunctive use of surface and groundwater in major command areas is to be evolved where groundwater storage during monsoon period may be fully replenished. By practicing this method, the food production may be increased and the storage problem can be solved.

Since water is a scarce resource it is necessary that the available water should be used optimally. Therefore depending upon the water scarcity, less water intensive crops may be substituted for more water intensive crops.

Right policies are to be emanated to address the ill effects at the areas wherever usages of fertilizer, farm yard manure, machine labour and irrigation are found to be excess. The extension agencies may impart knowledge to the farmers about the consequences of over use of inputs in different areas.

Preventive and curative measures against pollution and contamination of groundwater may continue to receive low priority for years to come, and technological measures to prevent the ill effects on human health will get priority in short term. Demineralization using RO system can remove all hazardous impurities from drinking water and would be cost effective in many situations where TDS, nitrate and fluoride in groundwater are above permissible levels. The cost of demineralization is falling rapidly. Saudi Arabia meets 20 per cent of its total water needs from desalinated sea water, and Saudi technologists believe desalination costs would fall so rapidly over the coming decades that desalination will be cheaper than pumping coastal aquifers. Low cost treatment methods are available for removal of arsenic from groundwater.

There are, however, challenges that water utilities would face such as building technical and managerial skills to design, install, operate and manage water treatment systems, making people pay for treated water and building knowledge and awareness among communities about groundwater quality issues and treatment measures. For the long run, policies need to be focused on building scientific capabilities of line agencies concerned with WQM, water supplies, and pollution control; and restructuring them to perform WQM and enforcement of pollution control norms effectively and to enable them implement environmental management projects.

IMPACT OF CLIMATE CHANGE IN WATER RESOURCES

Introduction

India will face shrinking water supplies, others will face rising seas. Average global sea levels are projected to rise at a rate of 2 to 3 mm per year over the coming 100 years. Low end scenarios estimate sea levels in Asia will be, at a minimum, 40 cm higher by the end of the 21st century. The IPCC calculates that this would expose from 13 million to 94 million people to flooding, with about 60 percent of this total in South Asia.

Because of their high population density, susceptibility to coastal flooding and saltwater intrusion from sea level rise, and exposure to storm surges, the IPCC has specifically designated several of India's low-lying coastal river deltas—the Ganges (shared with Bangladesh), the Godavari, the Krishna, and the Mahanadi—as particular “hotspots” of climate change vulnerability.

IPCC Projection

The IPCC Report -2007 states that “the gross per capita water availability in India will decline from about 1820 m³ per year in 2001 to as low as about 1140 m³ per year in 2050. India will reach a state of water stress before 2025 when the availability falls below 1000 m³ per capita. The report also mentions that “the per capita availability of fresh water in India is expected to drop from around 1900 m³ currently to 1000 m³ by 2025 in response to the combined effects of population growth and climate change. The report has also predicted more intense rain, more frequent flash floods, increase in drought-affected areas and extreme precipitation events in other areas. Water volumes stored in glaciers and snow cover are very likely to decline, reducing summer and autumn flows in the Himalayan river systems in the long run. At lower latitudes, especially the seasonally dry tropics, crop yield potential is likely to decrease for even small global temperature increases.

National Action Plan on Climate Change

The National Action Plan on Climate Change (NAPCC) has laid down the principles and has identified the approach to be adopted to meet the challenges of impact of climate change. A National Water Mission finds place among the eight missions identified. Its objective is to ensure integrated water

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resources management helping to conserve water, minimize wastage and ensure more equitable distribution both across and within states. The Mission will take into account the provisions of National Water Policy and develop a framework to optimize water uses by increasing water use efficiency by 20% through regulatory mechanism and differential entitlements and pricing. It will seek to ensure that considerable share of water needs of urban areas are met through recycling of waste water, and ensuring that the water requirements of coastal cities with inadequate alternative sources of water are met through adoption of new and appropriate technologies such as low temperature desalination technologies that allow for the use of ocean water. The National Water Policy would be revisited in consultation with states to ensure basin level management strategies to deal with variability in rainfall and river flows due to climate change.

CONCLUSION

The studies done on the impact of climate change on various aspects of water availability in India are as yet very few and far between. As knowledge is a prerequisite for managing adaptive strategies, we need to bridge our knowledge gaps in all areas that are relevant to better planning. These would include having better observational data and data access, work on detection and attribution of present day hydrological changes, higher resolution climate models, with better land-surface properties and interactions, analysis of demand and supply of water on a monthly basis, process oriented models for studying impact of climate change on snow, ice and frozen ground, climate change impacts on water quality, impact assessment on ground water etc.

NATURAL RESOURCES MANAGEMENT OF LAND AND WATER

INTRODUCTION

Water resources in India are regarded as one of its vital assets. India receives an annual precipitation of about 4000 km³. The rainfall in India shows very high spatial and temporal variability and importance of the situation is that Mousinram near cherrapunjee receives the highest rainfall in the world, also suffers from a shortage of water during the non-rainy season, almost every year. The total average annual flow per year for the Indian rivers is estimated as 1953 km³. The total annual replenishable groundwater resources are assessed as 432 km³. The annual utilizable surface water and groundwater resources of India are estimated as 690 km³ and 396 km³ per year, respectively. With rapid growing population and improving living standards the pressure on the water resources is increasing and per capita availability of water resources is reducing day by day. The quality of surface and groundwater resources is also deteriorating because of increasing pollutant loads from point and non-point sources. The climate change is expected to affect precipitation and water availability. Since India is a monsoon land, the majority of rainfall is restricted to a brief period of three to four months. As such, a large part of the country is scarce in surface water supply for a larger part of the year. Even regions like megalaya and Konkan receiving heavy rainfall, suffer from water insufficiency during dry months. Ground water resources in India are profuse only in the northern and coastal plains. In other parts of the land, supply is exceedingly inadequate. In reality, in specific places ground water is obtained from a depth of more than 15 metres. So far as safe drinking water resources in India are concerned, it has not yet been possible to supply it to every village. In many parts, people have to trudge for more than a kilometre to fetch water. Therefore, in most parts of the country, availability of water for agricultural and other purposes is insufficient and unbalanced. It is thus urgently needed to chalk out the use of accessible water. Taking into account the average yearly rainfall of 50 cm for the whole country and its totality area, it has been discovered that total water resources in India are of the order of 167 million hectare-metres. It has further been calculated that only 66 million hectare-metres of water resources in India can be employed for irrigation. Keeping in mind the confines of financial and technological resources, it has been chalked that water will be used in a synchronised manner, totally by 2010 A.D. Although India occupies only 3.29 million km² geographical areas, which forms 2.4 percent of the world's land area, it supports over 15 percent of the world's population. Thus, India supports about 1/6th of world population, 1/50th of world's land and 1/25th of world's water resources. India also has a livestock population of 500 million, which is about 20 percent of the world's total livestock population.

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More than half of these are cattle, forming the backbone of Indian agriculture. The total utilizable water resources of the country are assessed as 1086 km³. Before the start of the planning era, i.e. in 1951, only 9.7 million hectare-metres of water resources in India was used for irrigational purposes. By 1973, as much as 18.4 million hectare-meter of water was being used for irrigation. If the land area is adopted as a unit, the position could be put forward in a little different manner. In 1951 only 22.6 million hectares of land was under irrigation. By 1984-85, land under irrigation nearly increased threefold to 67.5 million hectares. By 1990 another 13 million hectares were brought under irrigation, carrying the total to 81 million hectares. This may be judged against the whole potentiality of 113 million hectares by 2010 A.D. This is the gross sown area and not the net sown area, because the former is bound to be bigger than the latter. At present around 28 percent of the net sown area is under irrigational use, i.e. 45 million hectares, although the gross irrigated area is approximately 80 million hectares. However, not more than 50 percent of the net sown area will eventually be brought under irrigation. This approximated potential embraces even ground water resources that are replenished every year by customary rainfall. These exploitable ground water resources in India are reckoned to be roughly 40 million hectare-metres. From this, only 1/4th i.e. 10 million hectare-metres are being employed at present. The remaining 30 million hectare-metres are in the pipeline for utilisation. This is an overview of the country's potency and developed water resources in India. The water resources in India are prime natural resource, a basic human need and a precious national asset. Best possible development and efficient utilisation of water resources in India, therefore, assumes great significance. The Ministry of Water Resources lays down policies and programmes for development and regulation of the water resources in India. It includes sectoral planning, coordination, policy guidelines, technical examination and techno-economic appraisal of projects, providing Central assistance to specific projects, facilitation of external assistance and assistance in the resolution of inter-state water disputes, policy formulation, planning and guidance in respect of minor irrigation, command area development and development of ground water resources in India and others.

PLANNING THE USES OF LAND AND WATER

The relationship between water rights regimes and land use planning regimes raises a number of important questions. Key among these are the jurisdictional scope of the regimes and the question of priority. While plans and important water resources management decisions are typically made at the basin level, land use planning and decision making take place at both regional and local levels, within administrative boundaries. Such boundaries often do not accord with the boundaries of river basins or sub-basins. And, in practice the distinction between water resources planning and land use planning breaks down. All uses of land have water resources implications and vice versa. Because water is a basic human need, any land development for agricultural, residential, industrial, commercial or recreational purposes involves a diversion of water of suitable quality. Changes in the water regime - for example the construction of an impoundment

for water supply, flood control and recreational purposes - have profound implications for land use in areas within the impoundment's zone of influence. Another issue is how to bring groundwater into the equation. This, too, is an area that has benefited from relatively little in the way of research. A key problem is that in many countries land use planning regimes outside urban areas are weak, un-enforced or both. An alternative, more ambitious, and in many ways more holistic approach is taken by India Natural Resource Management Act of 2009. The purpose of the act is to "promote the sustainable management of physical and natural resources". It provides for the issue of resource consents on the basis of outcomes from a comprehensive multi-layered planning process. agricultural and other uses. Management of natural resources is one of the most critical aspects in the economic development of any country. However, under Indian conditions, it assumes more importance, because the limited natural resources have to be judiciously used to feed the ever-increasing population. The overall objective of NRMS is to facilitate improvement in livelihoods of rural poor through sustainable management of natural resources and will take into account the four natural resources, namely, land, water, climate and forestry. Land Resources in India envelop approximately 1.3 million sq miles and is a cape protruding into the Indian ocean in between the bay of bengal on the east and arabian sea on the west. In spite of sufficient accessibility of landed topography, population pressure in the country is excessive and that makes space for both food production and the real estate market. However, land resources in India are both essential and at shortage in present days. Land resources in India are considered as non-renewable energy reserve. Further, they are associated with a host of several other elements such as agrarian base of rural as well as urban economy, accessibility of water, and other factors. Speedy urban expansion and the rising land usages have changed because of the increasing population growth and economic development in some selected landscapes is being observed in India of late. The monitoring of land use changes is essential to understand land use over different sequential or spatial time ialisation, an increased pressure has been witnessed on land, water and other environment resources, mainly in big metropolitan cities.

In order to utilize available land resources in India effectively, the country is re-organising efforts in the areas of land resource management. Thus, there has been a growth in land resource companies as well as in other service providers across the country. India occupies a land area of around 3,287,263 sq km. There are different types of land in India, of which 54.7 percent of it is civilised land.

The several types of land resources in India include agricultural land, farmland, barren land, real estate land, commercial land and residential land. Majority of the population of Indian are engaged in agricultural and allied activities and thus agricultural land accounts for near about 54.7 percent of the total land area of the country. These are mostly situated on the outskirts of metropolitan cites. There are lands for agricultural activities in almost every state of the country. Land resources in India also include vast barren lands. They are mostly found in states like rajasthanparts of Leh and jammu as snowfall prevents

any major cultivation here. Real Estate lands are growing at an incredible rate in India. With the people becoming mobile due to transferable jobs the growth of houses and apartments has increased vastly all over India. Havelis in Rajasthan Commercial land is becoming more expensive with passing years. All the major Indian cities are busy building up colossal marts, market plazas, malls, shopping complexes as all international brands are making their presence felt in India in a major planning along with many new local retailers. Farmlands are also a type of land resources in India and are considered as restricted property of the famous and the elite people. There is a strong competition in acquiring the best of farmlands, as they can be nestled in the lap of picturesque valleys replete with streams, private piece of beach in puducherry, or private Havelis in Rajasthan. The trend of love for nature and due to less available space in city apartments, farm land is fast becoming the best option for land resources in India. Residential Land is fast becoming scarce in the mad rush to stay near work places and near to the urban city patches. Thus, land resources in India are crucial factors dealt by the Indian government and managed effectively according to the requirements.

CONCLUSION

The Land and Water Division aims at enhancing the agricultural productivity and advancing the sustainable use of land and water resources through their improved tenure, management, development and conservation. It addresses the challenges member countries face in ensuring productive and efficient use of land and water resources in order to meet present and future demands for agricultural products, while ensuring the long-term sustainability of the land and water quantity and quality. It promotes equitable access to these natural resources with a view to enhancing productivity, livelihoods and ecosystem services. It provides assistance to member nations in developing policies, programmes, best practices and tools in the fields of irrigation and drainage, soil conservation, drought mitigation, water rights, access to natural resources, and improvement of land markets. Industrialization and various other developmental processes have added to the problem by enhancing pollution and global temperature and today the very future of mother earth is at stake.

WATER RESOURCES MANAGEMENT: CHALLENGES AND INITIATIVES

INTRODUCTION

Water is not only an essential element for our survival but is also an important vehicle for economic development of the nation. Although water is a renewable resource, its reserve in nature is limited and therefore, we have to plan for its sustainable development and efficient management so that the growing demands of a rising population, expanding industries and rapid urbanization are adequately met. It is tempting to blame nature, population explosion, farmers, the poor, slum dwellers and everything expect ourselves for the way we have managed water, especially in the last 25 years. Adopting innovative practices of groundwater augmentation by rainwater harvesting and artificial recharge, promoting water use and creating awareness through people's participation would increase the sustainability of ground water resources.

Available and Utilization Resources of Water:

The average annual rainfall in the country has been estimated to be about 1170 millimeters (mm). This, along with the total snowfall and glacier melt in terms of volume works out to about 4000 billion cubic meters (bcm). However, due to losses through evaporation and evapo-transpiration, the water availability in the country has been assessed to be about 1869 bcm. Even this available water cannot be fully utilized due to topographical constraints and hydrological features and utilizable water has been estimated to be about 1123 bcm comprising of 690 bcm of surface water and 433 bcm of replenish able ground water.

Development Potential and its Realization

Development of water resources in the country has revolved largely around creation of irrigation potential, providing safe drinking water to people, meeting industrial water demands, and addressing environmental issues.

Drinking Water Supply

The access to safe drinking water sources in urban areas of India was about 90% in the year 1990 and 93% in the year 2000 and this has improved to rural India, access to safe drinking water sources has increased from about 58% in 1990 to about 73% in the year 2008. Similarly, as per the reports of the Joint Monitoring Programme of World Health Organization and UNICEF, the use of improved sanitation coverage

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in rural areas of India was 7% in the year 1990 and this increased to about 21% in 2008. The urban sanitation coverage was 49% in 1990 and increased to about 54% by the year 2008. Obviously, a lot more needs to be done in this regard, especially since we aim to achieve the Millennium Development Goal (MDG) of improved sanitation facilities in the rural areas by the year 2013.

Hydropower

India is endowed with estimated hydropower potential of more than 1,50,000 mega watts. However, only about 21% of the potential has been developed so far, and a further 10% is being developed. Among the main reasons for the slow development are difficult potentialities, rehabilitation, environment and forest related issues and interstate issues. In addition, long gestation periods and geological surprises are important issues which need to be addressed so that this eco-friendly and renewable form of energy which also has comparatively lower running and maintenance costs can be developed to its maximum potential.

Flood Management

The total flood prone area in the country has been estimated to be about 46 million hectares. However, the area provided with reasonable degree of protection through structural measures is about 19 million hectares. A network of 175 flood forecasting station is also maintained which provide reasonably accurate forecast to help in warning and advance actions to reduce the damages from incoming floods. There is need for adopting non-structural measures like flood plain zoning etc.

Initiatives for Water Resources Development

The Ministry of Water Resources has been implementing some important programmes and schemes which include Accelerated Irrigation Benefits Programme (AIBP), Command Area Development & Water Management (CAD & WM) Programme, and Flood Management Programme, Scheme for Repair, and Renovation and Restoration of Water Bodies etc. A scheme related to the artificial recharge of ground water thoroughly dug wells has been taken up.

Challenges in Water Sector

The water sector in the country is faced with challenges like reducing per capita availability of water due to increasing population, deterioration in quality, over-exploitation of ground water resources leading to decline in the ground water table in many areas, sub-optimal utilization of the created facilities and relatively lower efficiency of the facilities for water utilization. The per capita availability of water in 1951 was assessed to be 5177 cubic meter. Due to increase in population, urbanization, and industrialization this has come down to about 1650 cubic meter. About 15% of the Blocks/ Talukas/ Mandals in the country are presently in the category of over-exploited. Another challenge relates to over-use of surface water which has resulted in irrigation drainage problem causing water logging in some areas. Pollution of rivers and deterioration in the quality of groundwater are well known. A large share of pollution is caused by untreated sewage from the urban areas and effluent from the industry. Excessive use of chemicals, fertilizers, and pesticides is also cause of pollution.

The five goals identified for the National Water Mission are;

1. Comprehensive data base in public domain and assessment of impact of climate change on water resources;
2. Promotion of citizen and state action for water conservation and augmentation;
3. Focused attention to vulnerable areas including over-exploited areas;
4. Increasing water use efficiency by 20% and
5. Promotion of basin level integrated water resources management.

Improved Management

Thirteenth Finance Commission has considered this aspect and provided special water sector management grant of Rs.5000 crores for four years i.e., from 2011-12 to 2014-15, which is subject to setting up of a Regulatory Authority and achieving the normatively assessed state-specific recovery of water charges.

Optimizing utilization of created facilities

The sub-optimal utilization of the created facilities is yet another challenge. Only about 85% of the created potential has repeatedly been utilized. Some of the factors which contribute to the under utilization of created potential include

- (a) Lack of proper operation and maintenance
- (b) Incomplete distribution system
- (c) Non-completion of command area development
- (d) Changes from the initially designed cropping pattern, and
- (e) Diversion of irrigable land for other purposes. Obviously, the modern tools for system improvement in the form of software can play very important role.

Improving the efficiency of the water facilities

The present level of efficiency of the irrigation system in India is relatively low and there is considerable scope for improvement. The National Commission for Integrated Water Resources Development has assessed that irrigation efficiencies from surface water in India can be improved from the present level of 35% to 45% to about 75%. Measures such as proper operation and maintenance, extension, renovation and modernization of projects, repair, renovation and restoration of water bodies on the one hand and use of agricultural practices such as moisture conservation, micro-irrigation etc. are required to be adopted urgently. Due emphasis has to be given to measures like waste water treatment, reuse of water, rainwater harvesting and groundwater recharge, watershed development etc.

Participatory Management

The government encourages participatory irrigation management and promotes formation of Water Users' Associations (WUAs). So far about 57,000 WUAs have been formed. Draft bill for Participatory Irrigation Management (PIM) has also been circulated to States and 13 States have already enacted appropriate legislation. The matter is being pursued with other States.

CONCLUSIONS

There is an urgent need to ensure sustainable development of the water resources and its efficient management. All section of the society have to join hands and contribute to addressing the challenges in the water sector-be it the centre, the states, Panchayati Raj Institutions, Urban Local Bodies, Industrial Houses, or the Civil Society. So that the demand for water by different sectors can be adequately met. The following water management strategies and actions are recommended: there must be scientific and comprehensive assessment of water resources, monitor and evaluate water extraction, storage, and use, and enhance income per unit of water consumed. Prevent/ discourage unsustainable use of groundwater resources in critical zones, develop the resources in unexploited zones, and increase awareness of farmers and other stakeholders about the value and scarcity of water and negative fallouts of improper use. Develop and adopt water use efficient cost-effective & eco-friendly crops, cropping patterns, farming systems and technologies. Integrate rain, surface, and groundwater and promote conjunctive use of poor quality & polluted water. Institutionalize participatory management of water; rationalize water pricing and operational & maintenance charges and distribution of irrigation water and equitable access to water as a common resource.

WATER RESOURCE MANAGEMENT IN INDIA

INTRODUCTION

The growing concern with environmental issues and their impact on general public awareness is one of the most noticeable phenomena of the last twenty years or so. From the question of holes in the ozone layer to conservation of forests and bio diversity, environmental issues are being raised at various levels. Water is a unique substance. It is one of the few materials on the Earth that exists naturally as a solid, liquid or gas. It is not possible for life on earth to exist without water. Scientists estimate that there are over one billion cubic kilometers of water on this earth, which covers nearly three fourth of the earth's surface. Though this seems an inordinately huge amount, in actual fact, less than one percent is fresh and usable and is found in lakes, ponds, rivers and groundwater. Of the remaining, ninety seven percent is found in oceans and two percent is locked up in glaciers and ice-caps. From a global viewpoint fresh water is abundant and the volume of fresh water renewed by the hydrological cycle between the oceans, the atmosphere, the sun and the land is more than enough to meet the needs of five to ten times existing world population.

WATER MANAGEMENT

Water management techniques in India followed are Subsidized Micro-Irrigation, Mandatory Rainwater Harvesting, Community-Based Watershed management and promotion of water conserving practices like system of Rice Intensification. Government policy transformation would ensure that water management techniques and initiatives are executed at a national level across all the major sectors. In the Agricultural sector, adoption of techniques such as rainwater harvesting and watershed management; reduction of subsidies on power and implementation of customized pricing models to counter groundwater exploitation through excessive withdrawal are some options. Waste water re-use in agriculture should be encouraged. The Government has targeted to bring 17 million ha under Micro Irrigation by the end of the 11th Five Year Plan period.

In the Industrial Sector, investment in recycling and treatment of industrial wastewater through regulations and subsidies for water treatment plants need to be encouraged. In the Domestic Sector rain-water harvesting need to be made mandatory in all cities of the country with new construction projects.

The available surface and ground water resources are inadequate to meet all the water requirements for all purpose. So the demand for water has increased over the years. The interpretation of satellite data in conjunction with sufficient ground truth information makes it possible to identify and outline various

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ground features such as geological structures, geomorphic features and their hydraulic characters that may serve as direct or indirect indicators of the presence of ground and surface water. The geomorphological conditions are an essential pre requisite in understanding water bearing characteristics of hard rocks. Sufficiently thick weathered zone forms groundwater storage in bedrock areas but often may not provide regular supply groundwater. Water resources development and management can be broadly studied under,

- Surface water management
- Groundwater management

CONCLUSION

Unless local and national communities come together and dramatically improve the way we envision and manage water, there will be many hungry villages and degraded environments and the economic development of the country will be put at risk. Stakeholders that include farmers, industries, policy makers, administrators, non government organizations etc will need to come together to formulate an integrated road map towards water resource security in India. Some resolution in this road map may require potentially unpopular policy changes and the adoption of water saving techniques and technologies. The dialogue needed amongst stakeholders, then, is about India's economic and social priorities and the challenges that are worth tackling to deliver or achieve water security, when every child in India would have easy access to water of the right quality, in the right quantity, and at the right place.

SCARCITY AMONG PLENTY: STATUS OF RURAL DRINKING WATER SUPPLY IN THANJAVUR DISTRICT

Introduction

If we look at the present scenario, we are leading towards crisis. About 85 per cent of rural population in India, which is solely depending upon ground water is depleting at fast rate. In the urban areas though about 60 per cent of the population is depending on surface water sources, the availability and quality are questionable.

Population growth is expected to result in a decline in the per capita availability of fresh water. In 1947, this was measured at 5,150m³. By the year 2000, it was around 2,200m³. It has been recently estimated that by 2017 India will be 'water stressed' - per capita availability will decline to 1600 m³. Studies put the amount of available aggregate annual utilizable water in India, surface and ground together, at about 1,100 BCM.

The Problem

Vision of the 11th Five Year Plan is faster and *inclusive growth*. It is designed to reduce poverty and focus on bridging the various divides that continue to fragment our society. It aims to reduce disparities across regions and communities by ensuring access to basic physical infrastructure as well as health and education services to all, and to promote the rights of the common person. Regarding drinking water, it aims to provide clean drinking water for all by 2009 and ensures that there are no slip-backs.

More than sixty per cent of time is runout in the Plan period. But, the evidences from various parts of the country show that the status of drinking water supply, particularly in the case of rural areas is still inadequate and not enough to fulfill the vision and objectives of the Plan. To re-examine the status of rural water supply this study takes Thanjavur district.

Objectives of the Study

Main objectives of the study are: to analyse the various rural water supply infrastructure of the district; to analyse spatial variation in the water supply conditions in the district; to examine variation in the water supply conditions among the habitations with various proportioned of marginalized groups; to study

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how the people depend on instream water uses to provide suggestions to improve the conditions of rural water supply with the view of inclusive growth.

Sources of Data

Necessary data for the study are mainly collected from the sources like Tamilnadu Water and Drainage Board, District Collectorate of Thanjavur, Panchayat Unions and Census 2001. For an indepth analyses the habitation-wise data are collected from Thanjavur Panchayat Union. Further, the present study used existing studies for analytical and comparison purposes. Collected data are analysed with simple tools like tables and percentages.

Analysis And Discussion

This section of the paper made analysis and discussion on facts collected from the above said sources in order to reach the objectives specified.

Water Resources of the District

Thanjavur district can be divided into two distinct divisions, viz., the deltaic region, the upland area or non-deltaic region. The deltaic region covers the whole northern and eastern portions of the district where the Cauvery with its wide network of branches irrigate more than half of the district. It comprises the whole of Thanjavur District. The rest of the southern and western areas of the district are non-deltaic or upland region. A good portion of upland regions which was dry has now been brought under irrigation with the help of Grand Anaicut canal, fed by the Cauvery-Mettur Project and by extension of the Vadavar river.

Thanjavur district is water potential area. River Cauvery along with many distributaries, their canal system, number system and non-system tanks, ponds, and different types of wells supply domestic and cropping needs of the people.

Table 1: Distribution of Population of Thanjavur District by Panchayat Union: 2001

Sl.No.	Name of the Panchayat Union	No. of Habitation	Total Population
1	Thanjavur	61	1,80,668
2	Thiruvaiyaru	46	90,447
3	Budalur	49	84,852
4	Orathanadu	80	1,55,294
5	Thiruvonam	44	79,370
6	Kumbakonam	66	1,45,807
7	Thiruvidadimaruthur	56	1,22,434
8	Thiruppanandal	52	97,025
9	Papanasam	38	1,09,335
10	Ammamet	64	93,138
11	Pattukkottai	56	1,05,225
12	Madukkur	45	66,761
13	Peravurani	55	84,319
14	Sethubavasathram	72	85,881
Total		784	14,14,675

Table 2: Water Sources of Thanjavur District: 2008-09

Sl.No.	Name of the Panchayat Union	No. of Tanks in Use	No. of Wells in Use	No. of Tube Wells
1	Thanjavur	111	8,395	7,077
2	Thiruvaiyaru	38	1328	1,288
3	Budalur	-	2,374	2,374
4	Orathanadu	-	6245	6,169
5	Thiruvonam	106	1978	1,978
6	Kumbakonam	-	4637	4,637
7	Thiruvidadimaruthur	-	4250	4,250
8	Thiruppanandal	-	4690	4,690
9	Papanasam	-	2812	2,812
10	Ammamet	-	3256	3,256
11	Pattukkottai	11	2682	2,556
12	Madukkur	8	651	641
13	Peravurani	57	3044	2,202
14	Sethubavasathram	97	2409	2,136
Total		428	49,291	46,066

The district is divided into fourteen panchayat unions for the purpose of local governance and implementation of development programmes. According to 2001 Census, total population of the district is 14,14,675, which is distributed in 784 habitations of 14 panchayat unions (refer Table 1). Size of the population largely varies from 66,761 persons in Pattukkottai panchayat union to 1,80,688 for Thanjavur panchayat union. Six out of 14 panchayat unions have more than one lakh population.

A large number of tanks and wells of different types of agricultural wells serve the needs of crops, cattle and people. Table 2 presents the sources of irrigation water of the district according to panchayat

union. There are 428 tanks in various sizes, 49,291 wells and 46,066 tube wells provide sources of irrigation for the farmers. These sources also act as sources of drinking and other domestic water needs of the people, particularly living in rural areas. Only 8 out of 14 panchayat unions have tanks. But the number of tanks is high in four areas viz. Thanjavur, Thiruvonam, Sethubavasathram and Peravurani. Thanjavur panchayat union has highest number of tanks, wells and tube wells, than the other panchayat unions of the district. Madukkur panchayat union has lowest number of all such facilities.

Sources of Domestic Water Supply - Rural and Urban Divide

Tables 3 to 5 provide information of sources of drinking water supply rural and urban areas, and district as a whole. In the district, 4,79,459 household have any one or more than one source of drinking water. Twenty-eight per cent of households has drinking sources within the household premises, 7 per cent away from the premises and rests of the households have such facilities nearby premises.

In the district as a whole, 64 per cent of household access water from the taps; 26 per cent from hand pumps, and 4 per cent each from tube well and wells. Percentage of households having access within the house premises are 28 in the case taps, 37 in hand pumps, 59 in tube wells, and 14 in tanks, ponds and lakes. Rest of the households mostly access water from the nearby premises, and remaining from the far away premises.

In the case of rural areas, total number of households access water from all sources are 3,28,021. In which 62 per cent access water from taps, 30 per cent from hand pumps, 3 per cent each from tube wells and wells, and rest from the tank, ponds, lakes, rivers, canals, and spring. Only 4 per cent of total household access water from taps which are located within the house premises.

Percentage of households access water within the house premises is 8 in the case of taps, 35 in hand pumps, 43 in tube wells and 22 in wells. A large percentage of households access water from the above sources either away from household premises or nearby premises.

In the case of urban areas, 1,51,438 households access water from any one of the sources like taps, hand pumps, tube wells, wells, tanks, ponds, lakes, rivers, canals and

Table 3: Distribution of Households by Source of Drinking Water in Thanjavur District

Location	All	Within Premises	Near Premises	Away
Total No of Households	479459	132739	315637	31083
Tap	309200	66504	223732	18964
Hand pump	125464	47001	72530	5933
Tube well	19054	11350	6591	1113
Well	18549	7460	8540	2549
Tank, Pond, Lake	474	25	258	191
River, Canal	433	0	246	187
Spring	1995	0	1317	678
Any other	4290	399	2423	1468

Source: TWAD Board (same for Table 2 and 3 also).

Notes : 1. Tables exclude institutional households.

2. Near premises has been considered if the source availed is within 100 meters for urban areas and 500 meters for rural areas.

Table 4: Distribution of Households by Source of Drinking Water in Rural Thanjavur District

Location	All	Within Premises	Near Premises	Away
Total No of Households	328021	54799	251080	22142
Tap	205541	14149	178775	12617
Hand pump	96866	33626	58480	4760
Tube well	10753	4584	5342	827
Well	10132	2305	5691	2136
Tank, Pond, Lake	371	7	205	159
River, Canal	300	0	155	145
Spring	1584	0	910	674

Table 5: Distribution of Households by Source of Drinking Water in Urban Thanjavur District

Location	All	Within	Near	Away
Total No of Households	151438	77940	64557	8941
Tap	103659	52355	44957	6347
Hand pump	28598	13375	14050	1173
Tube well	8301	6766	1249	286
Well	8417	5155	2849	413
Tank, Pond, Lake	103	18	53	32
River, Canal	133	0	91	42
Spring	411	0	407	4

springs. The percentage of households access water from taps comes around 68. Thirty four percent of the total urban households access water from the taps which are available within the household premises. The percentage of households access water from hand pumps, tube wells and wells are 19, 6 and 6, respectively. Most of the households access water from these sources are available within the household premises. This 51 per cent in the cases of taps, 47 in hand pumps, 82 in tube wells, and 61 in wells.

Facts and ongoing discussions reveal that households of rural areas have many disadvantages over the households of urban areas, in the access of drinking water. They are:

- Lesser percentage of households in rural areas are having taps within the house premises;
- But, higher proportion rural households depend on hand pumps, which require more time collect water;
- Relatively, a larger proportion of rural households collect water from all sources which are located either away or nearby to household premises. On contrary, urban households access the water from the household premises itself.
- Definition of access of water from 'near premises' is also unfavourable to the rural households. This is defined as 500 meters for the case of rural households, and 100 meters for urban households.

Conclusion

The analysis shows that the Rural Thanjavur district - a water plentiful area, suffered with lack of water supply infrastructure; there are higher spatial variations in the provision of water infrastructure; and people of marginalized groups suffer mainly by these variations and they meet their water needs with many instream water uses. The paper concludes that the provision of adequate and safe rural drinking water ensures the quality of the life of people of a fast developing nation. This is fundamental for a country having a vision of inclusive growth.

ECONOMIC VALUATION OF PICHAVARAM MANGROVES IN TAMILNADU

Economic valuation of marine ecosystems

The mangroves serve humans significantly protecting them against damages caused by soil erosion and storms providing a critical habitat for many terrestrial, estuarine and marine species, serving as a source and a sink for nutrients and sediments for other inshore marine habitats including seagrass beds and coral reefs. They also support flood protection, nutrient and organic matter processing, sediment control and fisheries. The mangroves through their various ecological functions were estimated to provide goods and services worth US \$ 1.6 billion per year worldwide. Almost 80% of global catches were dependent on mangroves in one way or other. Mangroves were estimated to sequester upto 25.5 million tonnes of carbon per year and provide over 10% of essential carbon to the oceans globally.

Although studies of economic valuation have been conducted across different biomes and ecosystems in the nature, valuation studies of marine and coastal resources deserve special attention owing to the fact that the coastal ecosystems act as buffers between the land and the seas in the earth – two important components of our planet, thus regulating the global natural environment and consequent human activities. It has also been estimated that in excess of 37% of the global population (> 2.1 billion people) are living in coastal areas⁴ and the world's coastal population (within 60 miles of the coast) increased by 35 % from 1995 to 2025, causing over-exploitation of fisheries, loss of coastal habitats, deleterious effects of land-based contaminants and eutrophication. However, the long-term sustainability of these populations is dependent on coastal ecosystems and the services they provide like storm buffering, fish production and enhanced water quality.

Coastal population densities are nearly three times that of inland areas, and they are increasing exponentially, which has pushed coastal ecosystems like the coral reefs, inshore fisheries, sea grass ecosystems and the wetlands into the teeth of intense environmental change pressure resulting in their degradation and loss over the past two or three decades – for marshes, 50 % either lost or degraded; for mangroves, 35 % loss; and for reefs, 30 % destruction with extensive feedback effects between the natural systems and the human systems. These precious ecosystems now need to be viewed in spatial and temporal context on a co-evolutionary development path socio-economic with perspectives. Therefore, the economic valuation studies of coastal ecosystems aim at capturing the value of the loss of intertidal habitats caused by land-claim and coastal squeeze; reduction in coastal resilience; and loss of nursery area.

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for fisheries and biodiversity, and for possessing coastal defense functions, carbon reservoirs and buffers to regulate nutrient fluxes, which is not possible through observational studies alone.

Design of the study

The overall objective of the study is to estimate the economic value of the mangroves in Pichavaram area as a case study. The present study was carried out in a village named MGR Thittu in the vicinity of the Pichavaram mangroves in the Cuddalore district of Tamil Nadu during the year 2009-2010. The specific objectives of the study were to review the current status of mangroves in Tamil Nadu, study the fisherfolk's perceived role of mangroves on their livelihood, estimate the economic value of mangroves as a case study, and suggest policy measures needed for the conservation, protection, management and development of mangroves. Information on the economic valuation of the Pichavaram Mangrove is presented in this paper.

The Pichavaram mangroves were selected for the reason that these mangroves have the distinction of being one of the healthiest mangrove occurrences not only in India but in the world. Another reason was that several scientific studies have been carried out in the Pichavaram mangroves in almost all fields except the economic valuation area, which is otherwise very important in the wake of recent events and discussions in climate change. These mangroves also possess rich and diverse floral and faunal wealth comprising a criss-cross network of as many as 4440 rivulets and 51 small and large islets.

The required data were collected randomly from 41 experts and 120 villagers, making a total sample size of 161. Information on the fisherfolk's perceived role of mangroves on their livelihood, and their views about the conservation, protection, management and development of mangroves were collected. Contingent valuation technique using Willingness-to pay (WTP) approach was used to estimate the total economic value of Pichavaram mangroves.

Results and discussion

About 37.5 % of the respondents were in 25-35 years age group, and 48 % of the villagers were primary literate (STD I-V). About 71 % of the village respondents were female but 79 % of the expert respondents were male. All the village family heads were fishermen (100%). The earner-dependent ratio in a village family was found to be 2:3.

All the villagers (100%) were members of organizations like EFICOR and Reliance, and some others also had memberships of various NGOs and other welfare foundations. All the villagers possessed assets like houses built by EFICOR and basic essential amenities provided by the State Government and other organizations and business agencies. But, the average monthly income of the villagers was low as found to be around Rs. 3,000 to Rs. 5,000.

The most important concern for protecting the mangroves was found to be strengthening of coastline against Tsunami through mangrove plantation, and that concerning the natural environment in general was global warming and climate change. Similarly the most important present use of the Pichavaram mangroves as cited by both the experts and the villagers was services of mangrove through their ecological functions

like protection against tsunami, floods and heavy winds; followed by contribution to fishery; and firewood collection. The issue unequivocally agreed upon by all experts regarding mangroves was protection of mangroves for sustainable benefits in the future generation and that disagreed upon was forest destruction. Opinions of both the villagers and the experts indicated moderate extraction of the Pichavaram mangroves at present but fear about expressed possible increase in future rates of exploitation.

In calculating the Total Economic Value of the concerned mangrove area, the values were divided according to direct use values, indirect use values and willingness to pay estimates. The direct use values involving fishery contribution and eco-tourism values were estimated to be Rs. 1,65,75,000. The indirect use value component comprising support to off-shore fisheries, carbon sequestration function and storm protection function of the mangroves, were valued to be Rs. 336,10,51,127. The Willingness to Pay estimate (WTP) found out through Contingent Valuation Method (CVM) amounted to Rs. 1,05,185. Thus the Total Economic Value (TEV) was added upto be Rs. 353,52,31,312. In other words, the Pichavaram mangroves provided goods and services worth Rs.353 crores annually.

The particular village MGR Thittu, which was selected for the case study, show cased the great role the mangroves tend to play in performing ecological functions which convert to large scale economic investments in the form of reduction of life loss from tsunami, protection from floods, heavy winds, cyclones etc., which would otherwise incur huge opportunity costs to the country's economy. The Pichavaram mangroves being a famous tourist spot helps in generating income and livelihood for the local people by means of varied uses of the mangroves. Hence, the economic valuation of the particular mangroves attributed an indicative price to the huge value of the mangrove resources, which is necessary for the formulation of proper budgetary allocations for investing in protecting natural resources on the part of the government and other stake holders in the wake of global discussions and agendas on protecting environmental resources and controlling climate change disasters for sustainable development of human resources.

Policy Recommendations

Viana¹⁶ opined that forests have historically been seen as valueless and forestry as backwards – neither of them worthy of inclusion in 'development' strategies or in the usual set of policy instruments encouraging relevant investment, such as tax incentives and credit. Yet the significant problems deforestation causes now suggest that forests now need to be regarded as valuable assets to individuals, families, businesses and governments. In short, public, non-profit and private sector policies have to be guided by a simple message: "forests are worth more standing than cut". This paradigm shift has to be translated into broad cross-sectoral policies in areas such as finance, education, health, energy and sustainable land use systems.

The biggest challenge now is not how to reduce deforestation, but how to finance the reduction. If the nature of the battle between irrational deforestation and rational conservation is predominantly economic, irreversible success will only come with sustainable finance – public, private and non-profit programmes aimed at stopping deforestation for carbon stored, biodiversity conserved, water supply protected or poverty eradicated. Of course, financing a new paradigm is relatively low in cost compared

to the environmental services produced by its standing ecosystems. Mangroves also need to be treated similarly.

In short, the mangroves help the socio-economic development of the coastal communities by supplying seeds for aquaculture industries as well as providing the traditional sources of medicines, honey, firewood, fodder and timber. Mangroves can therefore be developed as 'coastal cash crops' as sources of high value commercial products, fishery resources, as sites for the burgeoning ecotourism industry and for their ecological and economic benefits. A reduction in fisheries production not only affects the livelihood of the fisherfolk themselves but touches the vitality of the national population like India as well.

Forest conservation and greenhouse gas emission reduction targets must top the list of priorities in the new climate agreements and mangroves as carbon sink merit our attention.

Conclusion

The research study showed that the Pichavaram mangroves in general have great untapped potential to contribute to the national forest wealth in general in terms of contribution to national economy in the form of crude natural wealth. The particular village MGR Thittu, which was selected for the case study, showed the great role the mangroves tend to play in performing ecological functions which convert to large scale economic investments in the form of reduction of life loss from tsunami, protection from floods, heavy winds, cyclones etc., which would otherwise incur huge opportunity costs to the country's economy. This reason forms the baseline for the government and other stake holders to invest in the protection of natural resources like mangroves, as in this case, the Pichavaram mangroves, to avoid future losses in creating artificial structure to make up for the loss of these natural resources. Further, the Pichavaram mangroves being a famous tourist spot helps in generating income and livelihood for the local people by means of sustainable use of the mangroves. The total economic value of goods and services provided by the Pichavaram mangroves was estimated at about Rs.353 crores annually which could possibly on a conservative estimate as non-use values were not included in the study. So, this research work highlights the fact that mangrove resources need conservation, protection, management and development rather than ruthless destruction of the mangroves to create urban infrastructures and unsustainable extraction of resources for short term financial gain. The economic value of the mangrove worked out in this project is not an absolute value but an indication of the apparent minimum values as of now to illustrate the fact natural resources contribute significantly to the livelihood and earnings of the resource dependent people, and should be continuously looked into for maintaining sustainability of extraction, which if not, could turn up in great loss to the national economy and the human society.

A STUDY ON IMPACT OF FREQUENT POWER CUT ON IRRIGATION

Introduction :

The use of ground water accounts for over half of the total irrigated area in India. The expansion of ground water irrigation was largely due to improved drilling and lifting technologies lower per unit cost of water pumped, massive rural electricity programme, liberal credit for exploring ground water and subsidized supply of electricity.

Electric power is one of the main inputs in agriculture. Now a day the frequent power cut affects irrigation. It may be the causes for lesser yield and also reduces the gross and net income in farming operation. Therefore, the farmers do not intensively involve the farming operation of the ground water dependent crops.

Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops. In new agricultural strategy, the use of modern technology has a great significant to change agricultural patterns and productivity and irrigation is one of the basic determinants of agriculture. With the adoption of high-yielding varieties, chemical fertilization and multiple cropping, and controlled irrigation has become the chief factor in increasing productivity.

The present paper aims to examine the impact of frequent power cut adopted in Tamilnadu with special reference to Thanjavur District. Data were collected from two different taluk one in old delta another one in new delta of Thanjavur District viz

1. Thiruvaiyaru 2. Orathanadu of which three villages from each taluk in total six villages have been selected based on the sampling method.

Objective:

To study the impact of frequent power cut affecting irrigation in the selected villages of Thanjavur District both in old delta and new delta.

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The positive impact of irrigation on agricultural intensification and increased crop yield has been very well documented by various studies; the marginal returns of irrigation versus other factor inputs such as, farm technology and other rural infrastructure development are still a controversial issue in rural development literature. Some of the recent aggregate level empirical studies in India have also shown that irrigation access has a positive impact on farm productivity and poverty reduction.

Irrigation is an artificial application of water to the soil. It is usually used to assist in growing crops in dry areas and during periods of inadequate rainfall. Additionally, irrigation has also a few other uses in crop production, which include protecting plants against frost, suppressing weed growing in rice fields and helping in preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed farming. Irrigation is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area.

Results and Discussion:

Table .1
Farmer's Perception about Frequent power cut affects Irrigation.

Area	Farmer Category	Total Farmer	Farmer using Groundwater	Farmer's Perception about Frequent power cut affect Irrigation		
				Yes	PTF	PGUF
Old Delta	Small	65	51	51	78.46	100.00
	Medium	35	30	30	85.71	100.00
	Large	26	26	26	100.00	100.00
	Total	126	107	107	84.92	100.00
New Delta	Small	115	8	8	6.96	100.00
	Medium	58	13	13	22.41	100.00
	Large	46	46	46	100.00	100.00
	Total	219	67	67	30.59	100.00
Overall	Small	180	59	59	32.78	100.00
	Medium	93	43	43	46.24	100.00
	Large	72	72	72	100.00	100.00
	Total	345	174	174	50.43	100.00

Source: Compiled from Primary Data

Note: PTF- Percentage to Total Farmers,

PGUF – Percentage to Groundwater using Farmers

More than ninety per cent of the ground water irrigated farmers use electric motor. The perception of the farmers about the power cut affecting irrigation is analyzed.

Irrespective of the landholding category all the groundwater using farmers expressed their opinion about the power cut that it definitely affects the irrigation and crop production. Among the total farmers

(groundwater user and non-user) more than half of the farmers (50.43 per cent) said that the frequent power cut affects the irrigation. Whether considering the different land holding category in the sample as a whole 32.78 per cent of the small farmers, 46.24 per cent of the medium farmers and all the large farmers (100 per cent) told that the power cut is affect the irrigation.

The frequent power cut is affects the irrigation is the perception of the 84.92 per cent of the farmers among the old delta farmer. The same perception expressed by 78.46 per cent among small farmers, 85.71 per cent and 100 per cent in the medium and large farmers group.

As compared to old delta farmer less proportion of the farmer are told the frequent power cut is affects the irrigation, it is about 32.78 per cent only. All the large farmers, 22.41 per cent and only 6.96 per cent of the medium and small farmers are said that frequent power cut is affects the irrigation

Conclusion:

Among the total farmers (groundwater user and non-user) more than half of the farmers expressed their opinion that the frequent power cut affects the irrigation. Whether considering the different land holding category in the sample as a whole seventy eight per cent of the small farmers, forty six per cent of the medium farmers and all the large farmers expressed their opinion that the power cut is affect the irrigation.

Land Holding Category	Total	Medium	Small	Total	Medium	Small
Old Delta	100.00	100.00	100.00	84.92	100.00	82.71
New Delta	100.00	100.00	100.00	32.78	46.24	100.00
Total	100.00	100.00	100.00	58.55	73.12	91.43

Source: Compiled from Primary Data

Note: PTF - Percentage to Total Farmers

PGUF - Percentage to Groundwater using Farmers

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BETTER GROUNDWATER MANAGEMENT

INTRODUCTION

India is the largest user of groundwater in the world. In our country more than 60 per cent of the irrigation requirements and 85 per cent of drinking water supplies are dependent on ground water. Presently it is using an estimated 230 cubic kilometers of ground water per year. The United Nations predicts that by 2005, two thirds of the world populations will experience water shortage: affecting and livelihoods of 1.8 billion people and by 2050, 7 billion people in 60 countries may have to cope with water scarcity. Water scarcity already affects every continent and four of every ten people in the world. The situations are getting worse due to population growth, urbanization and the increase in domestic and industrial water use. Water scarcity forces people to rely on unsafe sources of drinking water. Poor water quality can increase the risk of diseases including cholera, typhoid, fever and other gastrointestinal viruses and dysentery.

With each passing decade less and less people are getting access to safe drinking water. The per capita availability of fresh water in the country has dropped from an acceptable level of 5180 cubic metres in 1951 to 1820 cubic metre in 2011, it's estimated that it would drop to 1340 by 2025 and 1140 cubic metres by 2050. The amount of water in the world is finite. Paradoxically, providing universal access to this basic minimum need by 2015 would take less than 1 per cent of the amount of water we use today. But we're a long way from achieving that. In our country we have been using traditional knowledge to conserve water in ponds and through rain water harvesting. However, over the years several of these sources of safe drinking water have become almost extinct and put to disuse.

ESTIMATION OF FRESH WATER REQUIREMENTS OF VARIOUS SECTORS

The amount of water in the world is finite. There is more than enough water available in total for every one's basic needs. The UN recommends that people need a minimum of 50 liters of water a day for drinking, washing, cooking and sanitation.

INTERNATIONAL EXPERIENCE

As the issue of groundwater management is larger, it has to be tackled at various levels of governance and communities. The international experience of groundwater management indicates that ground water is highly regulated in countries like Spain, USA, Mexico and china. In Spain, water users association is formed at the aquifer level. They are responsible for recharging the aquifer and its sustainable use. Similar

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laws have been enacted in USA. China, a country with similar development issues manages to store five times the water that India does per person. In India there is an urgent need for legislation and administration of ground water at the level of state governments. Free power to agriculture sector is also one of the contribution factors for the over use of the ground water and there is need to withdraw or reduce such benefits. In India, out of 85 million hectare area under cultivation 60 per cent is rain fed and this account for only 40 per cent of the total food production.

THREAT TO INDIA'S WATER RESOURCES

Water has become the biggest problem of the 21st century. Global consumption of fresh water increased six fold 1900 to 1995, at a rate greater than twice the rate of population growth. If the present trend continued, two out of every three people on earth will have to live in water stressed condition by the year 2025. The per capita availability of fresh water in the country has dropped from an acceptable 5,180 cubic metres in 1951 to 1,820 cubic metre in 2001. It is estimated that it would drop to 1,340 by 2025 and 1,140 cubic metres by 2050.

The following are all the major threats to India's water resources.

1. Population Explosion
2. Industrial farming
3. Water exploitation by multinational corporations
4. Water privatization

DEVELOPMENT OF THE WEB ENABLED GROUNDWATER INFORMATION SYSTEM (WEGWIS)

WEGWIS have been integrated with the thematic data, the dynamic data such as water level/ water quality, other ground water related information and socio-economic databases. The CGWB application will be a client-server based web GIS application. This CGWB application will advantageous over the existing system in the following ways:

- * User has been given choice to navigate Administrative Boundary or hydrological Unit. After navigating to district level or watershed level, user can select the layers to perform attribute based thematic map rendering and by clicking on the area of interest on the map, user will get the desired information.
- * User can 'print' the map displayed in the map viewer along with layer legend list. User can save the map and send it as an attachment through mail.
- * With the help of query builder, user can select map features by performing query. This functionality will provide user friendly interface to write/select query. Based on the query, map area will be selected and an attribute table will be shown.

- * With the help of GEMS integration module, user can see the wells having water level or water quality or rainfall information for a specified area and date. User can see the attribute information of the wells and can generate graphs and charts for the selected time series.
- * With the help of predefined query module, user can execute certain predefined queries to make analysis, selection on map and generate results on the basis of queries executed.

NEW CONCEPT

Integrated water resource management was adopted for improving the groundwater level of the village and for successful implementation of water supply scheme in the near future. For recharging and conservation of rainwater, a plan was made to construct rainwater harvesting structures in all houses; well deepening and recharging trench on abandoned community open wells and tube wells and construction of check dams.

RAINWATER HARVESTING

Rainwater harvesting in of course a focus area for sustainable agricultural production but attention should also be paid for efficient management of the available water resources. Several measures for development and management of water resources are undertaken by the respective state government with a view to optimally utilize the available resource which includes creation of storages, restoration of water bodies, rain water harvesting, artificial recharge to ground water and adoption of better management practices etc. Storage capacity of about 225 Billion cubic Metre (BCM) has been created so far.

The central government has implemented a scheme since 2008 in which 4,455 million wells will be dug up for recharging groundwater in 110 blocks of the identified states for the benefit of farmers. The artificial recharge of Ground water through wells scheme was launched keeping in view the concerns of over exploitation of groundwater resources in the country as well as to ensure sustainable water resource management and irrigation facilities in the affected rural areas.

CONCLUSION

As a global community, we put high demands on existing water resource. In some cases, perhaps more in the future, this becomes the source of international conflict. The water available for use on earth is finite, and if we are not wise in its use, clean water will become a globally scarce commodity, as it now is already in so may places. Instead of simply mentioning clean water as an input in food, the right of food complain should strongly incorporate right to water in the struggle against hunger and starvation.

A STUDY OF NATURAL RESOURCES AND ITS IMPACT ON LAND - USE PATTERN IN INDIA WITH SPECIAL REFERENCE TO TAMILNADU

Introduction

Resources may be classified in a million ways or for that matter two very distinct heads viz. renewable and non-renewable. Natural resources determine the course of development and constitute the challenge which may not be accepted by the human mind. Land, water, fisheries and forests are renewable and others like minerals and mineral oils which are exhaustible and can be used only once. Consequently, careful use of the exhaustible resources and maintenance of the quality of renewable resources like land are a *sin qua non* in the process of development.

Importance of Land Resource

Land, climate and bio - inhabitants constitute the natural wealth. Land the primary natural resource, includes soil, water bodies, vegetation, landscape and micro climate. Land is the most tangible one. Land by definition, is the solid part of the earth's surface. It is a finite resource, so great care should be taken to preserve it. Land has been put to many new uses, apart from traditional ones. The general uses of land are as agriculture and horticulture, housing, laying of roads and railway lines, industries, mining of mineral resources, a container for holding water, for fodder, cattle grazing, forest wealth for timber, fuel, etc.

India's land resources spread over an area of 329 mha with reporting area of 305 Mha are broadly classified into following uses :

Mha with reporting area of 305 Mha are broadly classified into following uses :

1. Agricultural sectors consisting of net cultivated area, current fallows, other fallows and cultivable wastes (180Mha):
2. Ecological sectors comprising forests, miscellaneous tree crops and groves, grazing and barren lands (130 Mha) : and
3. Non - agricultural sectors including lands under non - agricultural uses (22 Mha).

In India out of 305 mha available for potential use, 175 mha are degraded due to the following distribution.

- a) Land suffering from serious water and erosion - 150 mha
- b) Land affected by salinity & alkalinity - 7 mha.
- c) Land affected by water - logging - 6 mha
- d) Land affected by shifting cultivation - 3 mha.
- e) Land affected by miscellaneous factors - 9 mha.

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The Major cause of land degradation are excessive population pressure on land, deforestation, soil erosion, over-irrigation, floods, droughts, grazing, pollution, and management of land.

The Specific Objectives of the study

1. To examine the land use pattern in all regions of the country.
2. To analyze the need for land use planning in our country.
3. To evaluate the socio-economic usage of land resources in the country.
4. To estimate the role of state in land use pattern and agricultural development with special reference to Tamilnadu.
5. To analyze the major water resources and its conservation measures.

MATERIALS AND METHODS

This paper was prepared by the help of the secondary data collected from development statistics. From the data emphasized that the country has also been classified into 35 agro meteorological division for the purpose of monitoring rain fall intensity and drought. In this paper an attempt is made to highlight the method of land use pattern and land use planning in all over the country and special care study was taken from Tamilnadu.

1. Classification of Land use in INDIA

Out of the total geographical area of 328.73 million hectares, land use statistics are available for roughly 305 million hectares, contributing 93 percent of the total. Till 1949-50, the land area in India was classified into five categories known as the five - fold land utilization classification. This five fold land utilization was however, a very broad outline of land - use in the country and was not found adequate enough to meet the needs of agricultural planning in the country.

The Technical Committee on Co-ordination of Agricultural Statistics, set up by the Ministry of Food and Agriculture, recommend a nine - fold land - use classification replacing the old five - fold classification.

AREA UNDER AGRICULTURE USES

The states of Hariyana, Punjab, West Bengal, Maharastra, Uttar Pradesh, Kerala, Karnataka, Gujarat, Bihar, Pondicherry, Delhi, and Union territories of Laccadives, Minicoy and Amindive Islands (Lakshadweeps), Cultivate more than 45% of their reporting area. In some of the states like Hariyana and Punjab, which lie in the fertile Indo- Gangetic plains of India. The net area Sown is between 60 and 70 percent of the corresponding reporting area. Maharashtra has the highest net area sown in the country. The states of Maharashtra, Madhya Pradesh, Karnataka, Gujarat and Bihar account for more than three - fourths of the country's area sown.

activities, more land is being used for industrial sites, housing, transport systems, recreational purposes, irrigation systems etc.,

AREA UNDER FORESTS

In India there are 377358 sq.Km Dese Forest (11.48%), 255064 Sq.Km Open Forest (7.76%), and 4871 Sq.Km Mangrove Forest (0.15%) which constitute 19.39 % in total areas of 637293Sq.Km. That forest area inadequate in India is evident from the fact that the prevailing forest area available per capita is only 0.08 hectares. Whereas at current levels of consumption of forest produce and productivity of forests, it is estimated that each Indian would require at least 0.47 ha of forest to meet his basic needs. the Potential areas for expansion of forest cover are culturable wastelands covering 13.94 mha and part of fallow land and land other than current fallows, coverffing 9.89 mha. According to the National Remote Sensing Agency (NRSA), India has less than 11.4% of area under forest as per the 1992 obesevation. But the more recent satellite pictures show that the forest cover is now less than 10%.

II. Land - Use Pattern in India and Tamilnadu State

The pattern of land use of a country at any particular time is determined by the physical, economic and institutional framework taken together. In other words, the existing land - use patten in different regions in India has been evolved as a result of the action and interaction of other resources(capital, labour etc.,) available, and the location of the region in relation to other aspects of economic development e.g. those relating to transport as well as to industry and trade.

Land - Use Pattern in India and State of Tamilnadu

	All India	Tamilnadu
Categories	2008 - 2009 (In MHa)	2008 - 2009 ('000' Ha)
Geographical area	328.73	13026.65
Forest	69.67	2105.90
Land not available for cultivation	42.92	491.91
a) Permanent pastures & other grazing lands	10.42	110.13

In our state these type of land use was 1013.37 hectares as utilized. The Fallow Lands other than Current fallows were 149.76 thousand hectares as well as the Culturable waste land was 333.44 thousand hectares. There were 491.91 thousand hectares of land are not available to agricultural cultivation. In our state the forest area were 2105.90 thousand hectares and permanent pasture and othe grazing lands were 110.13 thousand hectares under utilized. The Gross Cropped Area 781.35 thousand hectares represents that the total area sown once and or more than once in the year 2008-09 in Tamilnadu. The Net Area sown in the state were 5042.90 thousand hectares and it represents that the total area sown with crops and orchards. Area Sown more than once in the same year is counted only once. The cropping intensity coverage were 114.9 thousand hectares represents that the ratio of net area sown to the total cropped area.

FINDINGS AND CONCLUSION

It is conclude tha proper utilliaztio of natural resources of land and water easily attain our all basic needs without misuse of scarce characterized sources An efficient land use policy caters to distributional aims such as making land available to all groups in the community and ensuring that the benefits got to the community as a whole by the aims of Control of urban sprawl: Control of encroachment on agricultural land and Achieving economies of sale and least cost production of public services.

LAND RESOURCE MANAGEMENT

Our land resources perform various functions like providing base for vegetation, water bodies, habitat for human, animals, birds and other organisms; producing food and fibre; maintaining or enhancing water quality; partitioning water flow and sequestering carbon. Land quality is defined as the capability of land to perform these functions without becoming degraded. Majority of these functions of land are, however, determined by the quality of soil. Maintaining and improving the quality of the Nation's soils can increase farm productivity, minimize use of nutrients and pesticides, improve water and air quality, and help store greenhouse gases. Soil quality is defined as the continued capacity of Soil to function as a vital living system, within ecosystem and land-use continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, promote the quality of air and water environments and maintain plant, animal and human health. In short, soil quality can be defined as the "fitness for use" or "Capacity of the soil to function".

In recent years, the land resource has been subjected to a variety of pressures. Still it is surviving and sustaining mankind. What is alarming in the way land is being used is the tendency towards over-exploitation on account of reasons leading this pristine resource being robbed of its resilience.

The Indian Scenario

India constitutes 18 per cent of the world's Population, 15 per cent of the live stock population and only 2 per cent of the geographic area, one per cent of the forest area and 0.5 per cent of pasture lands. The per Capita availability of forests in India is only 0.08 per ha. as against the world average of 0.8 per cent, thus leading to the pressure on land and forests. This poses a major and urgent concern. In accordance with the National Remote Sensing Agency's (NRSA) findings there are 75.5 million ha. of wastelands in the country. It has been estimated that out of these around 58 million ha. are treatable and can be brought back to original productive levels through appropriate measures. At the moment, taking into account the efforts being made by all the various players in this field treating facilities are in place only for around 1 million ha. per year. At this rate, that there is no further degradation also assuming that our efforts are 100 per cent successful, it will take around 1 million ha. per year. At this rate, that there is no further degradation and also assuming that our efforts are 100 per cent successful, it will take around 58 years to complete the process.

Watershed is a geo-hydrological unit which drains at a common point. Rains falling on the mountain start flowing down into small rivulets. Many of them, as they come down, join to form small streams. The small streams form bigger streams and then finally the bigger streams and then finally the bigger

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streams join to form a nallah to drain out of a village. The entire area that supplies water to a stream or river, i.e the drainage basin or catchment area, is called the watershed of the watershed of that particular stream or river.

Role of Ministry of Rural Development

The Ministry of Rural Development, Government of India, has recently created a Department of Land Resources to act as a nodal department in the field of watershed management and development. This has the mandate of development the valuable land resources of India, which are presently under various stages of degradation and it also endeavors to prevent further degradation of these resources through appropriate management and necessary measures.

The Department of Land Resources, being the nodal department has taken up certain new initiatives to play a more pro-active role in the Land Resource management in the country. At the conceptual level it has been realised that the management rather than the mere use of land is the central theme. There is no dearth of land, the real issue is management which should include: dynamic conservation, sustainable development should seek to maintain an acceptable rate of growth in per capita real incomes without depleting the national capital asset stock or the natural environmental asset stock.

Equitable access to the benefits of development could be achieved either through land reforms or a dedicated and institutionalized mode of people's participation. Here, besides the Government, other players like the corporate sector, NGOs, various institutions and self-help groups can be involved.

WATER MANAGEMENT TRADITIONS IN RURAL INDIA

Introduction

Water is the key to development and sustenance of all communities. Under conditions of increasing stresses on this essential renewable but scarce natural resource, effective and efficient management of water is emerging as an urgent contemporary issue. The realization of its limited availability in space and time has necessitated the designing of new globally viable water management regimes aiming at striking a balance between the use of water as a basis for livelihood and its production to help ensure its sustainability through present to future generations (Agarwal et al., 2000).

The water management traditions in rural India can be seen as organised within small - scale villang communities. These traditions embody a blend of knowledge and action as a means to fulfil the water-related needs of the members through management of the resource and the sources through which it is harnessed. The element of the system may be classified as falling within two basic realms, namely, the 'ideational' construct and the 'operational' aspects.

Water and water needs

water-related needs are identified at two levels : those pertaining to 'this wordly' survival (secular) and those meant for spiritual purposes (sacred), these perceptions exhibiting variation across the different caste groups in the local community. Certain secular needs such as drinking, cooking, washing, cleaning and bathing are common to all while those pertaining to certain productive purposes are caste- specific. For instance, the landowning agriculture castes, notably the dominant (also land-owning) castes require water for irrigation while others like potters washermen and cattle herders require it for their own specialized economies. Sacred needs are further identified as 'collective' and 'individual'. The former, to be fulfilled on certain special ritual occasions that are to be observed publicly while the latter may be fulfilled on a day-to-day basis at the domestic level. However, even individual sacred needs that are to be fulfilled at a sacred site (such as temple) are largely the privilege of the people of higher social stratum.

Water is seen as a renewable yet scarce resource to be handled with care so that quality and quantity are not decelerated, The underlying quantity- related principle in utilizing water resources in the village lies in exploiting nature for serving human interests but not to the extent of depleting them forever. The quality-related perception is functionally supported by the concepts of purity and pollution of water through human actions, part of which in turn derives from the caste-based norms and the day-to-day cultural practices concerning water use.

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IMPACT OF AGRICULTURAL LAND RESOURCES AFTER THE IMPLEMENTATION OF SEZ

Introduction

In India, the average size of holdings in India is very low. About 80 percent of the land holdings are less than 2 acres. Not only agriculture holdings are small but they are fragmented too. In certain parts of the country, plots of Land have become so small that it is impossible to move ordinary plough. Since the average agricultural holdings are too small no scientific cultivation with improved implements, seals etc., are possible. But in other side most of the agricultural lands used by SEZs. At the major states level 381 SEZ has been approved with allocation of land about 1.66 lakh hectares. In the case of southern region. 149 SEZs have been approved with an allocation of land about 27 thousands hectares.

MAJOR ISSUES OF LAND MANAGEMENT

India has adopted the policy of liberalization, privatization, and globalization (LPG) in 1990's and transferred the traditional market mechanism to the threshold of a free market philosophy. Many MNCs began services, some of them rather new goods and services, some of them rather new to the Indian market. They posed a tough competition before the Indian industry. In this chain government of India has taken various pragmatic steps as a result of which Indian business are getting more and more global, across geographical boundaries of the countries and continents. For capturing the foreign market is necessary to supply to achieve this concept of SEZ has been promoted in India on the track of their success in China.

Special Economic Zones (SEZs) are specially delineated area within the domestic territory of India that is treated as foreign territory in the context of Trade & Tariff (i.e. Custom and Excise Duties). The idea is to facilitate exports through special tax treatment to the units operating within SEZ on the competitive basis. More clearly, SEZs are defined as geographic regions designated for economic development oriented toward boosting inward FDI and exports, and supported by special policy incentives by the government.

In fact Special Economic Zones are the modified versions of the earlier export processing zones. The existing eight export processing zones have been converted into SEZs was first introduced in EXIM Policy, 2000 with a view to creating a healthy environment to achieve rapid growth in export and to provide a competitive and hassle-free environment. Since the policy relating to SEZs was contained in

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EXIM policy, 2000, which has been implemented through piecemeal, and ad-hoc amendments in different legislations and through executives order. This has put several hurdles in the path of its success.

To overcome these hurdles and to give long-term stability in policy framework covering all necessary aspects of SEZs as well as units operating in SEZ was prepared. To get the said advantages and for boosting exports SEZ Act 2005 was passed by the Parliament in May 2005 and it was approved by the President of India on June 23, 2005. The Act came into effect w.e.f. February 10, 2006. The Act extends to the whole of India. Section 51 of the Act confers and overriding effect of this Act by providing that the provisions of this Act shall have effect notwithstanding any thing inconsistent there with contained in any other law for the time being in force. More attention is required to pay on land acquisition in India that only barren or single cropped land would be used and there should be proper arrangement for displaced due to SEZs.

Objectives

1. To know the composition of GDP under primary, secondary of Tertiary sector.
2. To study the growth of SEZ as category wise by major states in India.
3. To analyse the distribution of land allotment of SEZs between public and private southern in software India.

Methodology

This study based upon the secondary data only. The data and literature were collected from books Journal and Reports. The data proposed the growth of the SEZs in India.

Findings

1. The growth of the primary sector (Agricultural sector) was 56% 1950-51 in GDP. But in 2005-06 it was 17.9% when compare to industrial sector it was very low
2. Industrial sector accounts Top position than in other two sectors.
3. In South region SEZs accounts more than i.e. 80 in the year. The southern region has dominated both in IT/ITES of plant Bio tech SEZs when compared to all the SEZs of major states in India.
4. Distribution of Land allotment to SEZs in public and private in southern India, Andrapradesh accounts total land area that is 13,224 acrs.

Suggestions

1. SEZs only set up on barren Land
2. Government should set the committee to watch over the activities of SEZs
3. While Implements of the SEZs in India the government should adept the labour intensive techniques only.

4. The multi product/services and other categories by virtue of horizontal expansion require large extent of land (94% of total land allotted to SEZs) Unlike IT/ITES, they need more land to create housing, education, medical and recreation facilities, It should be Minimized by the Government of India.
5. In addition, they require land to develop social forestry and effluent Treatment Plants (ETP) as mandated in the Environmental Protection Acts. But the developers should not be allowed to grab more land out of greed without proper justification, since grain area is shrinking drastically day by day. Owing to the above development, large part of agricultural land will be converted into non-agricultural purposes. At present, we are importing cereals, pulses and oil seeds to meet the basic needs of our people. Extravagant conversion of agricultural land to non-agricultural purposes may worsen the situation and may lead to drastic drain in for exchange reserves for importing food grains.

Conclusion

SEZs can not be the solve answer for speedy economic growth. They can only be supplements to other strategies and efforts at development and they can not be sole drivers of future growth of Indian economy. Government must also give adequate attention to the review and monitoring of the activities and performance of SEZs. Periodical reviews must be utilized to assess the progress achieved on various fronts such as industrial production, growth of units in services sectors, progress in area of infrastructural development, education, health care etc. It is possible that during the implementation process some other issues and problems may come to light. The government must take prompt action to address such issues and problems as and when they crop up.

A STUDY ON NATURAL RESOURCES MANAGEMENT IN INDIA

INTRODUCTION:

Sustainable development of any economy can be attained if and only if the basic needs of the present generations are met without compromising those of the future generations. The criticism of economy efficiency must be broadened to encompass ecological aspects. Otherwise the natural resources of the world economy will be recklessly exploited with huge losses to be borne by the future generations. Sustainable development must also ensure equity across line. Depletion of natural resource capital poses a very serious threat to third world countries because of their population pressure and excessive dependence on primary activities.

Waterlogging and Salinity

Waterlogging and Salinity is mainly caused by badly designed and managed irrigation systems. Unlined canals and other water channels, use of excessive irrigation than crop requirement and poor quality of ground water (when used for irrigation) can lead to salinity of soil. The problem of water logging and salinity is very serious in India. By 1988, the productivity of about 20 million hectares of crop land (30% of irrigation crop land) has been seriously affected and the farmer had to abandon about 10 million hectares of productive land (ADB, 1911). Increased water logging and salinity severely reduced productivity of land. Average yield in case of properly irrigated system is more than 6 tons per hectare but in case of Saline areas it can be only about 1.5 to 2.0 tons per hectare (Brandon, C. & Ramankutty, R., 1993).

Role of Green revolution

Green revolution in India has been attained through the use of high yielding varieties of crops, chemical fertilizer, pesticides and irrigation. The excessive use of chemical fertilizers, pesticides and irrigation. The excessive use of chemical fertilizers and pesticides has many adverse affect. In some causes it has resulted in eutrophication in nearby surface water and accumulation of phosphates and heavy metals in soil. Particularly in case of big and medium farmer in India. Excessive use of Pesticides has lead to pest resistance and reduction of the pests predators, forcing a vicious circle of more frequent and stronger applications. It is also health hazaed. In India increasing residues of H.C.H (banned in USA) has been found in food and mother's milk.

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FORESTS, WILD LIFE AND BIODIVERSITY

India's eco – system is facing a heavy pressure on account of a number of factors including commercial logging, conversion of forest land into agricultural land, grazing of domestic livestock, fuel and fodder collection, burning of forest, hunting and development projects. It has been estimated that as a result of these pressure, India might have lost as much as 80% of its original terrestrial habitat (World Bank, 1995). Despite huge losses, India continues to have rich resources of natural wealth. It is one of the 12 countries identified as mega centres of biological diversity. It has 45,000 species of plants and 81,000 species of animals. Mammal fauna comprises 372 species. India has 1228 bird species and about 13% world's total reptilian and amphibian fauna including 446 and 2044 species respectively. Out of these 3.5% in case of mammals, 14% of birds, 32% of reptiles and 62% of amphibians are endemic (MOEF, 1994). India has diversity of crop species and varieties. It has been estimated that India is the origin of at least 166 species of crop plants and 320 species of wild relatives of cultivated crops (World Bank, 1995).

CAUSES OF NATURAL RESOURCE DEGRADATION IN INDIA

The main causes of natural resources degradation in India include growing pressure of population, increasing inequalities, failure of market forces and system which encourage short-term exploitation rather than long-term conservation. Institutional factors are also responsible for mismanagement of resources.

a. Growing pressure of population

The population pressure has been mainly responsible for problem of poverty in India. There is a two-way link between poverty and environment. The environmental degrading contributes to poverty through worsened health and by constraining the productivity of those resources upon which the poor rely, and poverty restricts capacity of poor to acting in ways which are damaging to the environment. Besides the demographic pressure directly exacerbates problems of environmental degradation.

b. Increasing income inequalities:

Increase income inequalities are also responsible for environmental degradation. On the one hand, a large proportion of population has control over small proportion of country's resources. This results in an increase in the pressure on natural resources. It leads to excessive cutting-off of trees for fuel or income, overgrazing of land, reduction of fallow period. The minority population which has control over most of country's resources plays more active role, in degradation. These are the people who are responsible for neglect of the environmental issues as they are mainly interested in short-term profits. They want more dams, power, mineral for industry and urbanization irrespective of environmental costs. Thus, population pressure and economic inequalities significantly influence natural resources degradation.

c. Market failures:

Market failures combine with population pressures and lead to over-exploitation of land and forests. Market forces fail to take into account the indirect costs of degradation. These indirect costs include the value of foregone environmental services like biodiversity, soil stability, carbon sequestration, hydrological buffering, non-wood products, etc. Similarly, short-term gains of subsistence upland farming are less than the long-term environmental costs of future loss of on-site productivity, siltation, flooding.

d. Government policies:

Government policies have further compounded these problems. Public institutions have played an important role in the use of unsustainable practices in agriculture forestry and degradation of habitats in protected areas. Fertilizer subsidies in India have grown 40-fold from 57 million (in 1990 dollars) in 1973-74 to 2.63 billion in 1989-90 (in 1990 dollars).

e. Institutional weaknesses:

Institutional weakness are even more pronounced in forestry. Because of colonial background the forests in India were managed for long time only as sources of raw material for industry. Though comprehensive legislations have been passed but a lot has to be done as far as the implementation is concerned. Technical issues in forestry have lagged far behind agriculture. It can be estimated that less than one thousand scientists (excluding China) conduct forestry research in Asia, compared to 5000 scientists working on rice research alone. In India, expenditure on forestry research are less than .01% of the value of forest products consumed annually. As a result, policy is based on inadequate understanding of forestry eco-system.

POLICY IMPLICATIONS

- In case of land, various technologies which can prevent degradation are known.
- Farmer should be made aware that through soil and water conservation, productivity can be increased by 15% to 20%. Technologies for arresting desertification are being developed. Special species of plants should be planted in these areas.
- Large irrigation projects should be abandoned in favour of small and medium size projects.
- Planning should aim at sustainable development in case of agriculture. The agriculture policy should be integrated with various policies for tackling the problems of poverty and pollution.
- Institutional reforms in agriculture can play an important role in conservation.
- The natural Forests Policy, 1998 recognises the multiple use and natural of forests and right of local populations.

- Various subsidies on fertilizers, power, irrigation, diesel should be removed. These subsidies encourage their excessive and uneconomical use and further degrade the environment. Even the forest-based industries are eligible for a large number of incentives. These incentives prove to be counter-productive for deforestation.
- Alternative to cost-benefit analysis are being explored for proper assessment of indirect cost of various developmental projects.
- Proper implementation of these new procedures will require considerable strengthening of M.O.E.F.'s capabilities to establish guidelines and technical norms for assessment and ensure through prompt review and action (World Bank, 1995). For tackling various technical issues in agriculture, forestry and biodiversity there is a need for strengthening search and development in these areas.

CONCLUSION

The most important long-run aspect of natural resource management strategy is related with the problems of population, poverty and inequalities. Policies of poverty alleviation and population control must be interlinked. Basic needs of food and fuel must be met so as to reduce the vulnerability of poorest section of society. Various incentives for poor must not indirectly involve incentives for population expansion. Recent programmes of poverty control including those related with employment opportunities do not make any distinction between small families and large families among the poor. Any such distinction along with rigorous awareness and family planning programmes can go a long way in checking population problem. The mal-distribution of resources and services should also be addressed as it contributes to environmental degradation directly as well as indirectly. Such inequalities create all types of social problems and hence need to neglect of environmental problems.

AGRICULTURAL DEVELOPMENT IN THE POST - REFORM PERIOD IN INDIA

Introduction

India is primarily an agricultural country. Agriculture is the largest and the most important sector in India. Most of the Indian Industries are still depending on Agriculture. All leading industries of India are agro-based Industries like cotton Textiles, Jute, Sugar, Plantation, Vanaspathi, Oil and paper industries. The relationship between agricultural and all sectors are mutually dependent. However the agricultural sector feeds millions of people in all sectors and provides raw materials for industries.

The paper aims to bring out the growth of agricultural food production in particular and average growth rate in general during plan periods. The study used to analyze the growth by simple percentage and Five Year Average Production of food grains with its area in India.

Over all period from 1990 -91 to 2004 -05, the food production has increased from 162.1 MT to 204.6 MT and the area of agricultural production has increased from 103.2 MH to 124.2 MH. The production trends during the period indicate that an increase in production is neither continuous nor very large. For the last one and half decade, the production has increased by 21 percent, which had taken after adopting new technology in agriculture with high yielding varieties.

The area of production has also showed the same trend as production of food grains. There is mostly closed one factor to another. Even though, there was an increasing trend, it could not able to solve the food security problems in India.

The average annual growth rate in agriculture (with allied sectors) decreased from 4.7 percent during the eighth plan (1990-1997) to 2.1 percent during the Ninth plan (1997 - 2002). As against the targeted average annual growth rate of 4 percent during Tenth Plan, growth rate in 2002 - 03, the first year of Tenth Plan (2002 - 07) was negative - 6.9 percent). It may be due to drought of 2002.

Conclusion

The importance of agriculture in India economy is evident. Nearly 75 percent of the people in India depend on agriculture either directly or indirectly for their living. It can only promote economic development through increase the production. leads to increase the income of farmers and their savings. In spite of its growth, the agricultural sectors contribution has declined to GDP of country. For reducing this defect, the government will take and announce as public sector. It may show eventually and gradually of its progress with growth and development.

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WATER MANAGEMENT IN INDIA

An Overview

In India, the total utilizable water resource is assessed as 1123 BCM. Keeping a provision of about 71 BCM/yr out of 433 BCM of groundwater, 362 BCM/yr of the resource is estimated to be available for irrigation. The net draft of groundwater for irrigation is around 150 BCM/yr. The per capita availability of water at national level has been reduced from about 5177 cubic meters in 1951 to the estimated level of 1,820 cubic meters in 2001 with variation in water availability in different river basins. Given the projected increase in population by the year 2025, the per capita availability is likely to drop to below 1,000 cubic metres, which could be labeled as a situation of water scarcity (GOI, 2006). India has a highly seasonal pattern of rainfall, with 50% of precipitation falling in just 15 days and over 90% of river flows occurring in just four months. A total storage capacity of 212.78 Billion Cum (BCM) has been created in the country through major and medium projects. The projects under construction will contribute to an additional 76.26 BCM, while the contribution expected from projects under consideration is 107.54 BCM. The total availability of water in the 76 major reservoirs was 109.77 BCM at the end of the monsoon of 2005 (GOI, 2006). The irrigation potential of the country has been estimated at around 139.9 mha without inter-basin sharing of water and 175 mha with inter-basin sharing. The Central Ground Water Board (CGWB) has estimated that it is possible to increase the groundwater availability by about 36 BCM, by taking up rainwater harvesting and artificial recharge over an area of 45 mha through surplus monsoon runoff.

Irrigation Management

In an agrarian economy like India, irrigation has played a major role in the agricultural production process. Irrigation development in the country has been taken up in a big way through Major, Medium and Minor irrigation schemes since independence. The irrigation potential has gone up from 22.6 Mha (9.76 Mha through Major and Medium and 12.84 Mha through Minor) prior to Plan period to 93.95 Mha by the end of IX Plan and further to 97.15 Mha (38.87 Mha through Major & Medium and 58.28 Mha through Minor) up to March 2004 against the Ultimate Irrigation Potential of 139.91 Mha (58.49 Mha through Major & Medium and 81.42 Mha through Minor). This development of irrigation facilities has largely contributed to country's self sufficiency in food grains which has gone up from 51 Million tons in 1950 to 210 million tons in 2000. A total number of about 1248 Major, Medium and ERM (Extension, Renovation and Modernisation) projects have been completed.

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Water resources management in India In view of the existing status of water resources and increasing demands of water for meeting the requirements of the rapidly growing population of the country as well as the problems that are likely to arise in future, a holistic, well planned long-term strategy is needed for sustainable water resources management in India. The water resources management practices may be based on increasing the water supply and managing the water demand under the stressed water availability conditions.

Flood management

Among all natural disasters, floods are the most frequent to be faced in India. Floods in the eastern part of India, viz. Orissa, West Bengal, Bihar and Andhra Pradesh in the recent past, are striking examples. According to the information published by different government agencies, the tangible and intangible losses due to floods in India are increasing at alarming rate. As reported by the Central Water Commission (CWC) under the Ministry of Water Resources, Government of India, the annual average area affected by floods is 7.563 Mha. This observation is based on the data for the period 1953–2000 variability ranging from 1.26 Mha in 1965 to 1.75 Mha in 1978. On an average floods have affected about 33 million persons during 1953 to 2000. There is every possibility that this figure may increase due to rapid growth of population and increased encroachments of the flood plains for habitation, cultivation and other activities. The main causes of floods in India are inadequate capacity within river banks to contain high flows, river bank erosion and silting of river beds.

The return of water to the villages brought many benefits. Young people who had migrated out in search of jobs, returned back to agriculture in their villages; women who had previously spent most of their day fetching water could tend to the housework, while children could go to school. Water brought life back to the area and started attracting far more migratory birds. As a result of the construction of 350 Johads in the river catchments, from 1996 onwards the Arvari river, previously a monsoon drain, began to flow to its full capacity. It soon became perennial. With the revival of the river, aquatic life prospered and there was natural growth of the fish population. As a result, the government gave the contract for catching fish to a private party. The people of the region, whose hard work had revived the river, resisted this move, suspecting that the government may try and take control of the whole river.

WATER MANAGEMENT IN INDIA

Introduction

Water being the second most important necessity of life, after air, its adequate availability and assurance of safety by drinking it is the basic concern for any society. Though water has become very scarce in the world, its availability is taken for granted by many and climate linked. In recent times, several studies around the globe show that Water management System. In India, demand for water has already increased manifold over the years due to urbanization, agriculture expansion, increasing population, rapid industrialization and economic development. At present, changes in water distribution and land-use pattern, over-exploitation of water storage. So water management is very important to maintain our water resources for future generation. water management, its necessary for sustainable development.

Objectives of the Study

- To determined the water resources in India
- To measure the Water Management Systems
- Know the Importance of Water Management

Methodology

In this study, researcher had used secondary data. The secondary data has been collected from the Periodicals, Books, Newspapers, Reports and web source and so on.

Surface water Management

Surface water is precipitation that does not infiltrate into the ground or return to the atmosphere by transpiration or evaporation. It may be loosely defined as water that stands or flows on the surface of the Earth and is commonly referred to as runoff. The management of surface water is a complex issue, mainly centered in historical precedent and practices, yet as knowledge increases on the unsustainable impacts of these traditional approaches to management, so does the need to challenge the current orthodoxy. Since the spread of urbanization associated with the change from an agrarian to industrial society, in developed countries we have drained our landscapes using essentially the same approach. Standing water is perceived as a hazard and therefore we have tried to move the runoff, or storm water, quickly, safely and economically into sewers, and then with the same emphasis into the nearest watercourse. However, urbanization changes the local natural hydrological cycle as the impermeable surfaces associated with development reduce infiltration and transpiration, and instead divert the precipitation into the drainage system.

Ground Water Management

Groundwater management deals with a complex interaction between human society and physical environment and presents a difficult problem of policy design. Aquifers are exploited by human decisions

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and overexploitation cannot be always defined in technical terms, but as a failure to design and implement adequate institutional arrangements to manage people who exploit the groundwater resource. Common pool resources such as groundwater have been typically utilized in an open-access framework, within which resource ownership is according to a rule of capture. When no one owns the resources, users have no incentive to conserve for the future, and self-interest of individual users leads them to overexploitation. Groundwater management is a much debated issue.

Reduction in groundwater supply, saline water encroachment, drying up of the springs and shallow aquifers, increased cost of pumping by replacing centrifugal pumps with expensive submersible pumps, reduction in free flow, weakening drought protection and even local land subsidence in some places are threatening the sustainability of the aquifers. In many areas this has occurred more or less year-on-year, except for temporary respite following years of exceptional monsoon rainfall when a partial recovery has been observed. The practice of the sale of water, either in cash or on crop sharing basis has also encouraged the rich farmers to construct deep tube-wells and over pumping the groundwater. Rapid decline in groundwater levels in the drier parts of India is a matter of concern, since demand-driven exploitation without regulatory measures and understanding of area-specific problems lead to crisis not only for the present but may also result in damage to the groundwater system with adverse impact on future water supplies.

Water management in Agriculture

Agricultural water management becomes increasingly important in the presence of low water supplies because it is usually when consumption by agricultural operations is examined more closely by their respective communities. When agricultural operations are able to incorporate more efficient methods of using water, a greater quantity of drinking water is made available for use by the community at large. A properly designed and managed system has the potential to produce zero-discharge to streams, thus helping to improve water quality and reduce peak flows downstream. Water management refers to economies applied in the usage of water be it ground water or surface and ensures a judicious distribution of water to as many parts of the farm as possible. The objective of water management in irrigate agriculture is to provide a suitable moisture environment to the crop to obtain optimum crop yields with maximum economy in the use of water.

Conclusion

The current rate of population growth, combined with the growing strain on available water resources, India could well have the dubious distinction of having the largest number of water-deprived persons in the world in the next 25 years. This is the scenario if the available resources are not managed judiciously and with care. Urbanization and an ever-increasing population in the recent decades have contaminated water bodies, thus making them unfit for use. These, coupled with growing needs, have led to increasing dependency on ground water. Excessive tapping of ground water, through numerous boreholes, has led to a decline in the water table, whose means of replenishing itself have been greatly hampered. Eighty-five per cent of India's urban population has access to drinking water but only 20% of the available drinking water meets health and safety standards. It is estimated that by the year 2050, half of India's population will be living in urban areas and will face acute water problems. Furthermore, there are serious inequities in the distribution of water. Consumption of water ranges from 16 liters per day to 3 liters per day depending on the city and the economic strata of the Indian consumer.

SUSTAINABLE MANAGEMENT OF WASTE WATER FOR AGRICULTURE

RESEARCH PROBLEM

World population growth is reaching the point where available freshwater is insufficient for the basic needs of mankind (e.g. for agricultural, industrial and urban use). Hence, there is a growing need to utilise low quality water where freshwater is scarce. In this respect, wastewater, which is readily accessible, is a promising resource, for agriculture.

RESEARCH GAPS

- Study on waste water and climate change is very few.
- Little studies are focus on cost and benefits of waste water management.
- Suitable method for waste water management is scanty in earlier studies.
- Earlier studies omit instruments for managing waste water use in agriculture.

Present paper is an attempt to fill these gaps.

RESEARCH QUESTIONS

- Any linkages between Waste water and Climate change?
- What are the Costs and Benefits of Waste water Management?
- Any suitable method is available for waste water use?
- Any instruments are available for managing waste water effectively?

RESEARCH OBJECTIVES

- To examine the linkages between waste water and Climate change.
- To study the costs and benefits of waste water management.
- To frame the suitable method for waste water use in agriculture.
- To analyse the instruments for managing waste water effectively.

METHODOLOGY

The researchers conducted wide literature survey for alternative water resource for agriculture. During the survey researcher finds waste water is creating a great problem to environment and health impact. Foreign countries use waste water for irrigation purposes. Authors' finalised waste water is a good alternative resource for irrigation. It also gives so many nutrients to crops. Hence researchers choose this research problem for the present study. Present study is purely secondary in nature. Resources and

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data collected from library like leading national and global journals, text books, global reports, and web search.

MANAGING WASTE WATER EFFECTIVELY

Inadequate management in turn incurs heaving costs, threatening to undermine these ecosystems. Hence researchers provide proper management for waste water use in agriculture.

1. Economic Policy Instrument

As countries develop their economies, their citizens obtain higher living standards, yet during this process of economic development and industrialization, levels of pollution increase to a point at which citizens begin to demand a higher environmental quality – when measures come in to manage the polluting waste products of many goods (Lee et al, 2010). The construction and operation of waste treatment facilities, including those for wastewater requires a huge amount of capital – acting as a barrier to wastewater management in many regions. Creative solutions are required to finance management over the long term (Rammont and Nurul Amin, 2009). Economic Instruments (EI) are tools which can be used to support regulatory frameworks by recovering some of these costs. They generate market-conforming incentives, both positive and negative, that are directed to bring about behavioural change (Rammont and Nurul Amin, 2009). There are challenges in the implementation of economic policy instruments, in particular that they tend to require a high level of institutional capacity (Russell and Powell, 1996), other challenges include administration, politics, inconsistencies, need for enforcement of legislation and flaws in design (O'Connor, 1998).

2. Ecosystem based Management

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors. Specifically, ecosystem-based management emphasizes the protection of ecosystem structure, functioning, and key processes. It is place-based, focusing on a specific ecosystem and the range of activities affecting it. Ecosystem-based management explicitly accounts for the interconnectedness within systems, recognizing the importance of interactions between many target species or key services and other non-target species. It acknowledges interconnectedness between systems, such as air, land and sea, and it integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependences (COMPASS, 2005).

RECOMMENDATIONS

Countries must adopt a multi-sectoral approach to wastewater management as a matter of urgency, incorporating principles of ecosystem based management from the watersheds into the sea, connecting sectors that will reap immediate benefits from better wastewater management.

Innovative financing of appropriate wastewater infrastructure should incorporate design, construction, operation, maintenance, upgrading and/or decommissioning. Financing should take account of the fact that there are important livelihood opportunities in improving wastewater treatment processes.

In light of rapid global change, communities should plan wastewater management against future scenarios, not current situations.

CONCLUSION

Present paper has concentrated on highlighting links between agriculture and wastewater use. When used as an input into the income generating activities of agriculture, wastewater use has clear economic potential. Researchers wish to highlight three basic concepts that are necessarily the starting point in order to guide policy development in this area at both national and municipal levels. First, it is necessary for governments to accept that wastewater use for irrigation is a common reality and cannot be simply outlawed or ignored. Second, where health standards are adopted, the minimum health guidelines should be appropriate for the local context and not based on standards that are difficult, or too strict, to achieve. Finally, the need to shift policy towards developing appropriate technologies – technologies that are not capital intensive and large-scale – is key. Adopting these three concepts would lay a solid basis for the development of reasonably attainable wastewater recycling options.

RECOMMENDATIONS

Communities must adopt a more holistic approach to wastewater management as a matter of urgency. Incorporating principles of ecosystem-based management into the way communities manage their wastewater is a key to sustainable management. Wastewater management is a sector that will reap immediate benefits from better wastewater management. Innovative financing of appropriate wastewater infrastructure should be a priority in design, construction, operation, maintenance, upgrading and/or decommissioning. Financing should take account of the fact that there are important livelihood and opportunities in improving wastewater treatment processes. In light of rapid global change, communities should plan wastewater management against future scenarios, not current situations.

CONCLUSION

Present paper has concentrated on highlighting links between agriculture and wastewater use. When used as an input into the income-generating activities of agriculture, wastewater use has clear economic potential. Researchers wish to highlight three basic concepts that are necessary for the starting point in order to guide policy development in the area at both national and local levels. First, it is necessary for governments to accept that wastewater use for irrigation is not contradictory and cannot be simply outlawed or ignored. Second, where health standards are identified, the minimum health guidelines should be appropriate for the local context and not based on standards that are difficult or too strict to achieve. Finally, the need to shift policy towards developing appropriate technologies—technologies that are not capital intensive and large-scale—is being highlighted. These three concepts would lay a solid basis for the development of research, analysis, and policy-making options.

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