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WETLANDS – "REFUGE TO EXISTENCE"

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ABSTRACTS

"Civilizations began around wetlands; today's civilization has every reason to leave them wet and wild."[1] Water holds a special place of priority in the list of natural resources due to its strong linkages with the life supporting activities. The mobility of water makes it capable of leaving a visible impact on land, climate, whether, resources and productivity. The hydrological cycle is an example.

Shortage of water is a risk-multiplier. It has the potential to take all the other critical issues we face as a global community and transform their severity into a catastrophe. Reducing poverty, increasing food production, combating terrorism and sustaining economic development are all vital priorities, but it is increasingly clear how rapid depletion of water will make them even more difficult to address. Furthermore, because water is intimately connected with our systemic, unsustainable consumption of natural resources, any decline in the ecological resilience of one resource base or ecosystem increases the fragility of the whole.

The concept discussed in the paper has originated from the fact that water, energy and food are interdependent. It is these three elements which together have the capacity to ensure sustenance of any economy and its sustainable development. With Green Economy as mantra today the paper aims to reveal the multi facet qualities of water in the form of wetlands. It aims to address the problems faced to sustain and conserve wetlands. It plans to bring forward and portray water conservation or wetland construction as a tool for poverty alleviation and upliftment of the life prevailing on earth.

Previous research done in the related fields will be studied to support the concept. Linkages of water with infrastructure / townships, health, food / agriculture and energy will be established with the help of secondary data. Strategies for building sustainable and self sufficient infrastructure will be proposed and discussed.

Population increase will combine with other transformational changes, particularly in low-income countries as rising numbers of people move from rural areas to cities that will need to be serviced with food, water and energy. Half the world's population now lives in urban environments, a figure projected to rise to 60% by 2030[2]. It is estimated that there will be 26 cities with more than 10 million inhabitants in 2025, up from 19 today. Five of these new 'megacities' will be in Asia[3]. The study makes an attempt to address this concern by proposing methods to increase the per capita income of those near and below poverty line and thus eliminate the disparities. "Water and land are two sides of the same coin! – a land should also be considered in the nexus!", said Dr. Holzwarth. Thus the paper proposes the use of wasteland and waste waters to increase economic efficiency. Innovations for the same will be studied and modified as per the scenario of India.
The implications of the proposals will be laid down in non – monetary terms. Future prospects of these plans and proposals will also be mentioned. The cycle of interdependence will be monitored and the concept of inclusive growth will be realized through the Water Economy.

"Greater familiarity with marshes on the part of more people could give man a truer and more wholesome view of himself in relation to nature. In marshes, Life's undercurrents and unknowns and evolutionary changes are exemplified with a high degree of independence from human dominance as long as the marshes remain in the marshy condition. Marshes comprise their own form of wilderness. They have their own life-rich genuineness and reflect forces that are much older, much more permanent and much mightier than man.[4]"

INTRODUCTION

Wetlands have a poor public image.... Yet they are among the earth's greatest natural assets... mankind's waterlogged wealth.[5] This statement clearly highlights the paradox about image and value of wetlands. Wetlands remain one our most misunderstood, and therefore threatened environments. Common misconceptions of wetlands include the idea that they are "wastelands," "disease-infested," and dark and dirty "swamps." Wetlands considered worthless to early settlers were cleared for farmland. Many wetlands, especially coastal marshes, were lost to provide space for manufacturing or shipping. Furthermore were destroyed due to dumping by the people and their ignorance or carelessness. Ultimately, over half of the nation's wetlands have been destroyed.

Wetlands are very important for the existence of life. Wetlands form the transitional zone between land and water, where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in and on it.[6] Scientific definition of wetland is "ecosystems (ES) where water covers the soil or is present at or near the surface of the land for the majority of the year."

Wetlands are highly productive ecosystems. Their values and functions support other ecosystems and are significant to economic development. They once covered large areas of the world and are now among the rarest and most at-risk ecosystems. They are highly valued for their recreational, educational, scientific, aesthetic, spiritual and cultural values; and form an important component of lakes that provide critical functions influencing lake ecological functions. Despite the important roles in sustaining vibrant lake ecology, supporting economic development and elevating poverty, almost all wetlands in the world are threatened by diverse human induced factors.

An environmental assessment of wetlands is a must in order to understand the natural role played by wetlands.

SCENARIO OF WETLANDS IN INDIA

"Hope and the future for me are not in lawns and cultivated fields, not in towns and cities, but in the impervious and quaking swamps."[7] Water resources of a country constitute one of its vital assets. India with 16 percent of the world's population has only 2.4 percent of the world's total area and 4 percent of the total available fresh water. India has nearly 3.5 million hectares under wetlands.[8] Unfortunately, India has lost more than 38% of its wetlands in just the last decade. In some districts, rate has been as high as 88%.[9]

At present India is facing an alarming set of water related challenges. Urban and industrial demands for water are on a rapid upsurge without commensurate increase in the supply. The water challenges for the country and particularly for its states are manifold: (a) improving and safeguarding existing drinking water supplies, (b) managing water demand across competing sectors, and (c) determining environmental requirements and prevention of pollutions[10]. This clearly points out the need for development of water resources, their conservation and optimum usage.

India's freshwater resources comprise the single most important class of natural endowments enabling its economy and its human settlement patterns. The fresh water resources comprise the river systems, groundwater and wetlands. Each of these has a unique role, and characteristic linkages to other environmental entities----- Wetlands, natural and manmade, freshwater or brackish, provide numerous ecological services. They provide habitat to aquatic flora and fauna, as well as numerous species of birds, including migratory species'----- A holistic view of Wetlands is necessary which looks at each identified Wetlands in terms of its causal linkages with other natural entities, human needs, and its own attributes[11]. The availability of fresh water per capita has come down in India from about 5,177 cubic meter per head in 1951 to 1,820 cubic meter per head in 2001 and it is expected to further go down to 1,140 by 2050 AD[12]. An overview of the water scenario in India is portrayed in Figure 1.

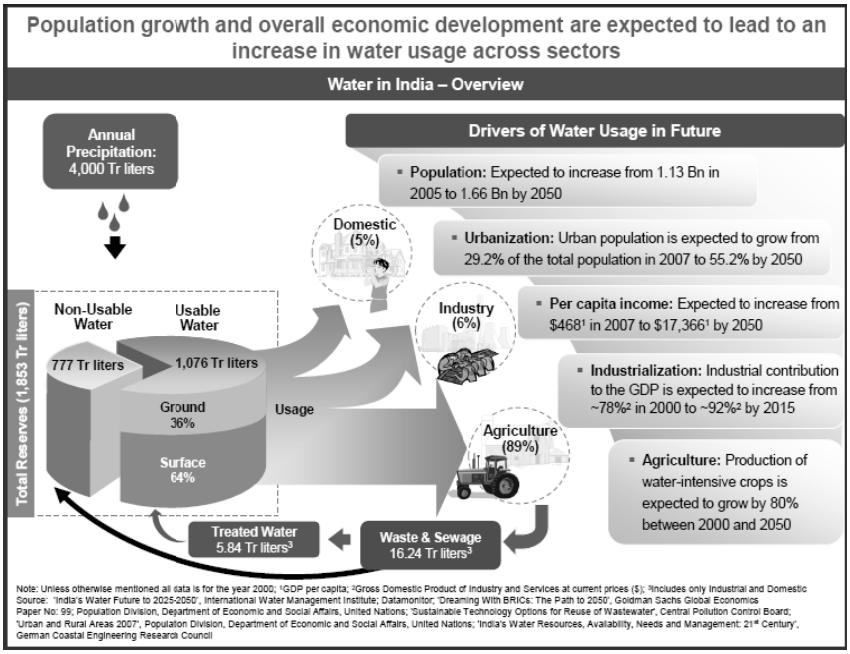

Figure 1.

FOOD SECURITY AND WATER IN INDIA

Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life[13]. Commonly, the concept of food security is defined as physical and economic access to food that meets people's dietary needs as well as their food preferences. In India health problems related to malnutrition and waterborne diseases have become a double burden.

The burden of waterborne disease in India is enormous. A report from the Ministry of Health and Family Welfare estimates that nearly 40 million people are affected by waterborne disease every year that places a large burden on both the health sector and the economic sector. As a consequence, approximately 73 million workdays or US$600 million are lost each year[14]. Although the World Health Organization (WHO) estimates that 900,000 Indians die each year from drinking contaminated water and breathing polluted air, the Indian Ministry of Health estimates 1.5 million deaths annually among 0- to 5-year-old children. Cholera provides another example, with approximately 5 million cases reported by WHO each year[15]. Approximately 73% of the rural population in India does not have proper water disinfection, and 74% do not have sanitary toilets[16]. Freshwater availability in India is also a concern; available water is expected to decrease from 1,820 m3 per capita to < 1,000 m3 by 2025 in response to the combined effects of population growth and climate change.

A few of the reasons for malnutrition are disparities in gender, economic inequalities, imbalance in regional productivity of food-grains etc. The last two are indirectly related to the irrigational facilities and thus water availability for food production in the regions.

The performance of the overall agriculture sector and the factors responsible for the slowdown provide an explanation for the decline in the growth of food production. It may be noted that foodgrains, pulses, oilseeds, sugar, fruits and vegetables, poultry, dairy, meat, fish, etc. constitute the bulk of the output in the agriculture sector. The performance of agriculture is important for availability and access to food as more than 55 per cent people in the country are dependent on this sector. Agricultural growth in India was high from the Fifth Plan period to the Ninth Plan period – highest being in the Sixth Plan period, at around 5.7 per cent. If we consider longer periods, growth of agriculture decelerated from 3.5 per cent between 1981-82 and 1996-97 to around 2 per cent between 1997-98 and 2004-05, although there have been signs of improvement in recent years[17].

There are both short run and long run problems in Agriculture. Due to the misassumption of people farming is gaining popularity as a non-developmental activity. Thus, people are moving from farms to allied and other sectors. There is no or very little scope of increasing the net sown area. Land degradation in the form of depletion of soil fertility, erosion and flooding has increased. There has been decline in the surface irrigation expansion rate and a fall in the level of the ground water table. These have resulted in a high order of volatility in prices. Disparities in productivity across regions and crops; between rainfed and irrigated areas has increased. Huge decline in per capita land availability and shrinking of farm size are also responsible for the agrarian crisis. Land issues such as SEZs, land going to non-agriculture, alienation of tribal land etc. are becoming important.

The Steering Committee report on agriculture for the Eleventh Plan has identified the possible reasons for deceleration in agriculture since the mid-

1990s. According to the report, the major sources of agricultural growth are: public and private investment in agriculture and rural infrastructure including irrigation, technological change, diversification of agriculture, and fertilizers. It seems that progress on all these fronts has slowed down since the mid-1990s. Though a 4% growth has been witnessed in 2007-2008 yet it is not sufficient enough to reduce the crisis[18]. Figure 2 captures the change in various inputs and determinants of agriculture. It can be observed from the figures that there has been a heavy decline in the area under irrigation. This is due to the intense competition between industrial, domestic and agriculture sector for allocation of water.

Trend growth rate in area, input use, credit and capital stock in agriculture (1980-81 to 2005-06)

	1980-81 to 1990-91	1990-91 to 1996-97	1996-97 to 2005-06
Technology	3.3	2.8	0.0
Public Invest.	3.9	1.9	1.4
Private Invest.	0.6	2.2	1.2
Irrigated Area	2.3	2.6	0.6
Area under Fruits and veg.	5.6	5.6	2.7
NPK Use	8.2	2.5	2.3
Credit	3.7	7.5	14.4

Source: GoI, 2007

Figure 2.

There exists a direct correlation between water content and agricultural productivity. Moreover agricultural sector employs a huge percentage of population of India. Due to the uncertainty of production the wages are still not as high as the other sectors. Thus land and water management along with diversification to rural non-farm structure need to be given a higher priority. Investment in irrigation, watershed development, and water conservation by the community are needed by way of water management.

ENERGY AND WATER IN INDIA

Water availability in India varies substantially over regions and time. Ground water occurrence in the country is also highly uneven due to diversified geological formations with considerable variations, complex tectonic frame work and also climatological variations. This is why Indian has not been able to satisfy the most basic need of safe drinking water for all its citizens. The annual requirement of water for different uses India are as in Figure 3.

Source: NCIWRD Annual water requirement (BCM) for different uses

	Year 2025			Year 2050		
Uses	Low	High	Percentage	Low	High	Percentage
Irrigation	561	611	72	628	807	68
Domestic	55	62	7	90	111	9
Industries	67	67	8	81	81	7
Power	31	33	4	63	70	6
Inland navigation	10	10	1	15	15	1
Environment – ecology	10	10	1	20	20	2
Evaporation losses	50	50	6	76	76	7
Total	784	843	100	973	1180	100
Population (million)	1286	1333		1346	1581	

Figure 3.

Domestic contribution to the total water consumption is projected to increase from 5% in 2000 to 11% by 2050. Domestic consumption of water is expected to triple from 2000 to 2050. Per capita water consumption is expected to double from 89 liters/day in 2000 to 167 liters/day by 2050. Cities are facing severe water shortage. Cities are reaching out to distant water sources, e.g., Delhi and Chennai receive water from rivers that are 250 Km and 450 Km away, respectively. Untreated sewage from cities is leading to severe water pollution. As a result reliability on underground water has been ever increasing. This is lowering the water level of the aquifers and the pumping cost is increasing with the increase in depth. As inflow to the aquifers is and long run process whereas outflow from aquifers can be achieved in no time.

Groundwater irrigation, which expanded rapidly in the last few decades, forms a major part of the water withdrawals in many river basins. At present, more than 60 % of the total irrigated area is groundwater irrigated. However, with relatively higher project efficiencies than surface irrigation, groundwater contributed to only 45 % of the total irrigation withdrawals. Still, due to over-abstraction, some basins are facing severe regional water table depletions[19].

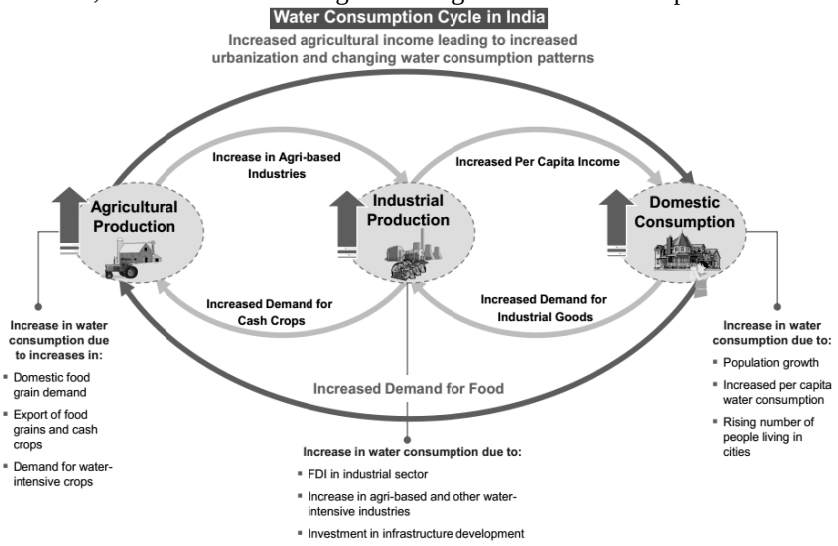

Figure 4 source: Grail Analysis

Figure 4. shows that how the water consumption cycle in India would grow and result in acute water scarcity if not checked today. The Government of India has come up with plans to link the river basins so as to trap the untapped water and meet the demands of its citizens by increasing supply. This proposal has a major drawback. It requires land for construction of dams and canals. Appropriate location needs to be sorted so as to build the linkages in the basin. This in turn would reduce the land availability for farming and increase the pressure on vulnerable natural sources of water i.e. rivers. The cost of desalination and purification are also quite high. Thus a way needs to be devised where the expansion can be done without increasing pressure on the existing sources.

ARTIFICIAL WETLANDS

Wetland construction would be an excellent solution to the above mentioned problems. Artificial wetlands would not only provide subsistence to the naturally occurring water bodies but would also create rural non-farm opportunities for the villagers. These would be minor projects and can be thus taken on individual, co-operative or panchayat basis. The cost incurred on their construction would be less than the major projects or desalination of water. The construction would also provide rural non-farm opportunities.

THE PROPOSAL

Plan I

The concept of artificial wetlands has been taken up in this paper from the concept of Johads. Johads were kind of water logged wetlands which were either depressions on the land or existing lakes. The cost incurred in construction is extremely less. This is because the tools used are mostly mechanical and not automated or technical. The labor employed also need not be literate or technically trained. The illiterate and unskilled manpower can be employed generating opportunities of employment for the rural and landless people.

The proposal aims at use of non-cultivable, degraded and wasteland for the construction of wetland. This would take care of the fact that the net sown area is not reduced. Thus there would not be a reduction in the production due to non-availability of cultivable land. Construction of the wetland on a little higher landscape would be more beneficial in terms of ease in water distribution without requiring much of extra power/energy.

In case of small lands or scattered land availability construction of deep wells would be an excellent solution. Under the Convention on Wetlands (Ramsar, Iran, 1971) "wetlands" are defined by Article 1.1 as:"For the purpose of this Convention wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres."Article 2.1 provides that wetlands:"may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands".

Water can be drawn from these wells with the help of mechanical, geothermal or solar water pumps. This can further be collected in a neighboring tank of reservoir and later used for irrigation or domestic supply to the rural houses.

The construction of these water bodies is economically affordable and a boon to maintain the ecological balance. These depressions and well would collect the rain water. This water can be used in dry season or when there is no rainfall. Gradually the artificially constructed water bodies become a part of the natural ecosystem. Their contribution towards groundwater recharge and flood control

becomes noticeable. As a result the soil of the surroundings regains its humidity and becomes cultivable.

Plan II

Collection of brackish water and its purification is another way of constructing a wetland. The duckweed technology is very effective in purification of water. The water can be further used for fishery and thus made odorless by reapplying the duckweed therapy. This would require setting up of small ponds which are interlinked and uninterrupted supply of waste water. This system would not only recycle water at a lower cost and in a natural way but also provide a source of income as well as food to the society. The duckweed technology is very effective and can be practiced even in shady areas. The depth of the pond can be managed from time to time and the soil removed from the bottom can be used as organic fertilizer.

Adoption of either of the two techniques is not possible for the Government alone. Private participation needs to be encouraged to develop a more resilient and sustainable ecosystem. This needs to be done on the individual basis. The farmers need to be given proper help and support for construction of such wetlands on their farms in case the land is uncultivable. The farmers with small holdings of wastelands can together form a co-operative and run water purification based on duckweed technology. This would provide them a source of income by pisciculture, aquaculture and supplying water to the neighboring households. These methods in turn would help generate the geothermal energy and contribute to less consumption of electricity.

Limitations

1. Not all lands can be converted to Johads, watersheds and wetlands. One can expect to find wetlands in the following places:
   - In low areas with a high water table.
   - On slopes where groundwater breaks out as springs or seeps.
   - Near rivers, streams, lakes, and the Great Lakes.
   - In flat areas where clayey soils or bedrock close to the surface form an impervious layer that creates a "perched" water table.
   - In abandoned ditches or stream channels.
   - In abandoned lands, wastelands and uncultivable lands.
2. Farmers need to be educated about the existing alternatives to agriculture.
3. Rural India still does not the skills and knowledge to make hay out of waste.
4. Proper planning and technical guidance is a must for construction of any sort of wetlands.
5. These projects cannot be initialized without monetary backup and there is no provision of credits for such activities.
6. The returns are not visible explicitly in the initiation phase and thus patience is required for the ecosystem to change.
7. The direct advantages to the owner are less and thus the benefits are monetarily unaccountable.

The limitations mentioned above reduce the view of incentives associated with the wetland construction and thus external motivation is a mandatory to take up and encourage such activities.

CONCLUSION

The most important lesson of the 2008-09 global economic slowdowns is that food security is of supreme national importance for maintaining social harmony, national integrity and sovereignty of India. India’s population is expected to increase continuously. First and foremost result of the increasing population is the growing demand for more food-grains and allied agricultural produce. It

results in expanding area of land under the crops especially high yielding crop varieties. It is estimated that the production of water-intensive crops is expected to grow by 80% between 2000 and 2050.

In India during 1989-90 to 1997-98 structural changes have pushed up the energy intensity index while conservation measures pulled it down after 1995-96. Annual per capita consumption of power is expected to reach its maximum level as compared to present installed power generation capacity. As per the ministry of power, thermal power plants which are the most water-intensive industrial units, constitute around 65% of the installed power capacity in India. Industrial water consumption is expected to shoot up its growth between 2000 and 2050.

All of this will result in increased consumption of water. That is why there is urgent requirement to address the issue of water scarcity in India to make better policy decisions which will affect its availability in future. This cannot be achieved with focus on major projects. Thus the new focus in policies and Command Area Development Programme should be on medium and minor projects. Water shed development and water management projects should be designed in such a way so as to fulfill the mantra of the millennium *"INCLUSIVE GROWTH"*.

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[1] Edward Maltby, Waterlogged Wealth, 1986.

[2] UNPD (2007).

[3] UN-HABITAT (2008).

[4] Paul L. Errington, Of Men And Marshes, The Iowa State University Press, Ames; 1957; 150 p. ISBN 0813829291.

[5]Edward Maltby, Waterlogged Wealth, 1986.

[6]Cowardian, L.M., Carter, V., Golet, F.C., and LaRoe, E.T. 1979. "Classification of wetland and deepwater habitats of the United States.", FWS/OBS-79/31. U.S. Fish and Wildlife Service, U.S. Department of the Interior. Washington, D.C.

[7] Thoreau, Henry David, Walking, 1862.

[8]Space Application Centre, 1992 – 1993.

[9] V.S. Vijayan (2004), Inland Wetlands of India: Conservation Priorities, SACON (Salim Ali Centre for Ornithology and Natural History).

[10] Raju K.V (2010) "Sustainable Water Use in India: A Way Forward", in Agriculture, Food Security, and Rural Development, Asian Development Bank, Oxford University Press.

[11] National Environment Policy, 2006

[12] Sankarnarayan, K. (2005) "Urban Water Supply – Challenges Ahead" Presentation made in the XII World Water Congress of the International Water Resources Association held on November 25-26, 2005.

[13] Food and Agriculture Organization (FAO).

[14] Mandal K 2008. Drinking Water Supply vis-a-vis Technological Interventions for Social Empowerment of Rural India.

[15] Zuckerman JN, Rombo L, Fisch A. 2007. The true burden and risk of cholera: implications for prevention and control. Lancet Infect Dis 7:521–530.

[16] International Institute for Population Sciences and Macro International 2007. National Family Health Survey (NFHS-3), 2005–06: India. Vol 1. Mumbai: International Institute for Population Sciences and Macro International.

[17] GoI (2008), "Draft 11th Five Year Plan", Planning Commission, Government of India.

[18] GoI (2007a), "Report of Steering Committee on Agriculture for the XIth Plan", Planning Commission, Government of India.

[19] Amarasinghe, U.A.; Sharma, B.R.; Aloysius, N.; Scott, C.; Smakhtin, V.; de Fraiture, C. 2005. Spatial variation of water supply and demand across river basins of India. Research Report 83. Colombo, Sri Lanka: International Water Management Institute.

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