DIMENSIONS OF WATER

Harsimrat Kaur Gill*

Abstract

Water is an essential and vital component for the survival of every existed thing on Earth. Billions of years ago its birth took place in the form of vapour with the formation of Earth's atmosphere. Eventually with time due to appropriate conditions it becomes the part of varied processes such as *evaporation, condensation, precipitation, deposition, runoff, infiltration, sublimation, transpiration, melting and groundwater flow etc* and thus, able to established its identity as ***hydrosphere***. Main component element of hydrosphere i.e. water journeyed through atmosphere, biosphere and lithosphere, and achieved its existence with 71% earth coverage and made our earth to earn its nomenclature 'Blue Planet'. Here, directly or indirectly it played a role of **life savior agent** for biospheric elements including human. Transformation of this molecular H_20 to water resource can be understood through its vital importance for human existence, this can be estimated from the locational attribute of early civilizations. Historical facts revealed that ancient human footprints found near or at the source of water in the form of river valley civilizations such as Mesopotamia originated between the Tigris and Euphrates rivers in the Middle East; Egypt near the river Nile; Indus along the river Indus and Shang along the Huang or Yellow river in China. With passage of time progress of human civilization happened in the form of development activities. For making the developmental processes smoothen human beings started disintegrating and coalescence of natural landscape into the administrative hierarchies. These administrative jurisdictions are inhabited by numerically progressive human growth and adversely affected by the ever increasing related demands. For fulfilling these requirements, human started doing **Re 'Source'** generation through modification, improvement and development of new avenues through damming and channelizing of river water. That gave birth to **water conflicts**. Water conflicts are directly related with the water resource exploitation procedures and prevailing political and socio-cultural conditions. Journey of chemically

* Center of Advanced Study in Geography, Panjab University, Chandigarh-160014, India.

configured H_2O to indispensable water resource was pure, until it enters in the **Human Sphere**, here it encounters with political, socio-cultural and economic sub-spheres, where human as a responsible being of this planet acts as a **deteriorator agent** for water.

Thus, water is not limited in its chemical bonding, its flowing passage in natural entity worked as a **binding thread** for culmination of civilizations on one side and on other side its movement in human entity made it to acts as a **divergent agent**. Here it becomes the soul cause of disputes between the countries, states, villages and local users over the issue of share distribution. These disputes can only be sort out with adaptation of **sustainability** in water utilization**.** So, multifaceted characteristics of water helped in the expansion of its horizons and made it to rightly entitle as **'precious gift of nature'** to earth's creature.

Key Words: Water resource, water stress, water crisis, water conflict, water right, sustainability.

Introduction

Drop by drop a passage is covered and then takes a form of 'rill', that rill adjoins the 'gullies', gullies collaborates with each other and formed a 'stream', that stream filled and expands its way and shaped itself into a 'river', these river after covering a long distance on land from its source of origin get merged into the 'oceans'. Flowing water in the form of river is a nature's precious gift, which transformed to resource, when entered in human sphere due to its high economic, social, spiritual and aesthetic values (European Food Safety Authority, 2010 and Ioris, 2013). A river body works as a magnet because of inherited attributes such as *riparian vegetation*, that adds aesthetic value to riverine landscape, various *drains* as a water carrier to river, *wetlands* purifies the river relatives resides underground in the form of sub surface water and became important source of potable water (Singh et al., 2014), *soil*, which was rejuvenated with every deposited alluvium and add fertility ingredient to this landscape. All these pull factors attracts and add variety of species to that place, while itself acts as habitat to them. All species from small insects to big giants lived there and thus a life sustained, which depends upon the 'flowing water' that becomes the important strand of this whole process. Thus, molecular H_20 proved its worth and turned as a 'resource'. But twist in tale originated, when resource dependency increased and bypassed 'source' sustaining capacity. Here, main focus is on water dependent element i.e. 'human', whose inconsistency to its utilization and management reached at recessed

and depressed level. This leads to degradation of that existed natural resource. But, with time this super brainy creature awakens and understands its ill deeds, somehow felt guilty. Finally, they start doing progressive work related with the improvement of their skills towards the natural resource utilization and management. Many councils, committee, panels, conferences, debates, reports and projects were happened and going on. Major concern of all these discussions is on finding the path of progressive human journey, which has been destined to 'development', while enjoying natural resources on a ride of sustainability conveyance.

Transition from H_2O to Water Resource

Billions of years ago our planet system generated from the gaseous clouds. Its formulation was centre of concern for many disciplines and many scholars manifested their ideas with scientific base and framed theories of earth origin, which includes Kant- Laplace nebular hypothesis (Bodenheimer, 2006), Tetrahydral hypothesis by Lowthian Green (1875) and Planetesimal hypothesis by T.C. Chamberlain (1904) etc. With earth formulation it fumed so many gases, which helped in forming our atmosphere. One of the important is water vapour. This water vapour get condensed and formed varied clouds, some of them bring precipitation, which reached on surface and becomes the part of ponds, lakes, rivers and oceans through their movement in the form of run off. Some part infiltrates and filled the sub surface aquifer. This surface and sub surface water evaporates, get condensed and precipitated. Thus, this cyclic hydrological process continued and resulted to the presence of its 71% share on earth. Its distribution figures revealed its limited availability on earth as only 2.5% of its volume is present in the form of fresh water and remaining 97.5% is saline in nature (Gray, 2000). This crucial 2.5% water is having so much importance to human as reflected from figure 1. Water as a resource played indispensable role in our varied societal sectors such as in agricultural sector, irrigation cannot be done without water, in aquaculture fish dwell only in water; in Industrial sector it is used in power plants, ore and oil refineries and manufacturing plants; in domestic area drinking, washing, bathing etc cannot be done without it; development of beautiful sites and recreational activities along the water bodies promotes tourism sector and navigation of folks and transportation of loges done through water. Thus, all these uses added socio-cultural, economic, political and aesthetic value to this molecular form and crowned it as precious resource (figure 1).

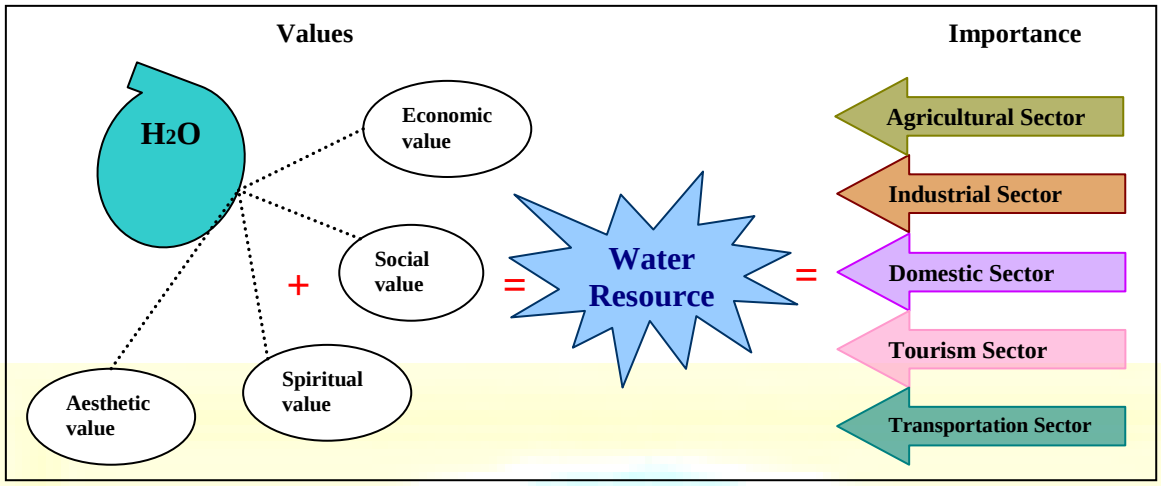

Figure 1: Transformation Journey of Molecular H_2O to Water Resource

'Water' a Binding Thread or a Divergent Agent

Available water resources are not equally distributed on the surface. Some continents, countries, states, villages are benefited more as compare to other. Presence of this source specifically in the form of rivers acts as a natural gravitational agent to human (Vallentine, 1967). These rich stakeholders in terms of water resource utilizer need to share this essential resource. Human beings then started forming dams and canals to channalizing the water to the dried areas, but this whole process get affected by the emergence of water conflicts (figure 2).

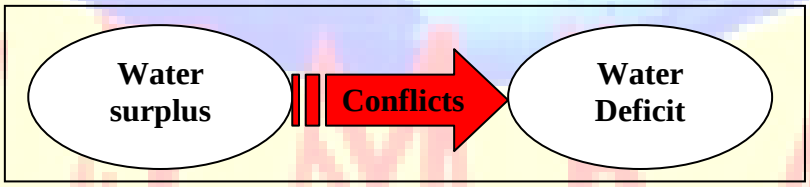

Figure 2: Water Conflict

Wood (2007) explained some conditions that can create water conflicts such as:

- At planning level of the new project, issues related with the sharing of cost and benefits.
- At utilization stage, water becomes a matter of dispute among its users, when a. There is a change in the hierarchy of users, but resource remains constant; b. Users demands increases or available resource diminishes.

These conditions of water conflicts between its users occurred at micro scale, when source is a tank or a village well and at macro level, when source is a lake, river or a dam. Among all this conflict situations and scale, river water distribution issue is prominent. Sharing of river water

across the political boundaries creates conflict situation (Mohan et al., 2010). Around 261 rivers in the world shared by more than one nation and made it an issue of stress, specifically political tensions among nations such as between Arab and Israel; Indians and Pakistan; India and Bangladesh and all ten riparian states of the Nile River (Wolf, 1998). Major reason of water conflicts is the distribution of water among its stakeholders as any change in upstream utilization pattern affects the quantity in downstream part. Available water supplies are challenged by the increasing population growth, progressive industrialization, expanded consumerism and pollution. Climate change phenomena, which occurred naturally and accentuated with the implications of human progressive steps also affect the quantity of water resource (figure 3).

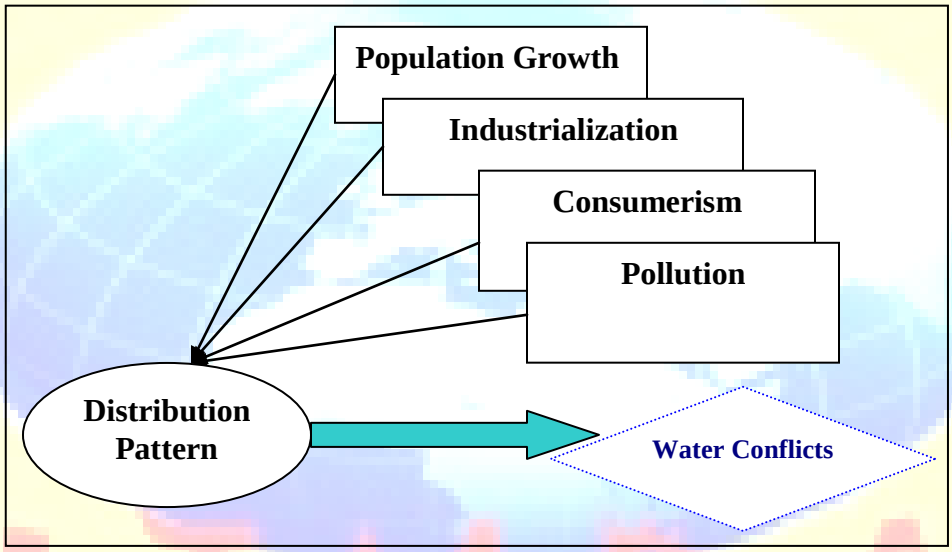

Figure 3: Reasons of Water Conflict

Assessments done on the relative effect of climate change and population growth on future global and regional water resources revealed that stress can be increased in those parts of the world, where run off is decreased, it included Mediterranean region, parts of Europe, central and southern America and southern Africa, where as southern and eastern Asia was attributed with increased run off with reference to wet season. This difference affects the water stress of an area and depicts the distinction between actual and perceptive water stresses that further influence the proposed water resource management policies and plans (IPCC, 2000).

Water Resource and its Depletion: A Glimpse from Satluj River

Satluj River originated from Lake Mansarovar situated in Tibet is approximately 1500 Km long (The Great Soviet Encyclopedia, 1970-1979) and drains 55000 Km² catchment area in Himalaya (Wulf et al., 2012). It watered from melting of glaciers and precipitation and its flow gain momentum from rugged topography. Its movement through Himalayan hillocks accentuates its erosive power and carrying capacity of that load, which was reduced simultaneously while entered in plains. In plain terrain, its suspended particles in the form of sand, silt and clay etc weight more than its carrying capacity, which leads to the deposition of that load. Frequent depositional river action renewed alluvium deposits and creates fertile floodplain landscape. Productive soil and water availability made this area attractive to pioneer of Indus valley civilization in about 1500 B.C (Maclagan, 1885). Locational attributes provide boost to the agricultural activities, which helped them in sustenance and promote food security, which leads to the expansion of human number.

In the journey of human life, balance with nature is must for healthy growth. But, human's greedy instinct towards natural resource exploitation with unconscious attitude towards sustainability made them reached to the imbalanced situation. In this situation human number exceeds the carrying capacity of natural environment. So, for further sustenance human started doing re-source generation such as canals and dams formulation etc. Channelizing of canals from 'Panchnad' region started after the British annexation in Punjab during 1849. In early eighties Sirhind canal was derived from the left bank of the Satluj river; Lower Sohag, Para and Sidhnai canal branched from Satluj below its confluence with the Beas. In 1920's, surplus water of river Satluj below its confluence with Beas was channalized through four weirs, from north bank Dipalpur, Mailsi and Pakpattan canal and from south bank, the Eastern Gang, Sadiqia, Fordwah, Bahawal, Abasia and Panjnad canals were derived (Fowler, 1950). This whole unified irrigation system faced turmoil, when India-Pakistan partition took place in 1947 and canal water disputes started over its distribution among two nations. On this issue India put forth its claim with reference to riparian and equity right, whereas Pakistan validate it's right in accordance with before partition authorized share of westward flowing rivers to Pakistan Punjab and benefits in terms of volume increase in water by any storage work along the rivers (Fowler, 1950). This legal fight continuous for years and with accordance to final award of Indus water treaty (1960) around 80% water of Indus system allocated to Pakistan and 20% to India. Here, this instance reflects how water becomes the ***agent of crises*** among the two nations, but story didn't end yet.

Conflicts on Satluj river water allocation at inter state level in India is still the issue of concern. This emerged with the implications of the Punjab Reorganization Act, 1966. According to this act Punjab was disintegrated into Punjab, Haryana and Himachal Pradesh. Thus, flowing water shared between the states and creates inter state river water distribution disputes. One of them is construction of Satluj Yamuna link canal to enable the Haryana to use its share of water (Iyer, 2007). This illustration shows how water became the matter of conflict between its users. Its availability played a crucial role in the advancement of Green Revolution. For understanding, how water was being exploited by human for sustaining its growth, small parcel from Punjab Satluj floodplain was taken as study area. This 104275.1 hectares area geographically covers 30°52' N to 31°03' N and 75°39' E to 76°30' E latitudes and longitudes respectively. Administratively it includes some parts of Phillaur tahsil of Jalandhar district, Nawanshahr and Balachaur tahsils of Shahid Bhagat Singh Nagar district, Rupnagar tahsil of Rupnagar district and Ludhiana West, Ludhiana East and Samrala tahsils of district Ludhiana. This selected floodplain entity was characterized by Satluj river, drains, fertile alluvium soil and ample subsurface water. On this surface population pressure was increased with time i.e. 2,00,753 population in 1961; 6,15,423 in 1971; 9,55,866 in 1981; 15,08,338 in 1991; 19,74,463 in 2001 and 21,98,128 in 2011. These increasing figures made this landscape changed in terms of land utilization, which was happened while channalizing Satluj River water, digging up of tube wells and wells in this area. Construction of Sirhind canal in 1883-84 was one of the initiatives with reference to the promotion of the agricultural sector in this area. According to the written records more than 30,000 acres of cultivated area was increased by 1901 due to the formation of Sirhind canal (Imperial Gazetteer of India, 1908, Vol. XVI, p. 204). During 1955, around 574 wells were digged in study area, which results in the promotion of 36258.07 hectares agricultural land in study area with its 34.77% contribution to total land use and land cover categories. This field pressure was increased to 91305.86 hectares and shared 87.56% of floodplain area during 2012. This changing statistical figure both in terms of human number and agricultural land expansion reveals the extensive pressure on land and water resources. Adverse impact of all these activities on water resource can be estimated from the decreased aquifer level. During 1970, ground water table depth was ranged between 1 to 12.33 meters below surface level, which was drastically increased and ranged between 2.75 to 33.47 meters in 2012. Waterlogged area was developed along the canals and drains, 12927.52 hectares (98.7%) wetland area was depleted and 3483.84

hectares (56.1%) area under natural rivulets was lost in the time span of 1950 to 2011. Chemical values have been added to left water sources in terms of water pollution. This is a life supporting system, it required harmonized approach of utilization and balance should be maintained between various sectors of human interest (Thomas and Goudie, 2000) for sustaining this resource (Delpla et al., 2014) for coming generations.

All these temporal changes along the river channel put forth the question of river management. There is a need to change the management ways, as majority of river channels were managed as definitive and static entities instead it should be taken as a dynamic component of nature which continuously modifying its surrounding landscape (Downs and Gregory, 2004).

Link between Water resource and Human through 'Sustainability'

Sustainability is an applied tool for attaining effective management. It is a holistic approach, which can establish appropriate link between social and economic development, while providing protection to natural ecosystem. United Nation took efficient measures in the form of decision making, which was discussed during various international conferences that involved 1972, United Nations Conference on the Human Environment in Stockholm; 1977, UN-sponsored Conference on Water at Mar del Plata, Argentina; January 1992, International Conference on Water and the Environment in Dublin, Ireland; June 1992, United Nations Conference on Environment and Development in Rio de Janeiro (Calder, 2006). All these conferences mainly focused on the development of new approaches, while considering each and every aspect of the water through political commitment and people participation. It opens up two important horizons i.e women role in water management and recognition of water as economic good with economic value. These are the forwarding steps of sustainability for attaining the equitable share distribution among society, while promoting economic growth through community participation (figure 4).

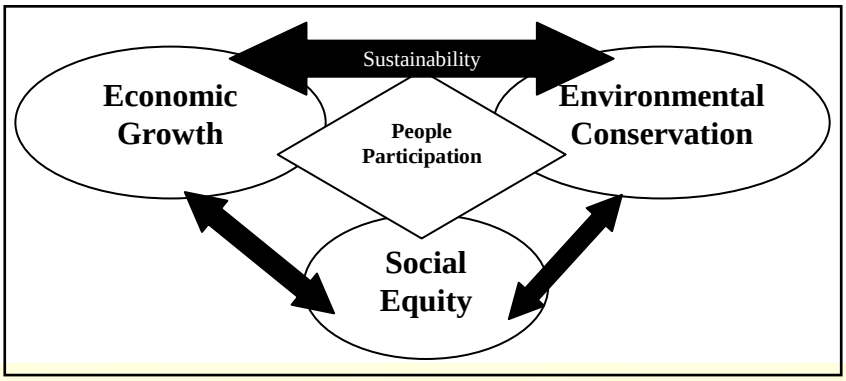

Figure 4: Human-Resource Link through Sustainability

Thus, it is required to formulate a comprehensive framework for providing practical assistance to the philosophical approaches. Theoretically these approaches involved a broad horizon of participation from all sectors. It should value the 'water' economically and also respects its spiritual and aesthetic dimensions. Initiatives must be taken towards the sustenance of its natural physical form for maintaining its purity.

Conclusion

Yes, without water one cannot imagine ones life on this planet. This valuable element with inherent life savior characteristics is highly vulnerable to the extrinsic disturbances. These disturbances mainly caused by human, results into the situation that accentuates the water scarcity that leads to water stress and proliferates water wars or water crises. No doubt, resolutions were generated to resolve these issues occurred at local, regional and global level with the help of legal decisions and government inputs such as riparian right, doctrine of prior appropriation and principal of equitable distribution etc. All these efforts cannot bring fruits until the conscious participation of human towards this issue, while applying eco friendly and sustainable approach in resource utilization and management procedures.

Acknowledgements

I would like to thank Prof. Karanjot Kaur Brar, Geography Department, Panjab University, Chandigarh (India) for providing me guidance and supportive work environment. Author is grateful to University Grants Commission for financial assistance.

References

1. Bodenheimer, P., 2006, Historical notes on planet formation in Planet Formation: Theory, Observation and Experiments edited by Hubert Klahr and Wolfgang Brandner, Cambridge University Press, United Kingdom, pp1-8.
2. Calder, Ian R., 2006, Blue Revolution: Integrated Land and Water Resource Management, 2nd edition, Earthscan Publication Limited, United Kingdom, pp 29-62, 76-77.
3. Delpla, I., Monteith, D T., Freeman, C., Haftka, J., Hermens, J., Timothy, G., Baurès, E., Jung, A., and Thomas, O., 2014, A Decision Support System for Drinking Water Production Integrating Health Risks Assessment, International Journal of Environmental Research and Public Health, 11, pp 7354-7375.
4. Downs, Peter W., and Gregory, Kenneth J., 2004, River Channel Management: Towards Sustainable Catchment Hydrosystems, Oxford University Press, New York, pp-3-19.
5. European Food Safety Authority (EFSA), 2010, Scientific Opinion on Dietary Reference Values for water, EFSA Journal, 8(3), pp 36-38.
6. Fowler, F.J., 1950, Some Problems of Water Distribution between East and West Punjab, Geographical Review, 40(4), pp 583-599.
7. Gray, N.F., 2000, Water Technology: An Introduction for Scientists and Engineers, Viva Books Private Limited, New Delhi, pp 34-41.
8. Imperial Gazetteer of India, 1908, Volume XVI, Oxford University Press, London, pp 199-209.
9. Intergovernmental Panel on Climate Change, 2000, IPCC, 2000: Emissions Scenarios, A Special Report of Working Group III of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
10. Ioris, Antonio. A.R., 2013, The value of water values: Departing from Geography towards an interdisciplinary Synthesis, Geografiska Annaler: Series B, pp 323-337.
11. Iyer, Ramaswamy R., 2007, Towards Water Wisdom: Limits, Justice, Harmony, Sage Publications, New Delhi, pp 95-106.
12. Maclagan, R., 1885, The Rivers of Punjab, Proceedings of the Royal Geographical Society and Monthly Record of Geography, New Monthly Series, 7(11), pp 705-719.

13. Mohan, N. Shantha, 2010, Locating Transboundary Water Sharing in India in Mohan, N. Shantha; Routray, Sailen and N. Sashikumar edited River Water Sharing: Transboundary Conflict and Cooperation in India, Routledge, New Delhi, pp 3-22.
14. Singh, C. K., Kumari R., Singh, R. P., Mukherjee, S., 2014, Geochemical Characterization and Heavy Metal Contamination of Groundwater in Satluj River Basin, Environmental Earth Sciences, 71, pp 201-216.
15. The Great Soviet Encyclopedia, 1970-1979, 3rd edition, The Gale Group, Inc. http://encyclopedia2.thefreedictionary.com/Sutlej+valley. Accessed 24 February 2014.
16. Thomas, D.F., and Goudie, A., 2000, The Dictionary of Physical Geography, Third Edition, Blackwell, Oxford, pp 176.
17. Vallentine, H.R., 1967, Water in the Service of Man, Harmondsworth, Penguin Books.
18. Wolf, Aaron T., 1998, Conflict and Cooperation along International Waterways, Water Policy, 1(2), pp 251-265.
19. Wood, John. R., 2007, The Politics of Water Resource Development in India- The Narmada Dams Controversy, Sage Publication India, New Delhi, pp 36-55.
20. Wulf, H., Bookhagen, B., and Scherler, D., 2012, Climatic and geologic controls on suspended sediment flux in the Sutlej River Valley, western Himalaya, Hydrology and Earth System Sciences, 16, pp 2193–2217.