

THE GANGES RIVER: SYMBOLOGY, SUSTAINABILITY, AND THE
CONFLUENCE OF CULTURAL AND FLUVIAL CONNECTIVITY

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Abstract

The Ganges River Basin is one of the largest in the world and is also one of the most spiritually and religiously connected to society. In order to understand the extensive relationship between the Ganges River and those who live in its basin, I will employ a framework based on The Six Degrees of Connectivity, a tool commonly used in the study of rivers. Through a detailed literature review this paper will analyze and address the anthropogenic influences on the river. Although each of the six degrees are equally important when examining river systems, for the purposes of this paper three will be analyzed in depth: longitudinal connectivity, lateral connectivity between the river and the floodplain, and vertical connectivity between the river and the atmosphere. Through these parameters, this paper will examine how the values, management systems, socioeconomic stratification, political marginalization, and livelihood of the population are effected geospatially within the Ganges River Basin. This research is pertinent to cultural ecology, as well as river basin management, because it demonstrates that cultural connectivity and fluvial connectivity should be analyzed in conjunction with one another for a more holistic understanding of the system. The definition of the river's significance does not solely rely on its physical magnitude, or the volume of water that is transported, but its significance must also be evaluated in terms of its cultural magnitude. The Ganges River is not simply a resource for consumption and use, but is essential to Indian culture through the lenses of spirituality, symbology, and moral regard.

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The Ganges River: Symbology, Sustainability, and the Confluence of Cultural and Fluvial Connectivity

Introduction:

The Ganges River Basin is the third largest river basin in the world covering an area of about 1.75 million km², and also has the largest delta in the world at 105,000 km² (Renaud et al. 2013). The river's size mirrors the size of the ever increasing proximate population, and this only enhances the need for water:

This international basin falling within the national territories of Bangladesh, Bhutan, India and Nepal is of very high importance globally the total population (536 million) is larger than that of either NAFTA or the EU and its growth rate remains high; and it is the largest pocket of poverty in the world (the UNDP poverty index ranges from 55% in India to 86.5% in Bangladesh). Water is a central resource in the region and must be the key to its development. (Biswas et al. 1998, 275)

Conservation of water, as well as the preservation of livelihood are the main factors at risk in the balance within the Ganges River Basin, each being equally important to uphold. With so many people living in poverty under such meager conditions, a heightened connection between the residents and the river evolves into an even stronger dependence.

The term "livelihood" has an inherent dual definition within the confines of the Ganges River Basin. On the one hand, livelihood with regard to the river can be interpreted as an immediate medium of survival. Water is essential for human existence and as the Ganges River is the main watercourse in Northern India, its ability to determine the way in which the population lives cannot be understated. However, matching the direct need for water to survive, is the spiritual livelihood of the population. The Ganges River, also known as the Goddess Ganga in the Hindu religion, is one of the

most sacred rivers in the world. Its waters are often accessed to purify Hindus of their sins, it is a “river that nurtures, heals and rejuvenates,” (Uttaranchal Tourism Development Board, 2004: 29 and is used to guarantee safe passage into the afterlife. The Ganges River is present in the lives of those who live within the basin, past, present, and future:

The Ganga, especially, is the river of India, beloved of her people, round which are intertwined her racial memories, her hopes, and fears, her songs of triumph, her victories and her defeats. She has been a symbol of India’s age-long culture and civilization, ever-changing, ever-flowing, and yet ever the same Ganga...the Ganga has been to me a symbol and a memory of the past of India, running into the present, and flowing on to the great ocean of the future... (Nehru qtd in Uttaranchal, 2004: 2-3)

It is this juxtaposition of livelihood is evident in the increased development and population boom within the Ganges River Basin. Religious tradition grapples with the intensification of modernity, and this is reflected through the evolution of how the river is identified: “in sum the Ganges are constantly mediated, and these mediations produce artifacts like canals and water pumps that regulate the river’s flow, alongside the temples and ghats (steps) that make up the ritual infrastructure of the river,” (Acciavatti, 2015: 18). The river is constantly in the process of being redefined in terms of importance and significance. Questions of how development and mechanization of the river will affect its sacredness are arising, and these answers are imperative for understanding the future of the river’s health. Water is an intrinsic part of Indian society, “from the simplest tribal to the most sophisticated Indian, all venerate water in some form or the other,” (Vatsyayan, 2010: xv) and it is this cultural cue that remains constant.

Methods

There are many approaches to study rivers -- but one of the most essential principles to consider is the connectivity of a river system. There are six degrees of spatial connectivity that should be recognized and studied in river systems, each of which are equally important in assessing the external inputs and their effects on the river: 1) longitudinal connectivity between its upstream and downstream, 2) lateral connectivity between a river and the floodplain, 3) lateral connectivity between a river and its surrounding uplands, 4) vertical connectivity between a river and the hyporeic zone, 5) vertical connectivity between deeper groundwater and the river, and lastly, 6) vertical connectivity between the river and the atmosphere (Wohl, 2014). The study of connectivity is important because “it helps to analyse the movement of biophysical fluxes in a large geomorphic system; it shapes the operation of geomorphic processes over a range of spatial and temporal scales, and finally, it provides a basis to predict future landscape trajectories,” (Jain et al, 2012: 1304).

This particular conceptual model, the Six Degrees of Connectivity, constructed by Ellen Wohl, was primarily created for the study of fluvial processes and hydrogeomorphology of any given river system, but it also recognizes that anthropogenic influences highly impact the connectivity of flow regimes. Many other scholars maintain the importance of these parameters when referencing fluvial connectivity, however, they do so in a different manner. For example, fluvial connectivity is referenced frequently in the literature regarding the physical nature of the Ganges Rivers, but emphasis is solely based on the change in geomorphic, material differences. Although, due to the nature of the Ganges River, integration of cultural connectivity is becoming ever more prominent.

In the work of Vikrant Jain et al. (2012:1314), for example, both physical and anthropogenic shifts are crucial: “Especially in the ‘Anthropocene’ period, the understanding of modern-day processes I geomorphic systems of one of the most populated parts of the planet will be crucial to develop appropriate sustainability strategies and models.” With the model of connectivity exposing many problems caused by humans, it also helps in understanding how to address those issues, namely through the application of connectivity in river basin management, repair, and rehabilitation (Jain and Tandon, 2009).

From this basis, I assert that Wohl’s (2014) connectivity framework can also be used to analyze the degree to which a culture is socially, politically, and economically connected or disconnected. This paper, will specifically analyze longitudinal connectivity, lateral connectivity between the river and adjacent floodplain, and vertical connectivity between the river and the atmosphere. This paper addresses these three degrees in order to get a full understanding of the socio-environmental interactions and relationships that arise specifically from the use of surface water from the Ganges River. In examining the river with the framework of connectivity, the different local, state, and international value systems placed on the river can be understood in terms of social, economic, political, and geospatial influence.

Through a literature review of cultural and scientific studies, this paper will correlate various qualitative and quantitative studies and assessments of the Ganges River Basin, along with different policies instituted for managing the system, to understand the degree to which cultural connectivity affects fluvial connectivity. Through this comparison, past management regimes can be reflected upon, present day problems can

be accounted for, and future issues can be predicted. This paper serves to analyze to what degree the religious symbolism of the Ganges River, affects the way in which its quantity and quality of supply are perceived, and how these perceptions can be attributed to socio-environmental frameworks to ensure that livelihood and vitality are secured for both the riparian population and the river itself.

Cultural Context: The Life Line of India

Mirroring the size of the Ganges River is the cultural significance of the river. The Ganges River begins its journey across Southern Asia in the Himalayas. This is where the river has obtained and maintained its religious roots for half a billion Hindus. In the Hindu religion, Shiva herself permitted the release of the waters from the Himalayas, giving it passage into the heart of India: “Rushing out from the icy womb of the Gangotri glacier at Gaumukh, the Ganga’s primordial, cascading, torrential flow has steered ascetics and ordinary travelers alike, in their quest to connect to divinity through nature,” (Uttaranchal 2004: 10). Because the Ganges was born of divine act, it serves as a vessel that can carry prayer (Pavan, 2005:15). It is the site of many Hindu pilgrimages, and is where people come to bathe to purify themselves in the holy waters. All along the length of the Ganges its religious magnitude, permeating from the headwaters, can be seen: “The river was considered sacred from its source to its mouth. Pilgrimages developed at all points – at the source, at the place where the Ganga joins the plains and far downstream as well,” (Uttaranchal, 2004: 29). Religious ceremonies are often held along or within the reaches of the Ganges, some of which include festivals, healing rituals, and funerals in which the deceased are sent on a floating funeral pyre

down the river to be sent to the heavens. The Ganges River is a Goddess personified through physical nature, making ecological and spiritual concern intrinsically bound, and is often considered a mediator between this world and the celestial world.

The Ganges is the blood line of India. It is not simply just a resource for consumption and use, but has become, “Part of the human psyche of India in which the life-giving qualities of rivers are part of both our scriptures and of our more mundane everyday living,” (Buch, 2010: 116). Dating back to its first original settlements, the Mother Ganga has provided for those who reside within the basin and along the banks, helping to foster a relationship between the physical environment and social environment that is unparalleled:

It is not strange that the Ganga should have such an extraordinary hold on the imagination of the people of India. For millennia she has watered and nurtured an entire civilization and has become a symbol of the eternity and a theme of art, legend and literature. The moods rivers are fascinating to watch but even more so are the faith and reverence they evoke in the hearts of millions. (Ghandi qtd in Acciavatti, 2015:18).

The people of India are completely immersed within its spiritual relevance and are bound to this resource in a manner that is indicative of complete interdependence: “It is a river of delicate ecological balance, which binds nature to human irrevocably to each other, a river of captivating physical reality,” (Uttaranchal, 2004: 10). The river is dependent upon the human population in terms of its capacity and quality to ensure its physical sustainability, whereas the human population is dependent on the river for the preservation and sustainability of culture.

Management Policies

Basing its federal water policy regulatory framework after the United Nations' Agenda 21 sustainable development policy structure, the Indian State explicitly advocates decentralized governance as a means to involve public protection of its own local water ways (Schiff 2014). Theoretically this form of governance would allow for more communal participation. Communities and localities would have a larger say in the necessary legislation to fit their particular environmental needs, this specialization being impossible with a centralized regime. However, more often than not this was not the case. This posturing of decentralization can be seen in the Ganga Action Plan (GAP) that arose in 1982 with the specific intent to intercept and divert waste away, and ensure the health of biotic and abiotic factors within the basin. The first phase was implemented in 1985 and was said to be complete by 1990. However due to the inactivity of the plan, the deadline was increased to 2001, by which time it was still incomplete. The timeline was extended once more to end in 2008 after GAP goals failed to become realized. By 2004 the second phase of the Ganga Action Plan GAP II was originally planned to commence, but never was initiated because GAP I was unable to create noticeable change the water of the Ganges River

The GAP failed to meet expectations by a large margin, leaving the water quality of the Ganges River in peril: "By 2004, despite spending approximately 3.5 billion rupees, the GAP had met only 39% of its primary sewage treatment targets. In addition, government auditors observed that only 45% of the grossly polluting industrial units along the banks of the Ganges had installed effluent treatment plants, and 18% of those newly installed treatment plants did not function properly or failed to meet technical

standards” (Schiff, 2014: 234). Its ineffectiveness can mostly be accounted for by the lack of support by the Indian populace. Local communities and civil society were supposed to have more of a say when it came to the policy implementation of GAP, but this premise only highlighted the marginalization within Indian society. In its actual implementation, most of the smaller localities along the river were either totally ignorant of the project, or were alienated, making local participation virtually nonexistent. The local communities, the very hinge of which Indian decentralized environmental policy depends on, has in effect been cast aside, or neglected, left to its own devices. The same of which can be said about the Ganges River, a pure, or rather turbulent, reflection of Indian socio-political environmental structures. GAP’s biggest failure was that it focused exclusively on scientific factors for the quantification of the river’s health. Cultural significance within the system was disregarded, which inevitably resulted in detrimental impacts to the river system.

Learning from their mistakes with the Ganga Action Plan, the Indian government teamed up with the World Bank and created the National Ganga River Basin Project (NGRBP) in 2009. The World Bank is funding the NGRBP with a \$1 billion loan and will provide long-term support for the program. The NGRBP’s goal is to ensure that no untreated municipal or industrial wastewater will flow in the Ganges by 2020. The NGRBP aims to create a Ganga Knowledge Center, which will act as a library for knowledge relevant for the conservation of the river, install water treatment facilities, and implement communication programs to encourage people to participate in clean-up programs.

GAP I and GAP II were both decentralized; the national government ran the program and created plans for pollution abatement that the local communities and cities were to enforce, however, there was very little collaboration with local institutions. As a result public participation was not adequate to deal with the task of diffusing sources of pollution. The National Ganga River Basin Project (NGRBP) plans to do the exact opposite of this. Although the plan is funded by the national government, the National Ganga River Basin Authority (NGRBA) plans to apply the project in a more cohesive, connected way through the levels of government so that pollution control can be executed in a more productive manner. Goals of decentralization include:

[1] Ensuring efficiency and equity by bringing decision making closer and making it more accountable to local positions. [2] Increase proximity between political representatives and citizens, enabling better mobilization and efficient allocation of resources at the local level. [3] Stimulate creative, innovative, and responsive programs that are locally driven. [4] Present opportunities for citizens to participate in decision making. (“Sustainability”, 2012).

Much like GAP I and GAP II, this plan relies completely on community based environmental involvement and advocacy. The public memory of these plans is still alive with regards to its shortcomings, and some critics point out that although citizen accountability is necessary and beneficial, the discrepancies between talk and action are great. Separating participation from politics is also a big issue. This type of governance is relatively new to water management in India and its success or failure will be monumental in the determination of the improvement of the Ganges River water quality and supply.

One of the more unique aspects of this new management system is that the National Ganges River Basin Project is operating under an Environmental and Social

Framework (ESMF) management practice: “The purpose of the ESMF is to facilitate the management of environmental and social issues of the river pollution mitigation investments,”(NGRBA, 2011). The managers first ensure that all investments adhere to the national, state and local regulatory requirements during the design, implementation and operation stages. Then the managers integrate environmental and social practices during the design, implantation and operation of investments. With this they strive to enhance environmental conditions wherever feasible. Another prime objective is developing communication strategies; capacity building and training initiatives for all stakeholders (NGRBA, 2011). This management practice is fairly new, but has been positive in pollution abatement in that it both addresses the problems with water quantity and quality, as well as addresses progressive ways in communicating river pollution in religious terms. For example rather than emphasizing how polluted the river is, instead managers communicate that the Mother Ganga is being harmed by the sewage that is being poured on her. This is a marked difference from the Ganga Action Plan. Whereas GAP was focused solely on the river health in terms of biotic and abiotic indicators, the NGRBP focuses on fluvial health as well as cultural health.

Stakeholders

Because the National Ganga River Basin Project is a government funded endeavor, most of the stakeholders are within government offices. For example, the World Bank allocated funds to India for this project and the management of that money is administered by the Ministry of Environment and Forests (MoEF) branch of the Indian government. Within the MoEF is the National Ganga River Basin Authority who

oversees the project, initiating, recording and analyzing the progress that is being made within the Ganges River:

The NGRBA is a planning, financing, monitoring and coordinating body of the centre and the states. The objective of the NGRBA is to ensure effective abatement of pollution and conservation of the river Ganga by adopting a river basin approach for comprehensive planning and management. The Authority has both regulatory and developmental functions. The Authority will take measures for effective abatement of pollution and conservation of the river Ganga in keeping with sustainable development needs. (Ministry of Environment and Forest Government of India).

Also under the MoEF are the Central Pollution Control Board and the State Pollution Control Boards. These entities are responsible for collecting water pollution source inventories, implanting water quality monitoring systems, biomonitoring rivers, providing online information for water quality, and establishing water quality monitoring programs (Central Pollution Control Board). Government agencies in addition are making steps to improve urban infrastructure through programs such as the Jawaharlal Nehru National Urban Renewal Mission.

A broad range of stakeholders also stem from Community Based Organizations (CBOs) or Non-Government Organizations (NGOs) that are both concerned with the water quality and quantity in India, many of these being interested in the agricultural, fishing, and religious practices that are of direct result to the river's health. Over 73% of the Ganges River basin is used for agricultural purposes, and with the population rapidly increasing, over extraction for watering crops has become a severe issue. Fisherman are involved because the pollution of the river has gotten so destructive that 109 fish species, and other aquatic and amphibian fauna have gone extinct ("Threat of Water Extraction on the Ganges"). Compounding these interests, the religious significance of the Ganges

means most of society can be considered as stakeholders. Not only does its spiritual connotation hold cultural meaning of being able to cleanse all those who touch it and lead people to the afterlife, but it also holds great economic gain from tourism and religious festivals.

Longitudinal Connectivity: The River from Head to Toe

Longitudinal connectivity of a river is understood as the relationship a river has from its headwaters to its depositional zone and vice versa. For this study, the headwaters are located in the Himalayas and the depositional zone is located off the coast of Bangladesh in the Bay of Bengal. In tracking geomorphic changes as the river transits the Indian landscape, one can ascertain the different ecological zones the river crosses, the different climates that it experiences, and the different human impacts that it absorbs. Its hydrological composition is constantly changing and often worsening as it moves downstream. These effects are due to cultural practices as well as matters of nature itself.

The cultural connectivity of the Ganges River is constant throughout the system, with religious practices, festivals, and sacraments being practiced all along the banks.

The degree to which it is revered does not waver from the headwaters to the mouth:

The constellation of faith around the Ganga has remained intact. Belief in the river goddess is the skein that ties the mountain shrines at Gangotri, Kedarnath and Badrinath to Rishikesh and Haridwar at the Uttaranchal foothills, to Allahabad and Varanasi in Uttar Pradesh, and Ganga Sagar island in West Bengal. (Uttaranchal, 2004: 15)

The prevalence of the Mother Ganga exists in all areas of the Ganges River Basin with its religious significance rarely disrupted. The cultural presence of water is evident in the

different festivals, ceremonies that occur along the banks, year round, but is also present in everyday life:

Any Indian is familiar with the daily rituals which serve as reminders of the concept of pure, and therefore, holy water. No daily, monthly, or annual ceremony is complete without ritual purification with water. At birth, marriage and death, this concept is articulated and yet we have polluted these waters of life. (Vatsyayan, 2010: x)

As the population of the region has increased, the high degree of connectivity can be seen wide spread throughout the basin, both in terms of cultural and fluvial connectedness.

Through the lenses of point and non-point pollution, untreated chemical waste, increased waste from religious festivals, and even decomposing carcasses from religious funeral processions, the cultural significance extends through every reach and catchment of the Ganges River.

With the inherent significance of the Ganges ever increasing, and the population along its banks continually growing, the ecological health of the river has decreased dramatically. Due to increased urbanization and rural development, the pollution rates of the river have sky rocketed and have increased when moving downstream. Different types of pollutants, including those such as agricultural, industrial, animal and human wastes from poor sewage, and also pollutants that come from religious rituals resulting in the decomposition of human and animal bodies are all found within the Mother Ganga. Over the course of recent decades the Indian Federal Government has instated many initiatives to help reduce the effects of and decrease the inputs and transmission of contaminants throughout the Ganges, but only minimal success has occurred. However,

with minimal progress being achieved, and only small steps being taken by a few localities the health of the Mother Ganga is still threatened.

Reflecting the water quality of the Ganges River is the water quantity. Originally a free flowing river, left to meander along the land of the Indo-Gangetic plain, the Ganges River has now become one of the most highly developed in the world, and “one of the most engineered spaces on the planet,” (Acciavatti, 2015: 8). With dams along each of its major tributaries, and many along the main stem of the river, the flow of the Ganges is as controlled as it can be. The foundation for the dam building along its reaches is both to ensure there is both a sustainable water supply for one of the most populated regions in the world, and to also provide power for its people. This seems logical enough, however, the construction of these dams have also had some very adverse effects: The construction of dams has left many people displaced, due to the flooding of their homes as a result of reservoir building; many people are in water scarce regions because of water being withheld upstream, making the growing season and daily life more challenging than ever; the construction of dams has caused many international disputes, especially between India and Bangladesh; and also dams are now seen as a denouncement to the Mother Ganga.

An examination of the Farakka dam exemplifies these issues, both in terms of physical, geospatial evolution within the river system, but also the socio-political challenges that are also involved. Although the Farakka dam was built to control the Ganges and its flow, it has become more unpredictable as a result. Because it can't drain properly into the Bay of Bengal, waters behind and beneath the dam rapidly accumulate during the monsoon season, leaving much of the population along the river displaced.

Annual flooding is a yearly occurrence during the monsoon season, but with the construction of dams, the magnitudes of the floods has increased. With the Farakka dam being located on the border of India and Bangladesh many conflicts have emerged, each having to do with water scarcity due to India withholding water upstream. Only after fifty years of back and forth policy approval and rejection did the 1996 Ganges Water Treaty come to fruition between the two countries. Thus far, as a result, relations have remained peaceful for the most part. Although the benefits in water conservation and hydropower production are evident, religiously many Hindus stay away from dams as they defile the Ganges in their cultural view: “Then she swells threefold from the huge inflow from Ghaghara, Gandak, and Kosi and becomes the Nepalese Ganga – a destroyer of land, animal, and human life. Not surprisingly, not many people seem to worship her here as a benign, generous goddess, giver of life” (Hollick 2008, 180). This suggests that the spiritual significance and physicality of the Ganges River are not mutually exclusive, but rather are intertwined: “To the people living in the mountains, this mythology is a living culture. In a land where humans live in the lap of nature, forever conscious of its bounties—and wrath, if crossed – nature becomes divine and ecology becomes another face of spiritualism,” (Uttaranchal, 2004: 14).

It is this relationship that defines the Ganges, and it is this relationship that is constantly changing. Do to the increased degradation in water quality and fluvial connectivity that is slowly beginning to disconnect cultural connectivity, congruently. The very principles on which the spiritual magnitude rests, is now being called into question because of the direct change in water quality that is occurring: “But the nature of the flow of water (is it natural or artificial if it’s dammed?) and its properties (is it pure or

is it defiled if it is full of sewage?) defines how people name it and how they use it,” (Acciavatti, 2015: 18).

Lateral Connectivity: The Ebb and Flow of a Chronically Flooding Basin

The relationship between the Ganges River and its respective floodplain is one that is highly interactive, sensitive, and is subject to a number of different influences... Lateral connectivity is the connection that a given river channel has with its surrounding riparian area. Ellen Wohl (2014), in her book *Rivers in the Landscape*, distinguishes between two degrees of lateral connectivity: 1) The connection between a river channel and the adjacent floodplain, and is primarily referenced during periods where river flow is high enough to top and flood the banks and 2) the connection between a river and its adjacent uplands, and is characterized by the one way flux of sediment water, sediments, and solutes traveling downslope into a system. Both are essential with regard to understanding complexities of river systems, however, the former (the connection between the river and its floodplain is the emphasis of this section. The hydrological channel- riparian environment interface is one that can be described as dichotomous. On one side of the scale are naturally occurring floodplain interactions. For example, monsoon season is a naturally occurring event that transpires seasonally. On the other side of the scale are human induced relations as predominantly exemplified by governmental construction of dams or barrages that cause displacement of populations or water disputes. Both contribute to the ever entwining web of policy implications, and are significant in terms of deciding who or what is important with regards to flood response, and at what scale can these entities be addressed.

The Ganges River Basin is extremely fruitful for the population of India, spanning a large area with a variety of different uses along its stretches; it is the prime resource of Northern India. As a result massive populations have settled along its banks either in its urban reaches or rural reaches. Dependency on the river has continued to grow and people have continued to move closer and closer to the banks. A move that is seemingly very intuitive, however, could have disastrous impacts to those unsuspecting of the climactic power of the region. The Ganges River, located in South Asia is subject to an annual monsoon season and as such, during the summer months experiences a massive influx in precipitation. The rainfall, although welcomed by farmers for irrigation purposes, and environmental proponents for a rise in water quantity that seems to be ever dwindling, the floods often have more negative consequences that seem to surmount the benefits, indicating that the management system is not functioning well.

As mentioned earlier one of the main land uses in the Ganges River Basin is for agriculture. Residents of the basin are reliant upon the groundwater beneath the basin, as well as the surface water of the Ganges River. Because of this dependence, irrigation technology has become a part of the landscape and influenced livelihood on a variety of scales: “These irrigation infrastructures transformed spaces, from the home to the region, often in unforeseen ways...further blurring the distinction between rural and urban,” (Acciavatti, 2015: 7). This is evident as one moves downstream. The pattern of increased extraction and steadily decreasing flow of water observed when traveling eastward through the system through rural areas, until the river is met by another tributary, replenishing its contents, is not a relationship of happenstance. Barrages in the Ganges River can divert up to 60% of water for irrigation purposes (Lebel et al. 2010), and

although irrigation is beneficial for agrarian communities, “its efficiency level is only up to 30 to 40 per cent, as estimated by the National Commission on Integrated Water Resource Development Plan (NCIWRDP),” (Iyer, 2010: 95). This pattern, however, is encouraged by water managers. With the threat of monsoon floods, and potential displacement, those settled along the banks extract an abundance of water to make way for the water to be added so as not to be displaced by it: “Instead of the passive surrender to an irrational monsoon, the Ganges River Basin shows a culture obsessed with water management to the point of paranoia – an unequalled exploitation of irrigation technologies to regulate capricious rainfall patterns,” (Acciavatti, 2015: 88). This mentality, although founded in concern for hazard management, only highlights that the Ganges River’s state is in an even more danger.

The Ganges River is continually being overdrawn for irrigation for crop production, and that has taken a toll on the quantity of water within the system. However, this scarcity is not often seen as a threat to some riparian communities. In Georgina Drew’s study to further explore these perceptions of water scarcity, she interviewed agriculturally dependent peoples who utilize the water for crop production:

To further explore this apparent lack of a preoccupation with the Ganga's longevity, I tried to pose hypothetical questions about the river's loss. I asked people at Manikamika, for instance, 'Could you ever imagine a time when the Ganga would stop flowing [by the ghat]?' Numerous people replied to this question with a gasp, a strong 'No', or a caution that the Ganga's disappearance would signal the end of the world. The difficulty imagining life without the river demonstrated the monumental value that people placed on its existence. (Drew, 2012: 352)

Alternatively, urban areas are booming in the Ganges River Basin, causing a relationship with water that is far more inclined to addition than extraction. With the

increasing development and population within India, ever more are hydrologic regimes being turned to as a source of energy production and water supply. The construction of dams has increased greatly within the Ganges River Basin and as such has significantly altered the population along the banks of the river itself. When dams are put into place for this dual purpose, the water floods the channel of the river creating mass flooding of a given area so that enough water can be stored for greater use, as well as have the potential to create the desired amount of electrical power. With the construction of these dams, surrounding populations get displaced, and often those who are subject to this process the most are the marginalized and those of low socio-economic status: “Divisions of high flows in the wet season to protect built infrastructure and human settlements may increase risks for other rural livelihoods and settlements without sufficient compensation (Lebel and Sinh 2009). The pursuit of adaptiveness can create winners and losers, shift risks and burdens and reinforce existing inequalities,” (Lebel et al. 2010).

With this dichotomy in place, those who have power to create policy also have the power to decide how the river should be valued. The management system with regard to lateral connectivity only enhances the marginalization of populations and is evident through a discussion of fluvial and cultural connectivity. In terms of fluvial connectivity the river is highly connected to the floodplain and vice versa. The river, due to extraction for irrigation, municipal, and industrial uses and additions from pollutants and monsoon season, has a very dynamic relationship with the riparian environment. Although it is good that the river is connected to the floodplain, that doesn't necessarily mean that is a healthy relationship. Due to the constant accumulation of contaminants riparian biotic environments are displaced, as are the humans who reside within the system. Although

water is imperative for these societies to survive, without proper management, it is often a detriment to settlements on the banks: “Rivers overflow their banks. Both in city and in countryside, the hoped for rain may turn to floods and destruction, for nature knows no moderation here,” (Darian, 1988: 84). The issue within the realm of lateral connectivity is not the degree to which there is fluvial and cultural connectivity, for both are very high, the issue is that it is not a healthy connection.

Vertical Connectivity: The Spherical Consequences of Climate Change

With the rapid growth of the Indian population, the effect that anthropogenic influences have on the development of climate change grows congruently. As the anthropocene traverses the lithosphere and water resources entwined with the Ganges River water supply are stressed, the call for interactive watershed reevaluation and management is called for on a wide scale (Sharma and Agrawal, 2014). These effects can be observed in a variety of different places through a variety of different mediums. By looking at the vertical connectivity, or the relationship a river system has with the atmosphere, through the lens of climate change, a more holistic, spherical point of reference can be drawn, or as Vikrant Jain and S.K. Tandon stated, “This interaction provides the basis for 3-D understanding of processes,” (2010).

One of the first avenues in which climate change is apparent is through the seasonality, duration, and magnitude of monsoon season. In his book, *Ganges Water Machine: Designing New India's Ancient River*, Acciavatti writes that,

Rennell...was perhaps the first geographer to conceptualize the profile of the monsoon and the Ganges River in vertical cross-section as opposed to horizontal plan. To do this, he observed the monsoon at the scale of the

region (how the ‘vast collection of vapours’ collide with the Himalayas) and how this event produced not only rains, but transformed the profile of the riverbed. (Acciavatti, 2015: 105)

This relationship of connectivity is pertinent because it helps to predict the future influx of water and how much can be expected in the years to come. However, because of climate change, these once predictable occurrences are now highly variable: “Future patterns of precipitation across most basins remains highly uncertain. Uncertainties about social responses to policies are even greater with prospects of water being a trigger for both more conflict and more cooperation,” (Lebel et al, 2010: 356). It is imperative to understand these vertical relationships because, “as far as the Ganges Basin is concerned, nearly eighty-percent of all precipitation occurs during the southwest monsoon,” (Acciavatti, 2015: 90). Within the span of three to four months India receives the majority of the water it will have all year, further raising the stakes for environmental regard and concern.

Another observable way to understand the effects of climate change is through the retreat of the Himalayas. As we delve further into the anthropocene, climate change is, “already affecting snowfall, precipitation and glaciation. The highlands of Asia are getting much warmer than the global average,” (IPCC 2007). Scientific studies suggest that glacier-fed rivers will swell for a few decades as glaciers and snow packs melt, but eventually many of those flows will slow to a trickle (Barnett et al. 2005; Rees and Collins 2006). Significant uncertainties and spatial heterogeneity in glaciation processes add to the complexity of forecasting future changes on water resources,” (Lebel *et al*, 2010: 356).

Climate change has also exposed the need for the creation and revising of transboundary water sharing agreements. For example, in the past historical water use was used to determine how water was allocated between international users, however as climate change takes its toll on the environment these historic uses will shift in accordance with shifting flow regimes (Label et al. 2010). This makes the induction of new policy much more strenuous no matter how strong a riparian federation is.

Perceptions with regards to framing impacts of management need to change:

In many cases, comprehensive agreements among riparian states and detailed allocation agreements are still far away. Here, more modest alternatives to strengthening cooperation are needed, that focus more on benefit sharing rather than just physical allocations and flows of water, for example, considering, power generation benefits, flood control, international trade and food security. (Lebel et al. 2010).

Observable impacts of change have been and will be seen within the Ganges River Basin over time, however, “Currently, little or no understanding exists about the projected future behaviour and form of rivers and other natural systems in India in the scenario of uncertainties associated with climate change and the ever-growing impacts of anthropogenic effects,” (Vikrant et al, 2012). This uncertainty is also reflected with the religious regard to the river with respect to climate change, but perhaps more importantly there is a certainty the Mother Ganga will maintain its significance whether it’s physically here on Earth or not:

Many refuted the idea that the river—and especially its Goddess—could completely disappear from the earth...In an interview, for instance, a schoolteacher drew from Hindu framings to say that the Goddess Ganga can never leave the earth because she simultaneously flows on three levels: in the heavens, in the riverbed, and beneath the surface of the earth. The subterranean zone is known in Hindi as *patal*. The schoolteacher cited the Saraswati River as an example of a river that has disappeared from the surface of the earth but that continues to flow underground. As

she and others reminded me, Hindus still worship the Saraswati even though the river dried up many centuries ago. For her, this meant that the Ganga would continue to bless humans from *patal* as long as they pray and keep her in their thoughts. In this logic, the glaciers may melt and ultimately disappear but the Goddess that flowed from them will never recede from devotees' hearts. (Drew, 2012: 355).

This perception has extreme consequences in terms of anthropogenic interactions with the river system and can be used to explain why regulatory frameworks have never taken hold within the basin. The significance of the river is so powerful that regardless of whether it physically exists or not, it is still a part of spiritual, cultural conceptualization. Its immediate care is overshadowed by its overarching divinity. In recent practices, one doesn't even have to physically touch the river to be purified: "The belief continues to this day—that even the sight the name and the touch of the Ganga absolves individuals from their sins and confers their blessings," (Uttaranchal, 2004: 29).

This then redefines the way that cultural and fluvial connectivity identify in comparison to one another. In the previous two sections, longitudinal and lateral connectivity, were fluvial and cultural connectivity were correlated positively with one another; if one mode of connectivity was high than so was the other. However, through the examination of vertical connectivity, one is truly able to observe the dissonance within the system. With spirituality conflicting with sustainability, the river's future is extremely uncertain. However, when symbology and spirituality meet sustainable efforts, the health of the Ganges River can properly be addressed.

The Intermediaries: Domestic Non-Governmental Organizations (DNGOs)

One way in which the bridging the ever increasing gap between modernity and religious tradition is beginning to occur is through the efforts of Domestic Non-Governmental Organizations (DNGOs). These organizations vary in cause and their effect on environmental policy, but in essence when it comes to the Ganges River, these organizations help create more connectivity between local, state, and federal governments. The ways in which they accomplish this are vast and differentiated to increase effectiveness:

These tools include public awareness campaigns, collection and dissemination of scientific data, monitoring compliance with existing regulations, mobilizing the masses in popular protests, letter writing to government officials along with visits to discuss scientific data, lobbying of government officials, organizing cleaning campaigns to directly remove pollution from the river and litigation. (Zawahri and Hesengerth, 2012: 279)

For many environmental DNGOs one of the main aims is to acknowledge the significance of the Ganges River, and highlight that its spiritual significance gives every incentive as a means to protect it. These groups encourage the confluence of spiritual morality and environmental advocacy: “What are sanctified in the myth are both the ecological process and the power of austere discipline to uphold the moral and ecological order not to destroy it,” (Vatsyayan, 2010: xvii).

One of the most effective groups on this Environmental front is Eco Friends. Established in 1993 to aid and promote the policy of GAP, Eco Friends has since centralized on decreasing untreated waste into the river as well as helping to strengthen infrastructure and treatment plants. One of the most prominent figures of Eco Friends is

the president of the Founder President, Dr A.C. Shukla. Originally one of the prime policy advisors of the Ganga Action Plan (GAP), he was especially concerned with the biological aspects of the rivers health rather than the engineering-centric aims of the project. With this, his efforts have oriented around highlighting ecological and biological health through the lens of spiritual health. In an interview with Eco Friends, Dr. Shukla reflects on this relationship, and emphasizes its importance:

I have nostalgic memories of vastly expanse of Ganga, its pure, deep, silver water and festivals, rituals and religious sentiments of Ganga devotees. During my times, Ganga has grown dirty, people dread to take aachman and bathing is no more refreshing – waters have lost basic drinking or bathing quality. Ganga banks have receded and the river shrunk... Worshippers are more worried about their own salvation rather than survival of “Patit-pavani Ganga” (purifier of the lowly people). They should be told by religious sects, saints and sages that care for the health of mother Ganga will absolve you of your sins. Ganga Seva is enshrined in our culture and religion, people only need reminders. (“Eco Talk”)

With these efforts, the Ganges River is not only a cultural symbol of life, but is now becoming a symbol of health in the landscape. Organizations such as Eco Friends are challenging the rising fluvial and cultural disconnectivity, and rather than treating them as separate entities, they are using each to support the other.

Conclusion

Over the years the Ganges River has changed dramatically both in terms sociopolitical organization and socio-environmental assemblage. The Ganges ranges from the predominantly untouched mother land of the Himalayas to the highly developed southernmost region in Bangladesh, with its cultural-geospatial relationship varying as the river flows downstream. By analyzing this watershed through the model of

connectivity, a more comprehensive view of cultural inputs within the river system can be seen. The cultural connectivity of the river weakens as the river lengthens and the basin widens; as the scale of the river basin increases, the cultural inputs increase creating a disconnect between localities, federal institutions, and international affairs resulting in the cultural stratification of the population. These inputs also massively impact the physicality of the river in terms of water quality and quantity, which in turn threaten the very nature of life for those who live within the basin.

Sustainable management practices have been implemented to mitigate the growing rate of pollution and population, each with its own successes and failures. The enormity of the issues concerning the Ganges River with regards to the holistic health of the environment cannot be understated. With the confluence of spirituality, sheer magnitude of size, and sociopolitical imbalance, it appears that the Ganges won't be tamed anytime soon. This is due to the inherent dissonance that occurs between the cultural need for water and the developmental need for water. The river, although highly regarded as an integral part of Indian culture and Hindu spirituality, is treated as though it is not with regard to its use.

The comparison between fluvial connectivity and cultural connectivity illuminate this fact. Although historically, cultural connectivity has remained consistent throughout the basin, fluvial connectivity is increasingly becoming disrupted. Be it through the interference of flow due to dams, the unhealthy interaction between the river and the floodplain, or the increased variability of the river due to climate change, the river, and its management are more tumultuous than ever. This is resulting in the cultural relation and identity of the people to redefine what they need in terms of securing livelihood, and how

the river is to be identified. In order for the Ganges River to survive and thrive within its geospatial context, river managers need to view fluvial connectivity in conjunction with cultural connectivity for successful management schemes: “Today Ganga is under a death threat from the very humans who revere it, through their literally polluting actions. To find answers to this crisis it is important to enter the soul of the Ganga, who nurtures a vast universe.” (Uttaranchal, 2004: 15). By understanding the conscience of the people, and the pulse of their relationship with the river, better practices can be molded and adapted so that the river does not only hold a spiritual, mental connection, but a physical, environmental moral respect as well.

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