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Foreword

The Centre for Earth Studies, founded in 2016 by IP College, reflects its ongoing engagement with the state of our being and becoming, as inhabitants of Planet Earth. The Journal of Innovation for Inclusive Development has been envisaged as an integral part of the Centre's activities. Conceptualized by the colleagues of the Department of Environmental Studies, the objective of the Journal is to produce a confluence of thoughts and ideas as well as the best practices prevalent in individual and institutional systems which speak to us of sustainability. The first issue presented here consists of invited research contributions. The subsequent issues will carry peer-reviewed articles.

Grateful thanks are owed to Dr. Govind Singh, Assistant Professor in the Department of Environmental Studies, for his untiring efforts to uphold quality and create something of enduring value, in the form of this Journal. The College also thanks Dr. Anindita Roy Saha, Associate Professor in the Department of Economics and Teacher in Charge, Department of Environmental Studies. As the Coordinator of the Centre for Earth Studies, it is her unstinting support and encouragement which has made implementation of novel ideas and initiatives like this Journal possible.

Dr. Babli Moitra Saraf

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Sustainable Development Goals 2016-2030: Easier Stated Than Achieved

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In 2001, the new millennium had arrived with hope and promise of a better world. This was because the last September of the previous millennium had witnessed a large gathering of world leaders in a Millennium Summit. World leaders, in consonance with the United Nations (UN), felt that the new millennium should begin with ensuring that no human being should have to live in dehumanizing conditions. The conclusion of the Millennium Summit, the UN Millennium Declaration (UN, 2000), led to the adoption of eight Millennium Development Goals (MDGs) to be achieved by 2015. These were, 1) eradicate extreme poverty and hunger; 2) achieve universal primary education; 3) promote gender equality and empower women; 4) reduce child mortality; 5) improve maternal health; 6) combat HIV/AIDS, malaria and other diseases; 7) ensure environmental sustainability; and 8) build global partnership for development.

The MDGs were to be achieved by 2015 and several of the targets set aside against each goal were in fact achieved. According to the concluding MDGs Report, the number of people living in extreme poverty had declined by more than half, to 836 million in 2015 (Way, 2015). Significant improvement in primary education enrollment, gender disparity, health care and environmental performance have also been highlighted in this Report. However, the Report does not hesitate to accept that despite these successes, the poorest and most vulnerable people were left behind (Way, 2015). Gender inequality, widening gap between rich and poor, poverty and hunger, conflicts and climate change & environmental degradation are some continuing challenges being faced by humanity even after a decade and a half long struggle to achieve the MDGs. Thus, a need was felt by the UN to define a new set of goals with a new deadline. This led to the emergence of 17 Sustainable Development Goals (SDGs) as part of a 2030 Agenda for Sustainable Development (UN, 2015).

The 17 SDGs can be briefly summarized as, 1) no poverty; 2) zero hunger; 3) good health and well-being; 4) quality education; 5) gender equality; 6) clean water and sanitation; 7) affordable and clean energy; 8) decent work and economic growth; 9) industry, innovation and infrastructure; 10) reduced inequalities; 11) sustainable cities and communities; 12) responsible consumption and production; 13) climate action; 14) life below water; 15) life on land; 16) peace, justice and strong institutions; and 17) partnerships for the goals. The SDGs are focused on the 5 Ps of people, planet, prosperity, peace and partnership. They also have an underlying objective of ensuring development for all, not just for a chosen few. However, while the goals are comprehensive and their associated targets practical, the SDGs may not be as easy to achieve as they are to state. This is because of some inherent inadequacies in the understanding and adoption of the concept of sustainable development.

The idea of sustainable development, defined as development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs (Brundtland, 1987), has been around since it was first put forward in 1987. In the last three decades of its existence as an international policy guideline, sustainable development has not been able to alter the development paradigm in its favour. To cite a few examples, the atmospheric carbon dioxide (CO_2) concentration has been on the rise since industrial revolution. CO_2 is a potent heat-trapping (greenhouse) gas and in excess, causes global warming. The CO_2 concentration has continued to rise unabated even after 1987. In fact in 2015, normalized atmospheric CO_2 concentration crossed the 400 parts per million (ppm) mark for the first time since its rigorous measurements

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began in 1958 (NASA, 2016). Far from reducing, atmospheric CO_2 concentration is not showing any signs of stabilizing even three decades after the introduction of the concept of sustainable development.

Further, according to the Our Common Future Report (Brundtland, 1987) which first defined sustainable development, three sectors need to come together in order to achieve the aforementioned. These are the economic, social and environmental sectors in their broadest sense. However, three decade analysis of the adoption of sustainable development will reveal that the onus of ensuring it has been skewed on only the environmental sector. The other two sectors have contributed little, though consistently, towards ensuring a shift to the sustainable development paradigm. This needs to change now, especially if we are to seriously work towards achieving the SDGs. Every sector needs to contribute towards achieving each sustainable development goal, neither of which can be met in isolation.

This necessitates the promotion of multidisciplinary and transdisciplinary research across different sectors. Like the SDGs, multidisciplinary research is also easier said than done. It requires participating individuals to be highly trained in their own disciplines and also develop multidisciplinary and innovative skill set. This requires the global research community to develop holistic and innovative approaches towards achieving the SDGs. This is also the backdrop for the initiation of this Journal of Innovation for Inclusive Development (JIID), in the ongoing first year of the SDGs timeframe. JIID will both promote and provide a platform for researchers from different disciplines to come together and to share their research contributions. JIID will give greater emphasis to research contributions which further our understanding on how to ensure that no one gets left behind in the achieving of the SDGs. It is hoped that JIID will pave the way for developing transdisciplinary approaches in the Himalayan task of achieving the SDGs, perhaps our last hope in the fight against inequitable development, climate change and environmental degradation.

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MGNREGA as an Environmental Policy: A Case Study of Pithoragarh, Uttarakhand

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Abstract: Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGA) is a widely practiced policy of the Government of India in the area of rural employment generation and poverty alleviation. While it has clear economic objectives, it also has a host of environmental benefits. Proper implementation of the scheme can generate a stream of economic, ecological and environmental services. The present study covers three villages of the state Uttarakhand which lies in the midst of the Himalayas. These small, medium and large sized rural areas have gained significantly by MGNREGA.

The MGNREGA works have generated employment and income, improved connectivity and reduced migration to urban areas in search of jobs. On the other hand, there have been distinct improvements in the standards of sanitation, resource use, water conservation, etc. However, there is considerable scope in the MGNREGA for improvement in terms of efficiency, institutional support, policy formulation and implementation. The paper brings forward the dual - economic and environmental - benefits of MGNREGA and also highlights improvements which can make it one of the largest and most productive rural employment scheme with significant environmental benefits.

Keywords: MGNREGA, rural development, poverty, employment, environment, energy.

1. Poverty Alleviation and Employment Generation in India

India is a country whose soul lies in her villages. There are nearly 6,40,867 villages with a population of almost 83 million that accounts for 68.84% of the entire population. The major source of livelihood in the rural sector is agriculture. Indian villages in general are submerged in abject poverty that is reflected in unemployment, low income and suboptimal quality of life. Therefore, development of agriculture and villages lie at the center of the overall socio-economic development of the country. As Mahatma Gandhi once said, the real progress of India does not mean simply the growth and expansion of industrial urban centers but mainly the development of the villages.

Poverty alleviation was recognized as one of the principal objectives of economic planning in the country during the fifth five year plan (1974-1979). Various schemes for rural development were designed in the following decades (Sharma, 2013). These include Integrated Rural Development Programme, IRDP, (1978); National Rural Employment Programme, NREP (1980); Rural Landless Employment Guarantee, RLEG (1983), Jawahar Rozgar Yojana, JRY (1989), Employment Assurance Scheme, EAS (1993), Jawahar Gram Samridhi Yojana, JGSY (1999); Swarna Jayanti Gram Yojana, (1999); Sampoorna Gramin Rozgar Yojana, SGRY (1999), National Food For Work Programme, NFWP (2004) and National Rural Employment Guarantee Scheme, NREGS (2006).

Mahatma Gandhi National Rural Employment Guarantee Scheme, MGNREGA (2005) is also one of the schemes for poverty eradication through employment generation. The primary objectives of MGNREGA are to provide wage employment opportunities and to create a sustainable rural livelihood through regeneration of the natural resource base, i.e. augmenting production and supporting creation of durable assets (GoI, 2005).

The objective of the present study is to assess and evaluate the impact of MGNREGA on the rural sector through a study of three villages in the Pithoragarh district of Uttarakhand, India. While generating rural employment and mitigating poverty, MGNREGA is also expected to

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improve the environment. A village needs environmental sustainability along with sustainable economic development.

2. MGNREGA: An Overview

Programmes targeted at rural employment generation typically provide unskilled manual workers with short term employment in public works such as irrigation, infrastructure and road construction. Mahatma Gandhi National Rural Employment Guarantee Act, 2005 is perhaps the largest and most ambitious social security and public works programs in the world.

2.1 Definitions

The act defines the following for its implementation for the eligible rural households: (a) 'Adult' means a person who has completed his eighteenth years of age. (b) 'Applicant' means the head of a household or any of its other adult member who has applied for employment under the scheme. (f) 'Household' means the members of a family related to each other by blood, marriage or adoption and normally residing together, sharing meals or holding a common ration card. (g) 'Implementing agency' includes any department of the central government or a state government, a *zila parishad*, panchayat at intermediate level, gram panchayat or any local authority or government undertaking or non-governmental organization authorized by the central government or the state government to undertake the implementation of any work taken up under a scheme. (h) 'Minimum wage' in relation to any area means the minimum wage fixed by the state government under section 3 of the minimum wages act, 1948 for agricultural labourers as applicable in the area. (k) 'Preferred work' means any work which is taken up for implementation on a priority basis under a scheme. (n) 'Project' means any work taken up under a scheme for the purpose of providing employment to the applicant. (o) 'Rural area' means any area in a state except those areas covered by any urban local body or a cantonment board established or constituted under any law for the time being in force. (r) 'Unskilled manual work' means any physical work which any adult person is capable of doing without any skill or special training (GoI, 2013).

2.2 Guarantee Scheme and Employment

The Act provides guarantee to employment through various clauses. According to it, the state shall guarantee employment to every household where adult members volunteer to do unskilled manual work which is not less than one hundred days of such work in a financial year in accordance with the scheme. Every person who has done the work given to him under the scheme shall be entitled to receive wages at the wage rate for each day of work, the disbursement of daily wages shall be made on a weekly basis or, in any case, not later than a fortnight after the date on which such work was done. Every state government shall make a scheme within 6 months from the date of commencement of act by notification. If an applicant for employment under the scheme is not provided such employment within 15 days of receipt of his application seeking employment or from the date on which the employment has been sought in the case of an advance application, whichever is later, he shall be entitled to a daily unemployment allowance.

Schedule I of the National Rural Employment Guarantee Act 2005 contains minimum features of a rural employment guarantee scheme. According to section 1, the focus of the scheme shall be on the following works in their order of priority: 1. Water conservation and water harvesting; 2. Drought proofing (including afforestation and tree plantation); 3. Irrigation canals including micro and minor irrigation works; 4. Provisions of irrigation facility to land owned by households belonging to the scheduled castes and scheduled tribes or that of the beneficiaries under the *Indira Awas Yojana* of the government of India; 5. Renovation of traditional water bodies including desilting of tanks; 6. Land development; 7. Flood control and protection works including drainage in water logged areas; 8. Rural connectivity to provide all-weather access; 9. Any other work which may be notified by the central government in consultation with the state government (GoI, 2012).

2.3 The Extended New Guidelines

There have been other demands from various states for inclusion of new works that would create an even stronger positive synergy between MGNREGA and agriculture and allied rural livelihoods. In response to these demands, the central government has, vide notification dated 4th May 2012, amended provision in schedule I to include an additional list of permissible works under MGNREGA and has also issued separate work guidelines for these works. As per the new guidelines the works under MGNREGA include: 1. Water conservation and water harvesting that includes (a) continuous contour trenches/ furrows, staggered trenches, box trenches, (b) sunken ponds, (c) gully plugs, (d) boulder check, (e) gabion structures , (f) ponds, tanks , percolation tanks etc , (g) underground dyke, (h) earthen dam, (i) spring shed development including staggered trenches and plantation, (j) check dam, anicut, stop dam, (k) artificial recharge of well through sand filter; 2. Drought proofing

including afforestation & tree plantation through (a) nursery raising, (b) eco restoration of forest, (c) afforestation to cover degraded forest and barren land under afforestation, (d) grass and development & silvipasture, (e) road/ canal side plantation, (f) block plantation; 3. Irrigation canals including micro and minor irrigation aimed at (a) construction of canal distributaries, (b) lining of canals, (c) rehabilitation of minor and sub minor works such as community well for irrigation; 4. Provision of irrigation facility, horticulture, plantation and land development on individual land including (a) construction of water courses/field channels, (b) lining of water courses/ field channel, (c) dug well, (d) dug out farm pond/ diggi/ tank, (e) horticulture plantation, (f) Boundary plantation, (g) block plantation, (h) sericulture (land development and Mulberry plantation), (i) construction of contour/ graded bund/ farm bunding, (j) land leveling and shaping, (k) reclamation of saline / alkaline land; 5. Renovation of traditional water bodies including desilting of tanks including (a) desilting of tanks, *talab* and ponds and other traditional water bodies, (b) repair, renovation and restoration of tanks, *talab*, ponds, check dam, escape, weirs and control structures; 6. Land development involving (a) reclamation of salt affected land for production measures like tree plantation/ silvipasture, (b) development of waste land; 7. Flood control including (a) diversion channel, (b) diversion weir, (c) peripheral/ cross bund, (d) drainage in water-logged areas, (e) deepening and repair of food channels, (f) *chaur* renovation, (g) construction of storm water drains for coastal protection, (h) construction of intermediate and link drains; 8. Rural connectivity including (a) *mitti murram* road, (b) gravel road, (c) WBM road, (d) C.C road, (e) inter-locking cement block road, (f) brick *kharanja*, (g) stone *kharanja*, (h) cross drainage; 9. Bharat Nirman Rajiv Gandhi Sewa Kendra (BNRGSK) including (a) New construction and (b) extension of panchayat *bhawan*; 10. Agriculture related works that include (a) NADEP composting, (b) vermicomposting, (c) liquid bio-manures: *sanjeevak* or *amrit paani*; 11. Livestock related work including (a) poultry shelter, (b) goat shelter, (c) cattle shelter, (d) *Azolla* as cattle feed supplement; 12. Fishery related works including fisheries in seasonal water bodies on public land which include excavation of pond and fish drying platform; 13. Works in coastal areas including (a) fish drying yards, (b) belt vegetation; 14. Rural drinking water related woks including (a) soak pits, (b) recharge pits (for point recharge), (c) dug wells;15. Rural sanitation related works including (a) household latrines with specification as per the Total Sanitation Campaign, (b) school toilet units, (c) *Aanganwadi* toilets, (d) solid and liquid waste management (SLWM).

A close look at the policy areas will reveal that MGNREGA is focused at ecological balance and environmental sustainability along with providing employment guarantee (GoI, 2013). A study of *Chitradurga* district of Karnataka has shown that this act has provided multiple environmental benefits (Kumar et al., 2013). It has resulted in increased ground water, increased water percolation and enhanced water storage in tanks. There have also been records of increase in soil fertility, reclamation of degraded lands and carbon sequestration. There has been an increase in crop and livestock production and a reduction in the vulnerability to poor soil quality and low rainfall.

2.4 Methodology

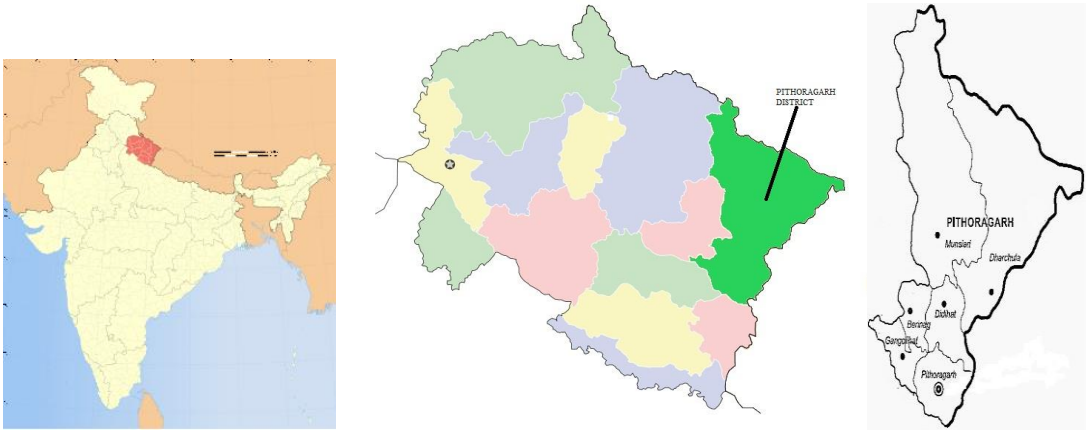
MGNREGA was notified on 7 September 2005. In its first phase in 2006, the act was notified in 200 rural districts. Another 130 rural districts were notified in the second phase in 2007. The Government of India notified all the remaining districts under MGNREGA in the third phase that started in 2008 with the exception of the nine districts that have a 100% urban population (Census, 2001). At present, nearly 631 districts in country are covered under this scheme. Uttarakhand is a predominantly rural state with about 74% of its population living in 15,667 rural settlements. 80% of the total number of villages are small with population less than 500, 10% of the villages have population within 500 to 1000 and the remaining villages have over 1000. Three districts were notified by government in the first phase, two more in the second phase and finally all the thirteen districts including Pithoragarh, were notified by the government under the MGNREGA in the third phase in 2008. All the villages in the three districts of Pithoragarh have the same type of mechanism to provide work. Those enrolled are divided into groups and work is assigned to groups by rotation. The *gram sabha* ensures that all groups get work which is four to five times in a year on an average.

3. Study Area

The study area consists of three villages, namely, Lelu, Suwakot and Kusauli in district Pithoragarh (Fig 1.).

3.1 Location

The study area is part of the hilly region of Kumaon in the state of Uttarakhand. It lies between the latitude 29º27’ and 30º49’N and longitude 79º50’ and 81º3’ E. The altitude is between 1,530 m and 1,610 District



(a) Uttarakhand (b) Pithoragarh (c) Village Panchayats of Lelu, Suwakot, Kusauli

Figure 1. The Study Area: Lelu, Suwakot, Kusauli.

Pithoragarh is 485 kilometers away from Dehradun, the capital of the state Uttarakhand. The nearest airport is Pithoragarh (Naini-Saini airstrip) and nearest Railway station is Kathgodam. Although the larger area is remote, the three villages selected for the study are within a radius of 10 km. All the three villages are located in the Pithoragarh Tehsil and under the block Pithoragarh. Gram Panchayat Lelu consists of eight small villages called Tilad, Tarauli, Talkot, Malkot, Sann, Maregaon, Balsuna, and Nagina. Gram Panchayat Suwakot consists of villages Talla Suwakot, Malla Suwakot and Wadda. Gram Panchayat Kusauli consists of village Kusauli only.

3.2 Demography of the Area

Villages Lelu, Suwakot and Kusauli have been selected for the study on the basis of their differing population sizes in order to capture the effects of the scheme on large, medium and small villages. While Lelu hosts 485 families, Suwakot has 216 and Kusauli has only 55 families. The basic demographic parameters of the area are summarized below.

Table 1. Demography of the Study Area (Census, 2011)

Village	Suwakot	Lelu	Kusauli
Population (numbers)	2147	2591	978
Number of households	421	581	244
Literacy rate (%)	89.94	82.63	88.24
Sex ratio (per 1000)	677	1122	1038

3.3 Geography of the Area

According to geological formation, the district may be divided into four broad belts: (1) the innermost Siwalik hill ranges, (2) the lesser and middle Himalayas, (3) the inner Himalayas and (4) the thin belt bordering the Tibetan Himalayas, roughly tending east-south-east. The study area lies in the innermost Siwalik hill ranges. Many minerals like copper, Magnesite, Soapstone, Arsenic, Sulphur, Kyanite, Graphite, Slate, Limestone, etc. are found in various parts of the district.

The elevation of the district ranges from 500 m. above sea level in the valleys in the south to over 7,000 m. in the snow-bound Himalayas in the north and north-west. The climate, therefore, largely depends on altitude and varies according to aspect and elevation. Winters are severe. As most of the district is situated on the southern slopes of the Himalayas, monsoon currents penetrate through the deep valleys and rainfall is at the maximum in the monsoon season (June to September), particularly in the southern half of the district. The northern half of the district also gets considerable rainfall during the winter season which lasts from mid-November to March. Most of rainfall occurs during the monsoon period. In the monsoon season there are a few occasions when there are spurts of heavy rain in the hills causing floods in the rivers. The rainfall decreases rapidly after September and is the lowest in November. During winter, from December to March, considerable precipitation occurs in association with the passage of western disturbances across the region, the average rainfall of the district is about 36.7 cm. and this necessitates an efficient water management policy.

There is no meteorological observatory in the district. The account of the climate is based mainly on the records of the observations in the neighboring districts where similar meteorological conditions prevail. Variations in temperature are considerable from place to place and depend upon elevation as well as aspect. As the insolation

is intense at high altitudes, in summer temperatures are considerably higher in the open than in the shade. January is the coldest month with a mean maximum temperature of 10°C at heights of 2,000 m. above sea-level, the mean minimum temperature being at the freezing point (0°C.). Cold waves in the wake of western disturbances often make winter conditions severe. With the onset of the monsoon towards the end of June, day temperatures fall by about 3°C to 5°C.

3.4 Flora and Fauna

Flora of the district may be divided into four main divisions: the Sal forest, Chir forests, Oak forests and the Coniferous forests. The willow and older trees are, however, common everywhere in damp situations. The deodars are introduced plants in the district but have become wild. The study area was also located around the Chir forest and the Sal forest. There were many medicinal plants found in the area. The type of vegetation has a direct impact on the fuel use pattern of the residents who use fuelwood for domestic purposes.

There is a huge diversity in the fauna of area. Animals like goral or Himalayan chamois, tiger, panther, the Himalayan Black bear, jackal, Sambar, kakar (barking deer), musk deer, Nilgai, Bharal (wild blue sheep), snow leopard, red bear, etc. are also found in the different parts of the district. There are 34 species of snakes which are found in the district, out of which 26 varieties are non-poisonous and 8 are poisonous. The cobra is found up to an elevation of 1,800 m. The area is also very rich in bird diversity. Birds of prey like eagles, hawks, falcons and vultures, the Himalayan Griffon vulture are very common. Among the other bird species are the lungi pheasant, monal pheasant, kokla, chir pheasant, kalij, black partridge, chakor, wood pigeon, etc.

4. Impact of MGNREGA in Selected Villages

To study the impact of MGNREGA, a sample of 25 was chosen from each village after a pilot survey. The household survey was conducted on nearly 72 people across villages. The main occupation in the area is agriculture. While some have agricultural holdings, some others work as agricultural laborers and wage laborers. Most of them revealed that the small holdings were insufficient for the annual consumption. Therefore, they were dependent on the public distribution system. There were also retired army men who receive pensions and have come back to the native villages. Nearly 44 % of population was in the age group of 31-40 years, 22 % was in the age group of 41-50 years, 21 % in the 18-30 years of age group and 13 % in the age group of more than 50 years. The random sample consisted of nearly 43 females and 29 males. This reveals the good sex ratio and larger female workforce participation in the area. The number of women registered in the scheme under study was also found to be greater than that of men.

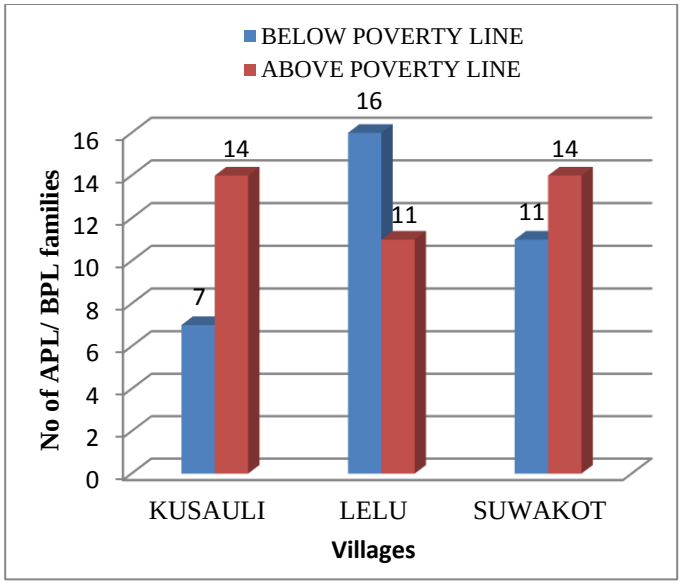


Figure 2. Poverty status of households in the study area.

The number of people above poverty line exceeds that below the poverty line on official records (Fig. 2). However, many respondents reported administrative and institutional lapses in the registration process. As a result, many of them miss the opportunity of getting into these schemes. The findings of the study are discussed below.

4.1 Migration

Because of the lower employment opportunities, migration with seasonal variations is a very common feature in the hills. The survey revealed a sharp decline in the migration rates after the introduction of MGNREGA. Not only there are new employment schemes, the wage rates have also been revised. The official daily wage rate in the study area was Rs. 125/-. Figure 3 clearly brings out the decline in migration in all three villages.

4.2 Employment

MGNREGA has helped reduce the extent of unemployment in the area. However, the extent of reduction is not very large (Fig. 4). One reason for that is in the mindset of the people. They consider MGNREGA only as a temporary employment opportunity during the agricultural off-season. Another reason is the lack of unemployment allowance that people are supposed to get during the days of no work within the scheduled period of 100 days. Respondents revealed that such periods are as long as 50 days. However, people felt that the scheme has

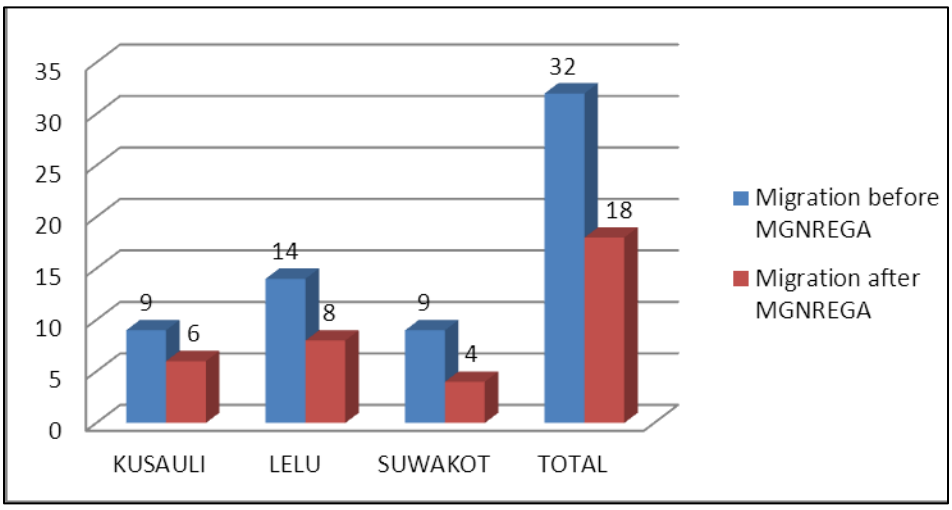


Figure 3. Effect of MGNREGA on migration.

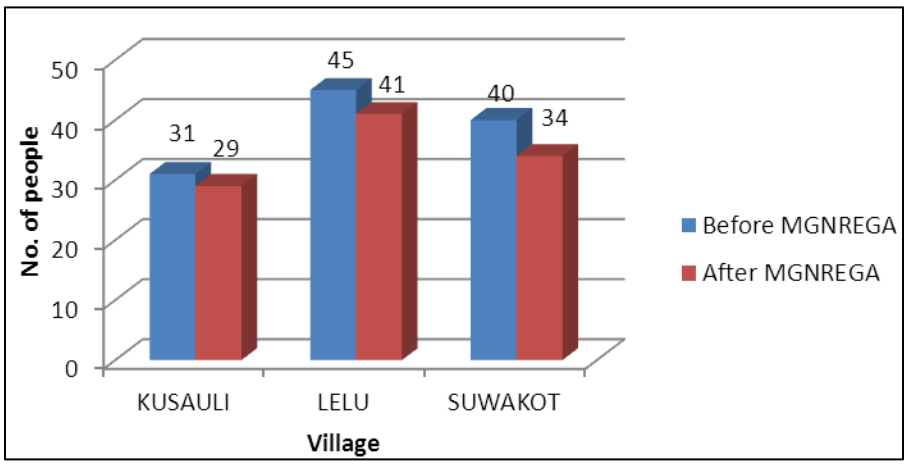


Figure 4. Unemployment status before and after MGNREGA.

helped them create some assets and generate some additional income.

4.3. Connectivity

The connectivity in the widely spread hilly terrains has improved due to the construction of roads under MGNREGA. While those who do not commute much did not perceive the change, the others felt a definite improvement in connectivity in the villages studied. More than 50% respondents felt that connectivity had improved in their village after the implementation of MGNREGA.

4.4. Sanitation

Although sanitation was not under MGNREGA in the initial phases, the Government later merged it with the Total Sanitation Campaign. Therefore, construction of individual household latrines, school toilets units and *anganwadi* toilets are now considered work under the scheme. Village Kusauli was already a *Nirmal Gram*, which means all the households in that village had sanitation facility even before MGNREGA. Sanitation facilities in Village Lelu were also already good and were only slightly improved after MGNREGA. Village Suwakot seems to have benefitted the most from MGNREGA has sanitation facilities in this village almost doubled after the implementation of MGNREGA.

4.5. Electricity Consumption

The pattern of electricity consumption is a major indicator of rural development. While power generation creates employment on one hand, it indicates the opportunity to engage in power-driven activities on the other. Any work under public schemes can also benefit from the availability of power and power-driven tools. The average

consumption of power across villages is 50-100 units of electricity per month. A significant portion of the population in the sampled villages consumes less than 50 units per month while a few have consumption above 100 units.

4.6. Use Pattern of Domestic Fuel

Because of the availability of wood in the nearby forests, many households use wood as the principal fuel. Their livelihood depends on these common property resources in a big way. LPG is a supplementary fuel in Lelu and Suwakot. Kusauli, which is the most developed among the three, has a larger use of LPG. An interesting observation is the non-existence of coal in all three villages. In total, 49% of households use a mixture of wood and LPG for meeting their daily domestic fuel requirements. 32% of the households depend only on word for the domestic fuel requirements while only 19% of the surveyed households depend on LPG gas to meet their domestic fuel requirements.

4.7. Water Use and Availability

Hills are typically water-scarce. Moreover, agricultural households have cattle. This indicates a shortage of drinking water for the people. However, a majority of the people surveyed have indicated a daily water consumption of 200-400 litres. This may be due to an efficient water management system and water conservation works under Government schemes. It was found in the survey that villagers depend totally on the rainfall for the purpose of irrigation. There was no irrigation work and agricultural activities were based on terrace cultivation. However, water conservation was taken up as a part of MGNREGA. The traditional water bodies in the villages which were primary sources of drinking water were restored. The respondents agreed that they have benefitted from such works.

4.8. Institutional Efficiency

Institutions form the basis of the success of any project. While MGNREGA has been a great initiative towards rural employment, poverty alleviation and environmental sustainability, it has not been institutionally very efficient. All the respondents felt that the system needs to be more transparent. Participation is also less than optimal with the '*Gram Sabhas'* (village council) holding meetings only once or twice in a year. A recent report from CAG pointed at the high level of corruption and huge irregularities in the scheme.

5. Observations and Survey Summary

A close examination of the various parameters reveals that MGNREGA has had an impact on the rural economy. The three villages in the hills have surely benefitted from the scheme. There have been distinct economic benefits in the form of increased employment, connectivity and reduced migration. The scheme has provided sources of additional income, though less than its full potential. The overall living condition has improved in some areas with better access to cleaner fuel and electricity.

Some significant changes have also taken place in the environmental domain. Sanitation has come under the priority list. Traditional water sources have been renovated for the purpose of water storage and distribution. However, irrigation facilities did not improve much because of lack of planning, priority and research. Rainwater still remains the major source of water supply for agriculture. While MGNREGA had a large scope for rural development, it has fulfilled its aims partially. The system has various drawbacks in policy formulation and more significantly in its implementation. Misuse of state machinery, corruption and irregularities have been part of a bigger institutional failure.

Exhibit A. Work under MGNREGA in Village Suwakot.

6. Conclusion and Recommendations

MGNREGA is by now a widespread scheme in all the rural districts of India. However, there is scope for a lot of improvement to make it more inclusive, efficient and productive. Such works have huge potentials to sustain and improve the rural environment. The emphasis on resources such as, water, forests, etc. is imbibed in the targets. Such activities have clear environmental activities while being employment generating in nature.

In view of the less than optimal success of the scheme, some policy recommendations may be made on the basis of the findings in the study. These are, 1) More work needs to be added according to the specific geographical conditions of the areas in order to develop more

sustainably; 2) Physical structures constructed under MGNREGA are assets requiring maintenance and/ or protection. Maintenance is necessary to sustain the delivery of environmental benefits, such as, continued ground water recharge from a check dam and structures to store water. Maintenance, along with construction, should be an integral part of MGNREGA; 3) There is a need of technical and expert support in some works, such as, during the formation of check dam, choice of site etc. This requires to be integrated to the schemes; 4) Many respondents felt that the wage rate should be Rs. 150 per day and the number of days should be Rs. 120. This may be scrutinized before implementation in the next phase. Similarly, unemployment allowance needs to be regularized; 4) There is a clear need to check corruption, bring in transparency and improve institutional efficiency.

MGNREGA has been found to have performed moderately in the villages of Uttarakhand. While it has direct economic motives, it has a wide range of environmental services. Improving the current drawbacks along the lines mentioned above, it can become an effective economic program as well as an environmentally sustainable policy.

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Sustainability Appraisal and Economic Valuation of North Delhi Ridge Using Participatory Research Approach

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Abstract: Delhi Ridge is the Northern extension of the Aravalli hill range and is a prominent landscape feature of the National Capital Territory (NCT) of Delhi. Presence of Delhi Ridge, along with River Yamuna, has been of strategic significance in the selection of Delhi as a capital city since ancient times. Modern Delhi has grown beyond the physical boundaries of the Ridge and the Yamuna. The once barren Ridge has now been transformed into a forest, which provides useful ecosystem services to Delhi. Despite the large number of benefits provided by the Delhi Ridge, the latter is under a constant threat of encroachment and degradation. This is because land is a highly priced natural resource in Delhi. The approximately 78 sq. km area of the Delhi Ridge is thus seen by many as prospective real estate and several legal and illegal structures can be found inside the Delhi Ridge.

The present research contribution is an attempt to carry out sustainability appraisal of the Delhi Ridge by using the principles of environmental economics and participatory research. We focus on the North Delhi Ridge (NDR) and have carried out an economic valuation of NDR using survey based methods. A participatory-GIS approach has been followed to highlight the physical boundary of NDR along with the areas of encroachment. We find that economic value of NDR is much greater than the benefits that may be drawn by modifying its land use land cover to concrete. We also find that in the absence of existing notification on the extent of the NDR, there is rampant encroachment on its eastern and southern side.

Keywords: ecosystem services, Delhi Ridge, environmental economics, urban ecology, participatory research

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1. Introduction

The Delhi Ridge is the vernacular name given to the Northern extension of the Aravalli Range as it passes through the Delhi megacity. The Delhi Ridge is also known as the 'green lungs' of Delhi and is a rocky hilly, reserved forest area, which lends a unique geographic character to Delhi (Mann and Sehrawat, 2008). The Ridge plays a vital role in maintaining salubrious environment in Delhi by acting as a barrier against the hot winds coming from Rajasthan. It also provides critical ecosystem services such as recharging the ground water, absorbing air pollution, purifying the air, providing habitat for urban biodiversity and giving Delhi a 'sense of place' as well as aesthetic beauty.

The once continuous Delhi Ridge is now found in four unevenly fragmented parts. These are: 1) Northern Ridge Forest (0.9 sq km), 2) Central Ridge Forest (8.6 sq km), 3) South-Central Ridge Forest (6.3 sq km) and 4) Southern Ridge Forest (62.0 sq km). The rapid pace of urban growth in Delhi is having a significant impact on the Delhi Ridge in the present day. This impact has been even more prominent in the last few decades and the Ridge is facing threats like encroachment, illegal construction, deforestation and garbage dumping. This is resulting in a gradual degradation of the Ridge (Mohan et al., 2000; Nath et al., 1993). There is also considerable ambiguity in the demarcation and governance of the Delhi Ridge and a large part of this forest land does not even come under the supervision of the Forest Department of the Government of NCT of Delhi.

It is interesting to note that the air quality in Delhi has simultaneously degraded in the same time period. While the degradation of air quality in Delhi may not be a direct result of the degradation of the Delhi Ridge, it is certain that the protection of the Ridge is certainly a pre-requisite

for ensuring clean air in Delhi. The Delhi Ridge therefore needs to be conserved and maintained in order to ensure the environmental health of Delhi.

According to the Geological Survey of India (GSI), 'the Ridge must be maintained in its pristine glory and no further infringements should be permitted'. Recent media reports indicate that the first step towards the conservation of Delhi Ridge is its demarcation. The National Green Tribunal (NGT) had already ordered Government of Delhi to carry out the demarcation of the Ridge in 2013. However, due to reasons that are yet to be established, the demarcation exercise is yet to be completed. It is therefore difficult to conserve the Delhi Ridge in a situation when its perimeter is not adequately mapped out. At the same time, land is a highly priced resource in a megacity like Delhi. Lack of demarcation as well as public interest and pressure could well lead to the modification of the land-use of Delhi Ridge from 'forest area' to 'residential' or 'commercial'. Indeed such modifications have begun to take place leading to a reduction in the overall area of the Delhi Ridge (based on media reports and personal visits).

The present research contribution is at an attempt at carrying out the sustainability appraisal of the Northern part of the Delhi Ridge. The boundary of the Ridge has been identified using Participatory-GIS approach. Such an approach has been used previously for identifying the benefits of green spaces (Brown, 2014). The political status of the North Delhi Ridge (NDR) was ascertained along with carrying out a spatial vulnerability assessment of this study area. Various stakeholders of the NDR have also been identified along with attempting to carry out its economic valuation.

The Delhi Ridge is a natural heritage of Delhi and India and it provides some very useful services to the people at large. Despite this, its existence has now become threatened. There is thus a great disconnect between citizens and the very natural resources that support them which has been highlighted in this paper. Since land is a highly priced resource, greater efforts are needed to protect the Ridge. We have attempted to evaluate the economic benefits of the NDR which may prove useful in developing a conservation strategy for Delhi's life supporting system.

2. Study Area

The North Delhi Ridge is located in the North Delhi District of the National Capital Territory (NCT) of Delhi between 28°41′34.8″N 77°13′12.9″E and 28°40′04.8″N 77°12′34.4″E. The North Delhi Ridge (NDR) is also called the Kamala Nehru Ridge and is the smallest among the four parts the Delhi Ridge. According to Government of Delhi, NDR occupies an area of 87 ha and constitutes 1.13 % portion of total Delhi Ridge area (DoE-GNCTD, 2014). There is, however, ambiguity on the total area of the NDR and the Survey of India has previously reported it to be 82 ha (SOI, 1976). NDR consists of quartzite rocks formation and is the rocky outcrop of the Aravalli Hill range. The NDR part of the Ridge has University of Delhi on its Western and South-western side, Civil Lines on its East side and *Timarpur* residential area on its Northern side (Fig. 1).

2.1 Ridge Management

Three different agencies manage different parts of the North Delhi Ridge and the parts are unequally divided. The Delhi Development Authority (DDA) manages the largest among these parts (73 ha) while the North Delhi Municipal Corporation manages 11 ha of total 87 ha. Interestingly, the Forest Department of the Government of Delhi manages only about 3 ha of the total NDR area. It needs to be noted here that the Delhi Ridge has been notified as a 'Reserve Forest' under Section 4 of the Indian Forest Act, 1927 vide Notification No.F.10 (42) - 1/ PA/ DCF/ 93/ 2012-17 (I) dated 24th May, 1994. At the same time, the Hon'ble Supreme Court of India has directed that the Ridge should be maintained in its pristine glory (DoE-GNCTD, 2014).

2.2 Historical Importance

Delhi has a rich history which still remains unexplored. Delhi is known to be consisting of seven (+2) cities which have influenced its history and urban planning from time to time. The North Delhi Ridge (earlier a continuous part of the Delhi Ridge) is of considerable significance with respect to the history of Delhi. The oldest structure present inside the NDR can be attributed to the reign of Ferozshah Tughlaq.

Historians believe that Tughlaq had also made attempts to carry out afforestation activity in the Northern ridge in addition to developing it as a game reserve (Horton, 2008). The structures remaining inside the NDR from Tughlaq period are *Chauburja* Mosque, *Kushk-i-shikar* or Pir Ghaib and Ashokan Pillar. The Ashokan Pillar is 10 meter high and was brought to Delhi from Meerut in 1356 as part of a beautification project (WMF, 2014). It is believed that reckless deforestation of NDR took place during the Mughal period and continued till early nineteenth century. In the British period, the first efforts to plant the NDR were undertaken by J.R. Maconachie and Dr. Ross.

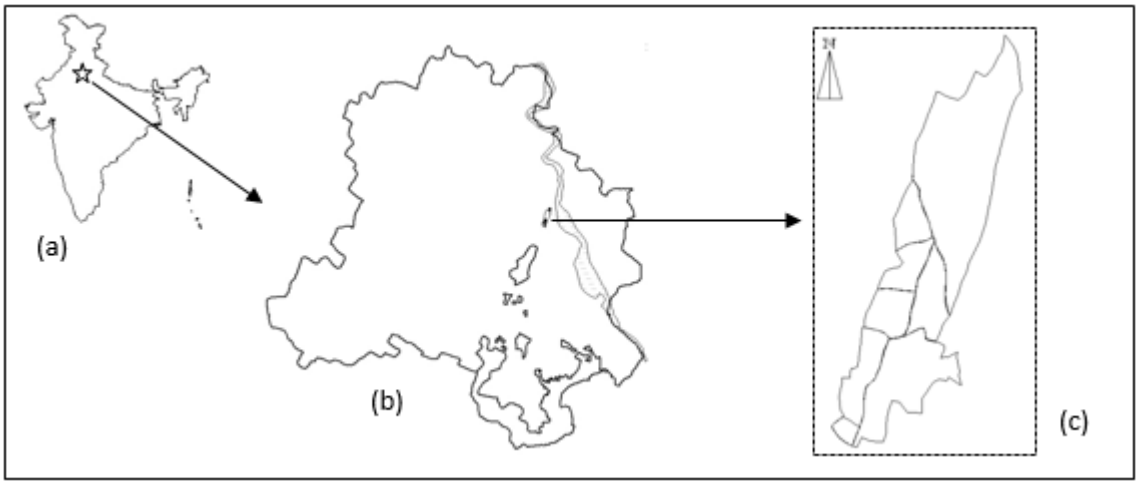

Figure 1. Map showing (a) location of NCT of Delhi on map of India, (b) location of North Delhi Ridge on map of Delhi and (c) North Delhi Ridge.

This was followed by few others like Rev. G.A. Lefroy and Deputy Commissioner C.A. Barron, all of whom attempted to increase the vegetation cover of NDR (Mann and Sehrawat, 2008). The Ridge holds tremendous relevance from the point of view of the First War of Independence in 1857. The British camped in and around the Northern Ridge after the mutiny took place. NDR was the centre of attention during the British period even before the mutiny. The British Cantonment was located in Civil Lines. The area around the NDR was the administrative hub and hosted buildings such as the Old Secretariat (present day *Vidhan Sabha*) and the Vice Regal Lodge (present day University of Delhi Secretariat). A flagstaff tower was constructed inside the NDR in the year 1826. NDR and the structures inside the Ridge provided refuge to the British army during the mutiny of 1857. A 29.5 meter tall 'Mutiny Memorial' was constructed inside the NDR in 1863 after the British regained power.

2.3 Ecological Significance

Ecosystem services are of critical importance in rapidly urbanizing megacities like Delhi. The city of Delhi has an alarmingly high population of 16.7 million (Census of India, 2011) and an increasingly consumerist culture. A recent study by Yale University has placed Delhi as the worst polluted city in the world. According to this study, Delhi has surpassed Beijing (EPI, 2014), the latter of which has been known for its pollution problems since a long time (Down to Earth, 2014). This makes it even more important for us to understand and appreciate the ecosystem services provided by the Delhi Ridge. The role of Delhi Ridge as the 'Green Lungs' of Delhi needs to be revisited. The 'green lungs' metaphor is very relevant as the Delhi Ridge has been preventing the deleterious impacts of air pollution in Delhi to the greatest possible extent. The ecosystem services tendered by the Ridge can be classified broadly into four categories.

Provisioning Services are the supply of goods of direct monetary value to the people for example timber, fish, fiber, fruits etc. These are of immediate benefit to communities living on the fringes of the ridge or those who are encroaching up on it. ***Regulating services*** underscore the range of functions performed by the ecosystem that cannot be defined in monetary terms but are of great value. The regulating services of the Delhi Ridge are paramount for survival of the citizens of Delhi. The Ridge protects Delhi from the searing winds and sandstorms of Rajasthan and helps in lowering the temperature by retaining moisture. It checks soil erosion, purifies the polluted air, regulates rainfall and recharges the depleting ground water resource. It also regulates global warming by sequestering carbon. These functions are of enormous significance to present day Delhi, which is highly polluted and faces challenges like air pollution and water scarcity regularly.

Cultural services are not defined in terms of material benefits but are understood as the needs of society or are understood for the aesthetic benefits that they provide. The Ridge is the only cherished refuge to the threatened urban biodiversity in Delhi. This makes the Ridge an ideal spot for birding. The Ridge enhances the landscape and was in fact landscaped by the British for the beautification of the capital. NDR is inundated with morning walkers who profit from these cultural services. ***Supporting services*** are difficult to perceive as they are of no direct

benefit to the people. They are basically services that form the basis for provision of all other services and are crucial for the functioning of the ecosystem. Formation of soil, process of plant growth, habitat for species, oxygen from plants, nutrient cycling, primary productivity etc. are some of the supporting services provided by NDR.

3. Methodology

The objective of the present research contribution was to carry out a sustainability appraisal of the NDR using survey, participatory GIS and economic valuation tools. Three different survey sheets were prepared, one each for morning walkers, students and tourists visiting the NDR. A random survey was carried out (between 7.00 am to 8.30 am for morning walkers, 12.00 pm to 2.00 pm for students and tourists) to understand the public perception towards the Ridge. This was followed by carrying out an exploratory vulnerability assessment of the Ridge using GPS. Encroachments and other breach of the Ridge wall, as well as structures like waste disposal sites were noted and marked on the map of the NDR using MapInfo GIS software (v.10.0). An attempt has also been made to carry out the economic valuation of the NDR using rapidly developing environmental economics methods.

4. Public Perception about NDR

Preliminary survey conducted for identifying the population universe indicated that approximately 300-400 people visit the NDR as morning walkers every day. Approximately 100-200 students/ day visit the Ridge on a regular basis while approximately a similar number of tourists visit the Ridge on a daily basis. A sample size of n=20, 15 and 15 was then selected for morning walkers, students and tourists populations. The random survey encountered 85% males and 15% females among the morning walkers, 27% males and 73% females among the students and 60% males and 40% females among the tourists. Amoung all males visiting the NDR, maximum percentage of visitors are between the age group of 20 to 30 years, whereas in females, maximum percentage of visitors lie in the 10 to 20 years age group (Fig. 2). Most of the visitors to Noth Delhi Ridge are youth under the age of 30 years. The main reason behind this could be the proximity to the North Campus of University of Delhi.

People visit the NDR largely due to its natural beauty and for obtaining health benefits. Apart from this, the Ridge also provides recreational space for college students and a peaceful place for couples (who visit the Ridge as tourists). Around 49% of total surveyed people visit the NDR daily, mainly for the purpose of morning walk. 17% of sampled visitors visit the Ridge weekly while 20% were found to be occasional visitors. Among the total sample size, 56% visitors prefer to reach the Ridge on foot while 16% use public transport. 28% of the surveyed population commuted to the NDR using their personal vehicle (cars and bikes).

Only 22% of the sampled population was aware about the history associated with the NDR. Detailed analysis revealed that those below the age of 30 years are less aware about the history of NDR as compared to those above this age. More than 50% of all visitors feel that the Ridge is threatened with encroachment and degradation. Littering (especially plastic waste) by visitors, municipal waste dumping as well as problems of law and order such as chain snatching and eve teasing are perceived by the sampled population. Among the total sampled population, 66% of people are willing to work for the conservation of the NDR. This percentage of population is keen to get involved with any conservation program initiated for the protection of the Ridge.

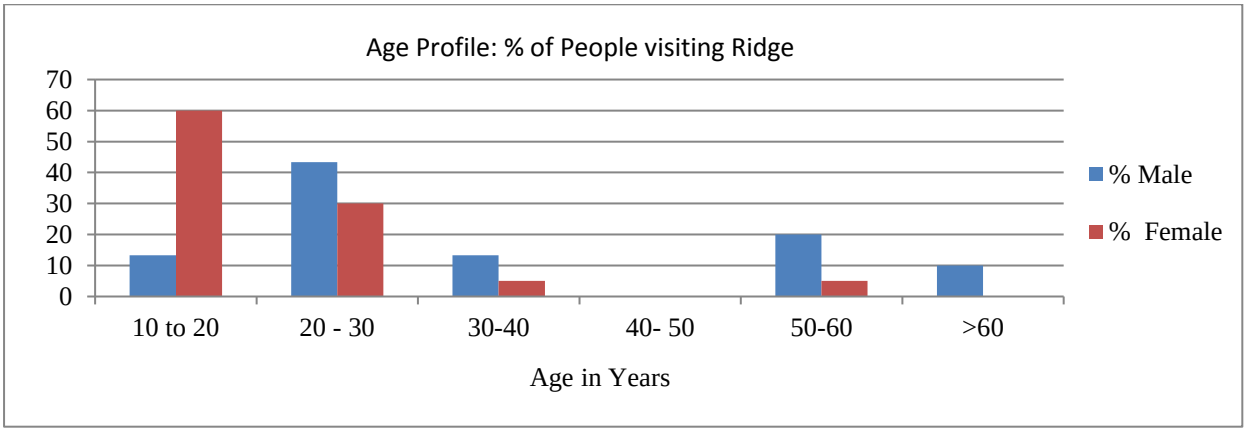

Figure 2. Age profile of the surveyed population visiting North Delhi Ridge.

50% of the sampled population is willing to pay for entering the Ridge, if such a conservation strategy is implemented. Those opposing such a measure are of the opinion that the poor will be severely affected and the NDR will become a public space for elite only. It was interesting to note that a large proportion of the sampled population consider the NDR as rejuvenation place which should not be regulated for any section of the people. 50% of the people, who are willing to pay to enter the NDR, are largely below 30 years age. The amount opined by more than 90% of this population, as entry fees for the NDR, is Rs. 20/-.

5. Participatory-GIS Analysis

A participatory-GIS process is a relatively new concept involving the integration of inputs from multiple stakeholders and technical experts with Geographic Information System (GIS) to establish pre-defined objectives (Zhang et al, 2013). The objectives in this case were to carry out a threat perception and vulnerability assessment of the NDR. It was deduced that the boundary of the NDR was yet to be demarcated (personal communication with Forest Officials). It was also found that the process of the declaration of the NDR as a "Reserve Forest" has not been completed. This implies that the protected status of the NDR does not hold true and required further investigation of encroachments around its entire perimeter.

The latter was done using personal visits to the entire perimeter of the NDR while simultaneously using inputs from daily visitors and management authorities of the NDR. A thematic map was prepared based on the participatory-GIS data. While existing management of the NDR considers it to be a single entity, participatory GIS research indicates the existence of at least eight distinct zones (Fig. 3). The zones are formed due to the road network that exists inside the NDR and are enclosed by a prominent boundary wall. An auxiliary zone of the NDR was also discovered during the participatory-GIS exploratory research.

The first zone is the largest among all zones and has been christened the **University Zone** based on its location. This is the zone which is frequented more often by morning walkers as well as students. The second zone houses the office of the Forest Department as well as a nursery. This is the zone managed by the Forest Department and has been christened as the **Forest Office Zone**. The third and the fourth zones are managed by the Municipal Corporation of Delhi. The third zone is forested while the fourth zone houses the Hindu Rao hospital complex. These third and the fourth zones have been named **MCD II Zone** and **MCD I Zone** respectively. MCD II Zone is also interesting since a large solid waste dumping *dhallaon* (bin) is located in it. Preliminary investigation of the *dhallaon* indicates that both solid waste as well as hospital waste is dumped here.

The fifth zone is forested and has been christened **Zone 5** due to the lack of any prominent feature. The sixth zone is the second largest among all zones and is being called the **Mutiny Memorial Zone** due to the presence of the Mutiny Memorial in its vicinity. The seventh zone houses a large water reservoir and is being called the **Water Reservoir Zone**. The southernmost part of the NDR has been converted into a public park which is known as the **Kamala Nehru Park**.

The participatory-GIS approach identified a zone of the NDR which is no longer part of it. This zone lies in the adjacent Civil Lines area and has been christened the **Civil Lines Zone**. More than 90% of this zone is still forested and the zone lies approx. 250 m. from the perimeter of the present NDR. Residential and commercial structures exist between the present perimeter of the NDR and this zone. Encroachments on the South-eastern perimeter of the NDR were observed at several places. These were more prominent in the area between the Mutiny Memorial and the outer-wall perimeter towards Civil Lines where cattle grazing inside the NDR was also spotted.

5.1 Tourism Potential of NDR

The participatory-GIS analysis also highlights the tourism potential of the NDR. Participatory-GIS mapping added the logistic perspective to exiting knowledge in the development of a tourism package for the NDR. The different heritage structures inside the NDR have attracted citizens of all age groups as well as tourists visiting the city. However, no concrete efforts have been made to promote tourism in the NDR. We would like to maintain here that while tourism in itself could lead to adverse exploitation of the natural beauty of the NDR, the NDR can become a hotspot for ecotourism. An experimental attempt to initiate urban ecotourism in the NDR has carried out by Delhi Greens NGO and is discussed elsewhere (Singh, 2011).

The participatory-GIS approach indicated two distinct sectors for carrying out ecotourism in the NDR. The first Sector includes Zone 1, which further includes the following heritage structures: a) Flagstaff Tower, b) *Sarpakaar Jheel* wetland, c) *Chauburja* mosque and d)

Khooni Khan Jheel wetland (Fig.3). The second sector includes geographically linked Zone 4 and Zone 7 and includes the following heritage structures: e) *Pir Ghaib*, f) *Hindu Rao Baoli*, g) Ashokan Pillar, h) *Teesri Jheel* wetland and i) Mutiny Memorial. A third and larger Sector can be conceived which could include both these sectors. Each of the aforementioned structures are part of the natural and historical heritage of Delhi and India, and have tremendous economic potential with respect to conducting ecotourism.

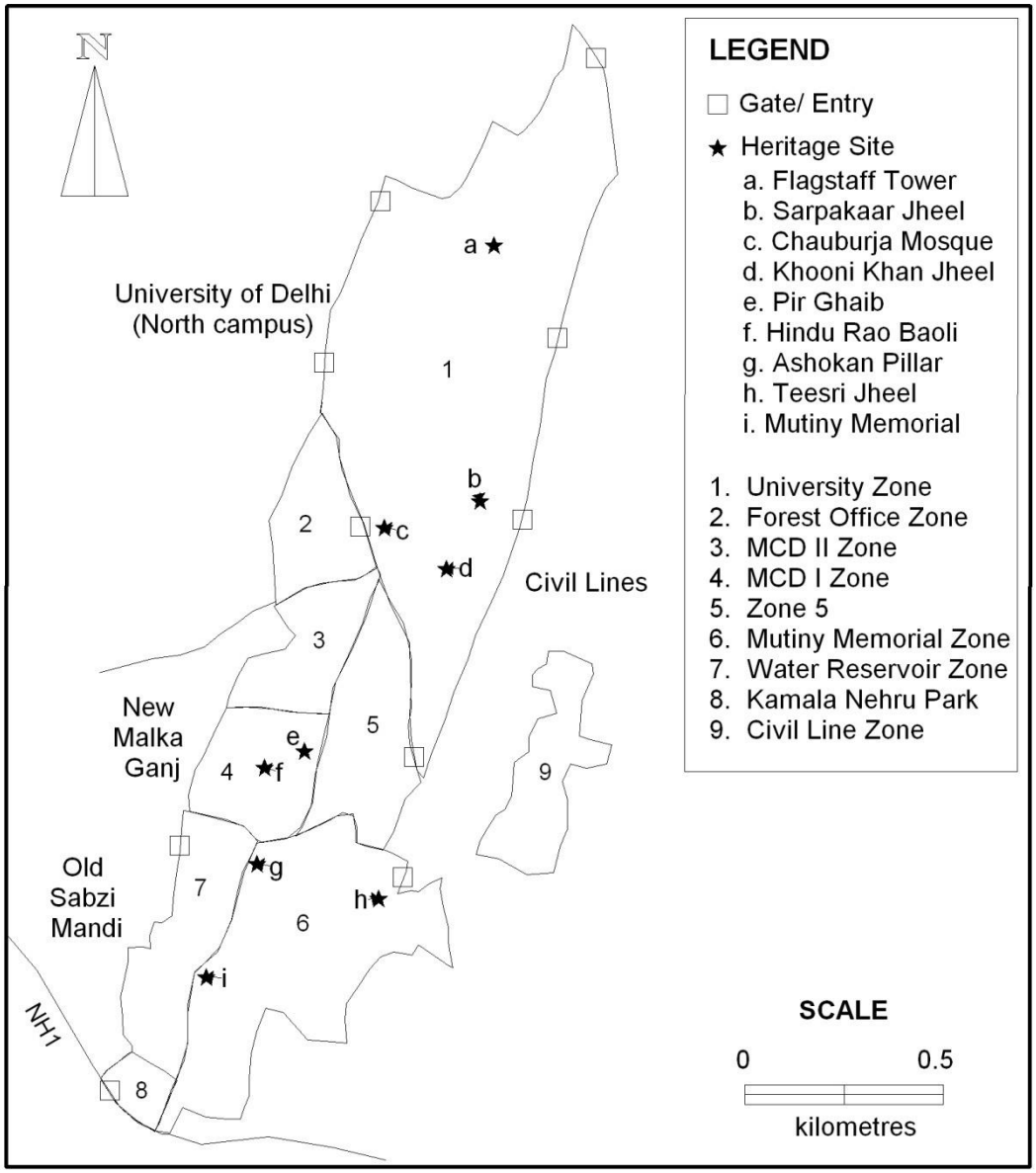

Figure 3. A Participatory-GIS map showing the identified zones and heritage sites of the NDR.

6. Economic Valuation of NDR

The knowledge of ecosystem services has long existed (Tallis, 2013). The methods for the economic valuation of such services are now being developed (Whitehead, 2013; Laurans, 2013). The success of such an approach is validated by the fact that it has also been extended to valuing historic environments (Provins et al., 2008). The present research contribution attempts to initiate an economic valuation of the NDR. While the economic valuation methods could be used on several attributes i.e. above discussed tourism potential, ground water recharge ecosystem service etc., the oxygen producing service was selected as the chosen attribute. This was based on a previous study on the economic valuation of healthy trees

(Delhi Greens, 2013). There is no official census of the trees for the NDR. Consequently, a tree census was made in the fourth zone (MCD I Zone) which has the least tree density due to the presence of Hindu Rao Hospital complex. A total of 68 healthy trees were counted in this zone. Since this is the pilot investigation, the age of the tree was not taken into account. The latter will play an obvious role in the oxygen generating capacity of the tree. The figure so obtained was multiplied by the economic value (EV) of one tree with respect to (maintenance free) oxygen production (~Rs. 23,72,50,000/-) (Delhi Greens, 2013).

$EV_{MCD\ I\ Zone}$ = 68 x Rs. 23,72,50,000
= Rs. 16,13,30,00,000

We deduce that the economic valuation of the 'oxygen producing' ecosystem service of the most disturbed zone of the NDR is at least one thousand six hundred and thirteen crore rupees. The EV so obtained will increase multifold if other ecosystem services of this zone are calculated and included in the valuation. The EV of the other zones of the NDR (which are both larger and less disturbed) is bound to be several times more than the above calculated EV.

7. Discussion

The North Delhi Ridge provides useful ecosystem services to the student population and the residents living close to it. However, there is a need to recognize these services and understand the importance of the NDR with respect to these services. There is a good level of understanding of the importance of the NDR with the residents living in its vicinity. A similar level of understanding is wanting with the administrative authorities managing the North Delhi Ridge. The NDR and the entire Ridge was notified as Reserve Forest on 24 May, 1994. But the process has not been completed due to pending land dispute cases and the Ridge continues to be managed by agencies other than the Forest Department. The NDR is managed by three agencies, out of which the Forest Department manages only a small part of the entire NDR. Interestingly, this is also the part of the NDR which is most conserved and has least encroachment. Consequently, it is reasonable to believe that the complete transfer of the NDR to the Forest Department will aid in the conservation of the NDR. The study recommends the speedy settlement of all pending land disputes and the transfer of the Ridge Forest to the Forest Department.

The NDR has been found to exist in eight distinct and continuous zones based on the participatory-GIS analysis. These zones are divided by roads and have variable pressures. Consequently, it is suggested that the management of the NDR needs to be carried out in a zone wise manner. Such a micro-management of the NDR will help enhance the green cover and also address environmental challenges such as habitat fragmentation and loss of biodiversity. Absence of clear demarcation of the Ridge limits any methodological approach in its conservation. The ninth zone of the NDR, as identified in the participatory-GIS approach, is an interesting find. It is an indicative that there exist areas in the vicinity of the Ridge, which have retained the Ridge Forest character, but have been fragmented due to urbanisation. These areas could serve the purpose of ecological corridor and could aid in the enhancement of the urban biodiversity.

Encroachment from the South-east perimeter and heavy traffic movement are some other challenges being faced by the NDR. While littering is observed as a problem, the presence of an open-air waste disposal municipal *dhallaon* adjacent to the Hindu Rao hospital is an indirect public health hazard. It is highly recommended that either this municipal *dhallaon* should be removed outside the NDR or it be covered and frequently emptied. Preliminary economic valuation of the NDR shows that it provides high economic gains. Indeed, a more comprehensive economic valuation is needed to identify the exact economic benefits derived from the NDR. Such a study is much needed and should be carried out by (or in collaboration with) the Government for more effective results. Such a study will also aid in developing education and awareness programmes on the benefits of the NDR. This will then sensitize the people and the administration machinery about the importance of protecting and preserving the NDR in its present state.

The participatory-GIS assessment also highlighted the tourism potential of the NDR. Almost 1.89 million foreign tourists visit Delhi every year, making it the third most preferable tourist destination among all states in India (ITS, 2010). In addition to the foreign tourists, a large number of Indians also visit their state capital each year. According to 'Identification of Tourist Circuits across India' Interim report, the top four most visited places in Delhi are Qutub Minar, Red Fort, Delhi Zoo and Pragati Maidan (IL&FS, 2012). Strangely, the Northern Ridge and its monuments do not find mention in the list of the tourist destinations of Delhi in this report. This highlights the lack of awareness in the people and in the administration about the North Delhi Ridge and its historical importance. This lack of awareness has indeed robbed the ridge of its tourism potential. The NDR has immense tourism potential and is already frequented by

those who are aware of its ecological and heritage importance. Hence, it can be inferred that if more awareness is generated in this direction, the North Delhi Ridge will certainly see a spurt in the number of (eco)tourists. The latter could also boost conservation measures taking place for protecting the NDR and enhance its ecosystem services.

8. Conclusion

The conservation of NDR is critical to the sustainability of the urban growth of Delhi. However, concrete efforts towards sustainable management of the NDR are wanting and there is ambiguity in its political status. While the entire NDR should be under the supervision of the Forest Department, that is not the case. Only a small fragment of the NDR is under the Forest Department, which was found to be the most protected among all zones appraised in this study. The entire NDR must be brought under the Forest Department before any further conservation measures can be taken.

Participatory GIS has been found to be useful tool for promoting people based conservation efforts. The NDR was found to be divided into eight continuous zones largely due to the presence of a road network traversing through it. These eight zones are of unequal sizes and are marked by the presence and absence of concrete structures. There is also a difference in the number of visitors frequenting the different zones. Consequently, individual zones face unique anthropogenic pressures thereby requiring zone specific management strategies for the conservation of the NDR.

The NDR is of greater relevance today due to ever increasing number of vehicles in NCT of Delhi. The inability of the state administration to put a check on unsustainable growth in the number of vehicles is concerning and further highlights the significance of the NDR in the present day. The NDR is located adjacent to the University of Delhi and acts as a buffer to the air pollution contributed by vehicular exhaust and other emissions. In doing so, it acts as a green belt which absorbs the air and noise pollution and protects the health and wellbeing of a large number of youth who frequent the University of Delhi for education purpose.

The exact economic valuation of the NDR requires a detailed study of all the ecosystem services provided by it. Preliminary investigation of just one ecosystem service (oxygen production) reveals that the total economic valuation of the NDR may well be above two thousand crore rupees. Despite such high economic benefits being provided by the NDR, there seems to be lack of concerted efforts towards its protection and preservation. There is thus a need to carry out a rigorous economic valuation of the entire Ridge. Such a research work needs to be complemented with awareness generation on the ecosystem service benefits of the Ridge to the people of Delhi.

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Assuaging Human Health Concerns Through Analysis of Physicochemical Parameters of Potable Water Samples in Delhi

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Abstract: Water is a critical component for life and is an indispensable natural resource containing minerals required for human nutrition. However anthropogenic activities related to rapid industrialization, effluent discharges, overpopulation, atmospheric pollution etc. have stretched water reserves to alarming levels wherein the situation has come to a breaking point. Water quality parameters including pH, turbidity, hardness, presence of calcium, chloride, sulphate, ammonia, total dissolved solids (TDS) and magnesium are evaluated in the present study to elucidate apprehensions about potability of water being consumed in day-to-day life. Eleven water samples from areas in Delhi were investigated for the aforementioned physicochemical parameters to identify water potability issues. A few samples exhibited ultra-high values of TDS (~15,000+ mg/l) while standard value is prescribed at 2,000 mg/l by Bureau of Indian Standards (BIS). Water samples with high TDS values are reported to be potential harbingers of bacterial contamination. In eight of the eleven samples the hardness coefficient was found to be higher than WHO baseline value of 100 mg/l. Three samples from Faridabad, Govindpuri and Pushp Vihar had either more or values approaching BIS standard of 300 mg/l, thereby indicating that the so called potable water was unfit for human consumption. High hardness values can be conjectured to be arising from rusted water supply pipes and/ or mixing of effluents from industries running from homes.

Keywords: water quality, drinking water, turbidity, TDS, Delhi.

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1. Introduction

Worldwide researchers are increasingly concerned about the quality of drinking water (Gulson et al., 1997; Ozturk and Yilmaz, 2000). Over the last few decades, burgeoning anthropogenic activities have led to fast depleting natural resources and steeply falling ground water levels. Simultaneously indiscriminate use of pesticides and insecticides for achieving bumper production levels has affected both quality and quantity of drinking water (Sillanpaa et al., 2004). Quality of potable water is also reported to significantly impact the human health and has paved way for various gastrointestinal problems, cancer, eye and skin diseases etc. (Ikem et al., 2002). Even the storage and supply of safe potable water has a significant impact on water borne diseases (Virkutyte and Sillanpaa, 2006).

One among the 17 Sustainable Development Goals of the UN adopted in *2030 Agenda for Sustainable Development* is to provide clean water and improved sanitation facilities to all. Assurance of drinking water safety is a foundation for the prevention and control of water-borne diseases, especially when the World Bank estimates that 21% of communicable diseases prevalent in India are due to unsafe drinking water. Moreover, world over approximately 8,46,000 deaths occur annually due to diarrheal disease. Diarrhoea remains the most prevalent water borne disease in India. It mostly affects children under the age of 5 often leading to death.

Scarcity of fresh, clean and safe water is thus seen to rank amongst one of the most urgent environmental challenges facing humankind. Primary cause of waterborne diseases as a result of microbial contamination is reported to be the disturbance in the raw water and/or distribution networks (Craun and Calderon, 2006; Risbero et al., 2007). Viruses

like Noroviruses and protozoa i.e. *Cryptosporidium* play a significant role in affecting human health primarily due to long persistence and high infectivity as per the statistics available with WHO (WHO, 2011a). One of the primary aims of WHO is to ensure general access to adequate supply of safe drinking water under formulated Guidelines for Drinking Water Quality (WHO 2011a).

Suitability of water for human consumption is best indicated by its chemical, biological and physical characteristics which together epitomize quality. Human body is known to comprise about 50-60% water, hence pH level of water has a direct impact on all the chemistry associated within the body as also general health. Digestion, breathing, hormonal production, blood circulation and other regulatory mechanisms in the body perform the basic function of balancing pH. Typically for a human body, the fluids clock a 7-7.2 level of pH value (Avvannavar and Shrihari, 2008). Although pH has no direct impact on water consumers, it is one of the most important operational water quality parameters. A pH value of more than 8.5 conforms to a bitter taste and at the same time negatively impacts disinfection of water with chlorine (a process routinely practiced in India). High pH water is also known to affect the mucous membrane, skin and even the eyes. Further, if the pH value falls lower than 6.5 then acidic nature of the water corrodes drains and pipes of the household water supply systems leading to contamination of drinking water.

Turbidity, a key parameter to test the efficacy of drinking water is a measure of relative clarity of a liquid and can be attributed to presence of phytoplanktons, small algae, waste discharge, urban run-off etc. Although turbidity is generally associated more in the aesthetic sense, however pathogens encased in particulate matter can stay protected and survive multiple decontamination processes undertaken. Hence measurement of turbidity is an indirect indicator of existence of pathogenic organisms and directly impacts the human health. A contaminant level of 5-10 NTU (depending on treatment process used) is considered safe for human consumption (Sawyer et al., 1994; Burden et al., 2002; De, 2003). WHO recommends turbidity levels to be less than 1 NTU and not more than 5 NTU whereas Bureau of Indian Standards (BIS) specifies a recommended maximum turbidity of 10 NTU. Turbidity can provide food and shelter for pathogens in the distribution system leading to out-break of water borne diseases (EPA, 1999). Presence of micro-organisms like *Cryptosporidium* in drinking water, even in low concentrations can pose a health hazard. The high turbidity levels observed in potable water may be attributed to the common occurrence of sewage water somehow getting mixed with potable water due to faulty pipelines, negligence and official apathy which is expected to give rise to water borne diseases. As mentioned earlier, clarity of drinking water is important; and significant evidence exist which supports the view that controlling turbidity is a competent safeguard against pathogens in drinking water.

Quality of potable water is also crucially dependent on the balance between the cations (Calcium and Magnesium) and anions (Sulphates and Chlorides) present in it. The principle of electroneutrality requires that the sum of positive ions (cations) to be equal to sum of negative ions (anions). It is a widely accepted truth that cations are primarily responsible for the secondary attributes of salts whereas anions modify perceived intensity (Marcussen et al., 2013). The sensory attributes of a cation may further depend on its concentration with sweet taste being more dominant at lower concentrations whereas the salty taste often but not always dominating at higher concentrations (Koseki et al., 2005; Marcussen et al., 2013).

Sulphates are present in all body tissues, with highest concentration in the connective tissue and also in active areas of bone and teeth development. The average daily intake of sulphate (500.0 mg/l) in humans is met through water, air and food. WHO does not identify a level of sulphate in drinking water but its presence above 500.0 mg/l in water leads to a noticeable taste. High concentration of sulphate can be problematic as it makes water corrosive and is further capable of being reduced to hydrogen sulphite. Calcium and magnesium are both essential minerals and beneficial to human health in several respects. Inadequate intake of either nutrient can result in adverse health consequences. If high concentration of calcium affects bones then low levels may cause osteoporosis. Magnesium is the fourth most abundant cation in the body and the second most abundant cation in intracellular fluid involved in the synthesis of proteins and nucleic acid and is needed for normal vascular tone and insulin sensitivity (WHO, 2011b).

Drinking water provides small daily doses of calcium and other essential minerals and may be an important source throughout the life span (Bonjour et al., 2009). Minerals are more readily absorbed from water than food. Water samples low in magnesium and calcium are associated with higher incidence of hip fracture in both men and women (Dahl et al., 2015). Recommended daily intakes of each element have been set at national and international levels. Deficiency of calcium and magnesium results in

cardio-vascular diseases, tiredness, weakness and muscular cramps. When these both combine with carbonates, bicarbonates, sulphate etc, they contribute to hardness of water. Ammonium being corrosive by nature is another ion of concern. Though it is not of direct importance for health, it can be toxic if its intake becomes more than the capacity of the body to detoxify. Also, taste and odour problems are likely to occur if ammonium concentration goes more than the desirable limit as it binds with chlorine after which it becomes unavailable for disinfection.

The palatability of drinking water is also affected by the Total Dissolved Solids (TDS), which is a combination of calcium, magnesium, sodium, and potassium cations and carbonate, hydrogencarbonate, chloride, sulfate, and nitrate anions. TDS is broadly a term used to describe the inorganic salts and small amounts of organic matter present in water. The quality of water is rated as excellent, when TDS levels are less than 300.0 mg/l; good when TDS falls between 300.0 and 600.0 mg/l; fair with TDS between 600.0 and 900.0 mg/l; poor between 900.0 and 1200.0 mg/l; and unacceptable when TDS levels are greater than 1200.0 mg/l.

Certain components of TDS, such as chlorides, sulfates, magnesium, calcium, and carbonates affect corrosion or encrustation in water-distribution systems leading to excessive scaling in water pipes, water heaters, boilers, and household appliances such as kettles and steam irons which can shorten the service life of appliances. The Bureau of Indian Standards (BIS) fixes the upper limit of TDS in drinking water at 500.0 mg/l. Crucially the standard also mentions that in case no alternative source of drinking water is available, then this upper limit can be relaxed to 2,000.0 mg/l (BIS, 2012).

In the wake of current situation it becomes important to test the quality of drinking water available in regular households on which 1.8 crore of Delhites rely. In the current study, various physicochemical parameters of potable water from eleven different locations across Delhi, India are evaluated as a routine monitoring exercise so as to reassure the general populace about the adequacy of the quality of drinking water. Besides this, the endeavor is expected to detect deterioration in the drinking water quality so as to facilitate timely and appropriate corrective approach with minimal impact on the environment. A correlation is established between contaminants and the likely sources of contaminants based on the areas where maximum deterioration in quality of water is found.

2. Materials and Methods

For the current investigation, samples of potable water from eleven different places in Delhi (Table 1) were acquired in sterilized capped bottles (500.0 ml each). One sample was also collected from Faridabad in the Delhi NCR.

Table. 1: Water sampling sites.

S. No.	Abbreviation	PLACE
1.	NR	Naraina
2.	PV	Paschim Vihar
3.	KN	Krishna Nagar
4.	SV	Sangam Vihar
5.	TU	Tughlakabad
6.	PUV	Pushp Vihar
7.	GP	Govindpuri
8.	JP	Jahangirpuri
9.	LN	Lajpat Nagar
10.	SN	Sarojini Nagar
11.	FBD	Faridabad

Physicochemical water quality measurement for potable water was undertaken on the basis of nine water quality parameters of pH, chlorides, sulphates, calcium, magnesium, turbidity, ammonium, TDS and hardness and obtained values have been enumerated in Table 2. The procedure for analysis was followed as per standard methods of analysis of water for chlorides, sulphates, calcium, magnesium, TDS and hardness (APHA, 1998). Testing of the water samples for pH, turbidity and ammonium was carried out using commercial sensors available from Vernier Inc., USA and data measured by the sensor was acquired using LabQuest interface from Vernier Inc., USA. The LabQuest data acquisition system is a stand-alone data collection and analysis device. However, in the present study it was interfaced to a computer using Logger Pro 3.0 software for data integrity purposes and circumvent memory limitations. All the different sensors including pH, turbidity and ammonium were interfaced with LabQuest and automated data was acquired onto the computer. Measurements for different characteristics of water were carried out after due precautions including using borosilicate glassware and washing of the sensor probes with double distilled water before and after every measurement.

3. Results and Discussion

The physicochemical examination reflected alarming values questioning the potable quality of water (Table 2). The pH of all the water samples conform to the desirable range (6.5 to 8.5) prescribed by BIS and to WHO (Table 3) except sample from Jahangirpuri which was slightly acidic (6.2) probably because of proximity to a landfill.

Table 2: Physicochemical characteristics of eleven potable water samples.

Place	pH	Cl (mg/l)	Sulphate (mg/l)	Calcium (mg/l)	Magnesium (mg/l)	Turbidity (NTU)	Ammonium (mg/l)	Hardness (mg/l)	TDS (mg/l)
NR	7.3	9.9	5	40	2.13	11.6	0.5	108.68	2,040
PV	7.7	79.9	30	50	6.24	11	0.5	150.58	16,920
KN	7.2	9.9	27	20	1.70	11	0.3	56.95	1,240
SV	7.7	79.9	25.5	40	2.78	10.4	0.4	111.36	15,640
TU	7.7	79.9	11.5	50	3.24	13.3	1.1	138.23	15,760
PUV	7.5	129.9	4	90	4.80	13.2	1	244.57	6,440
GP	7.4	89.9	15.5	120	3.02	12.4	0.7	312.19	920
JP	6.2	19.9	0	10	3.66	7.9	0.3	40.04	4,800
LN	7.2	29.9	0	30	1.56	16.4	0.1	81.36	3,720
SN	7.3	59.9	9.5	40	2.25	10.8	0.1	109.18	5,560
FBD	7.3	0.31	31	90	8.71	15	1.7	260.67	3,800

Abbreviations: Cl – Chloride; TDS: Total Dissolved Solids

Table 3: Permissible drinking water quality standards prescribed by WHO and BIS.

		BIS Guidelines		**WHO Guidelines**
S. No.	**Parameters**	**Desirable limits (mg/l)**	**Permissible limits (mg/l)**	**Limits (mg/l)**
1.	pH	6.5 - 8.5	No relaxation	6.5 - 8
2.	Turbidity (NTU)	5	10	0.1 5
3.	Sulphate	200	400	No value issued
4.	Chloride	250	1000	200 - 300
5.	Calcium	75	200	In the form of $CaCO_3$
6.	Magnesium	30	100	No value issued
7.	Ammonium	-	0.2	1.5
8.	Hardness	300	600	100 - 300
9.	TDS	-	500 - 2000	600 - 1000

At Jahangirpuri, toxic metals in the form of leachates from the unscientific landfills could be adding to the acidity of ground water. This can cause premature damage to metal pipes and can lead to a metallic or sour taste of water, besides staining of laundry, sinks and drains. Anionic concentrations of chloride and sulphate in all the water samples were very low as compared to desirable limits (Table 3). The highest recorded concentration of 129.9 mg/l for chloride is obtained from Pushp Vihar and the highest recorded concentration for sulphate is 31.0 mg/l from Faridabad. Though it is a common practice to add chlorine tablets for disinfecting water, concentrations over 100 mg/l of chlorine give water a salty taste and thus make it unsuitable for human consumption which is true for water from Pushp Vihar and also Govindpuri. Calcium levels were found to be lower than the prescribed permissible limits in most samples. The calcium ion concentration was reported to be more than the desirable limits in the samples obtained from Pushp Vihar (90.0 mg/l), Faridabad (90.0 mg/l) and also Govindpuri (120.0 mg/l). The lowest concentration for calcium is recorded in the sample from Jahangirpuri (10.0 mg/l).

Magnesium also follows calcium in being within the permissible limits in all samples. Sample from Lajpat Nagar had drastically low value of 7.8 mg/l and that from Faridabad had magnesium more than the desirable limit. It is further speculated that people residing in Krishna Nagar are more susceptible to osteoporosis and bone injuries as both calcium and magnesium are very low in drinking water available in this area. The total hardness which is a mean of total of calcium and magnesium for each sample lies within desirable limit of 300.0 mg/l as per the BSI Guidelines. Though most samples are soft in

nature, samples from Govindpuri and Faridabad are moderately hard. A large number of studies have investigated the potential beneficial health effects of drinking-water hardness. Most of these have reported an inverse relationship between water hardness and cardiovascular mortality (WHO, 2011b). Humans need minerals to stay healthy, and the National Research Council (National Academy of Sciences) states that drinking hard water generally contributes a small amount toward total calcium and magnesium human dietary needs.

Drinking water samples analysed in this study do not boast of any such claims. It is alarming to note that even in supposedly potable water, the minimum noted turbidity is way above the desirable limits prescribed by Bureau of Indian Standards (BIS) and is also more than the permissible limits laid down by World Health Organisation (Table 2 and 3). In fact, turbidity is 2-3 times the WHO guidelines in all 11 samples. Since turbidity is caused by suspended particles, phytoplanktons, bacteria or colloidal matter, it is responsible for microbial contamination. Turbidity can provide food and shelter for pathogens and can promote growth of pathogens in the distribution system, leading to waterborne disease outbreaks throughout the world. The particles of turbidity provide *shelter* for microbes by reducing their exposure to attack by disinfectants. Microbial attachment to particulate material has been considered to aid in microbe survival. High turbidity could be resulting from faulty and degrading pipelines coupled with mixing of sewage with potable water. Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and represents a major health concern.

With respect to Ammonium, only the sample from Lajpat Nagar and Sarojini Nagar noted values within the permissible limits (0.2 mg/l) while the other nine samples exhibit ammonium ions concentration more than the permissible limit prescribed by BIS. This is a matter of concern as ammonium is both corrosive as well as toxic in nature. It is a biologically active compound found in most waters as a normal biological degradation product of nitrogenous organic matter (protein) and may find its way to ground and surface waters through discharge of industrial process wastes containing ammonia and fertilizers. It is concluded that high levels of ammonium ions in water samples from Tughlakabad, Pushp Vihar and Faridabad could be due to mixing of industrial effluents in the ground water in these areas which could also be contaminated by organic waste as we do not have stringent laws to manage the solid waste.

The amount of Total Dissolved Solids in all samples studied are seen to exhibit values varying from the borderline to alarmingly high in the range of 920.0-16,000 mg/l. It is important to keep in mind that drinking water needs to have optimum TDS for it to be palatable. High TDS makes water unfit for drinking while water with extremely low concentrations of TDS may also be unacceptable because of its flat, insipid taste.

4. Conclusion

Overall, the quality of water samples collected from Delhi in this study leaves a lot to be desired as indicated by the measured physicochemical parameters. Specifically, TDS values noted in all the water samples (9 out of 11) besides Govindpuri and Krishna Nagar were seen to exceed even Indian BIS values. It is alarming to note that TDS values from Paschim Vihar, Sangam Vihar and Tughlakabad surpassed the BIS standard by around 8 times.

Coincidentally, in all these three cases water, sample collection points had major drains in the immediate vicinity thereby indicating a possible mixing of potable and sewage water supplies. Furthermore the total hardness in eight of the eleven samples crossed the baseline limits of 100.0 mg/l prescribed by WHO while water samples from Govindpuri, Faridabad and Pushp Vihar had either more or values approaching BIS standard of 300.0 mg/l, thereby indicating that the so called potable water was unfit for human consumption.

Corroded water supply pipes and/ or mixing of effluents from industries running from homes can be attributed for the high hardness values. Further, it is disturbing to note that turbidity, which is responsible for providing food and shelter to pathogens is much above the prescribed desirable limits. It is envisaged that market for individual water processing units like Reverse Osmosis (R.O.) plants would continue to grow till the time quality of potable water being supplied to households matches internationally set standards.

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Innovative Educational Corporate Social Responsibility Initiatives for Inclusive Growth in India - Challenges and Lessons Learnt

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ABSTRACT: The Companies Act, 2013 encourages the corporate sector to devote a fraction of their profits to enable education efforts in India. This is based on the premise that not only is education beneficial in itself, but it facilitates access to economic opportunities, which helps in poverty alleviation. This paper aims to understand the challenges faced by the corporate sector in implementing CSR programmes, through a case study approach of two organisations in the diversified infrastructure and chemicals sectors. The key findings are that stakeholder management viz. community, government and schools, is critical to success for educational CSR to succeed. The corporate sector has to look towards a holistic approach for education development in the pursuit of key learning outcomes. The key implications for practitioners from this study are to develop new and innovative solutions to deal with multiple complexities during implementation. They need to be sensitive towards the social and cultural context of their CSR programmes. For academicians, one of the suppositions is that they help generate consciousness and appreciation of difficulties faced at the ground level by the underprivileged among students, as well as, values rooted in creating a better world for the greater common good.

Keywords: inclusive growth, education, corporate social responsibility, industry.

1. Introduction

Inclusive growth as a strategy of economic development received attention owing to a rising concern that the benefits of economic growth have not been equitably shared (Ghosh and Chakraborti, 2010). Creation of new economic opportunities and providing equal access to these opportunities are the congruent aspects of inclusive growth. In 2007, the Planning Commission of India stated that inclusive growth requires agents who were hitherto excluded from the process of development to become active participants in the development process. The Indian Census provisional population totals 2011, observed that only 72.99% of India's population above seven years of age was literate. The Census also highlighted the existence of a gender gap in education. While 80.89% of the males were literate in 2011, the comparative figure was 64.64% for females. Since it is believed that the human capital of a country is one of the key drivers determining the direction, speed and quality of civilization advance, availability of good quality education aimed at holistic development of every individual is a national imperative.

The concept of inclusive growth and development can be traced back to the writings of Kautilya, who in the epic *Arthashastra* extolled the virtues of a good king who created wealth and helped distribute it equitably (Prasad, 2009). The intersection with the concept of individual responsibility and personal philanthropy can be traced back to the Vedas which incorporated the *varna dharma* or social duty towards the nation, society, community, business and family. The concept of Corporate Social Responsibility (CSR) is an extension of the individual responsibility to the corporate sphere. The latter took root with the emergence of industry in India after 1911, when the first heavy industry for iron and steel was formed in Jamshedpur by late Jamsedji Tata. The history of CSR and education may be traced back to pre-independence period when many business houses and industrialists forayed into the education sector as enablers. Primary among them were Late Jamna Lal Bajaj, who formed the Shiksha Mandal Trust in 1919, Sir Ratan Tata who also

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formed a trust in the same year, Karve, who was instrumental in the creation of SNDT University in 1916, Raja Annamalai Chettiar who was pivotal to the creation of colleges in south India, Birla family which helped in the establishment of BITS Pilani in 1946 and Lala Shriram who helped form IIT Kharagpur in 1959.

While the period from 1991 till 2000 marked important developments in the areas of globalization and evolution of standards in various aspects of corporate working, education found focus in the form of Millennium Development Goals (2000-2015) under the aegis of the United Nations. India also took upon the target of achieving universal primary education by 2015. Horwitz and Budhwar (2015) have discussed this changing scenario in CSR functioning in the 2000s. Several initiatives have been undertaken by the corporate sector in the sphere of education. Some of the educational CSR practices include providing vocational training, aiding student placement into jobs, strengthening school infrastructure and encouraging students to complete their education through merit scholarships (Bhatnagar, 2013).

The current paper is focused on sharing the experiences of two organizations in the realm of education as part of corporate social responsibility (CSR) efforts. Their efforts have been started under what researchers state to be *Educational CSR*. While literature review reveals discussions on various aspects of CSR in the education space, none of the researchers have discussed the specific challenges faced by the corporate sector in the implementation of educational CSR programmes. The studies usually take the form of generic and all-encompassing CSR enablers and barriers research. Hence, important lessons and knowledge that may be learnt by the corporate sector in specific fields may be lost without consequent gains in terms of shorter learning cycle for those interested in pursuing similar initiatives. It is with this specific objective of understanding both challenges and enablers that this research paper has been put together. This research paper should be of interest to corporate CSR professionals, especially those associated with execution on the field.

2. Lacunae in Existing Research

A detailed literature review on CSR in the Education sector was carried out to identify any lacunae in the same. According to Arevalo and Aravind (2011), several studies related to the extent of CSR practices have been conducted in India. Balasubramanian et al. (2005) have identified the motivations for conducting CSR by companies. These were stated to be interest in social improvement, belief in stewardship model and reputation enhancement. According to Chaudhary (2009), some of the external barriers to CSR included an absence of local capabilities to carry out the work, missing community participation and unorganized non-government organizations (NGOs). Internal challenges included unclear CSR guidelines, lack of consensus on implementing CSR issues, lack of dialogue with stakeholders, weak governance and effort required for collecting information to take decisions. Various researchers have analyzed global programmes related to educational CSR. Westhead et al. (2000) examined the relationship of Shell's 1994 Technology Enterprise Programme with outcomes in terms of student ability to procure full time employment after internships. The study conducted over a 36 month period did not observe any significant relationship between students undergoing the programme and procuring full time roles. Students who underwent the programme were however observed as demonstrating a more *positive* attitude than their counterparts.

A business in the community case study on Koc Holding Co. in Turkey in the area of vocational studies highlighted how the foundation of the company in collaboration with the Ministry of Education was able to increase participation in programmes by 68% (Koc, 2006). They were able to expand the ambit of vocational education to 8,000 students from 264 schools in 81 cities, connected to 21 companies and 350 employees. Rivera (2011) investigated how CSR was being applied to educational needs in Latin America. Examples of INTEL in Costa Rica and EPM (Empresas Públicas de Medellin) of Columbia have also been studied. While INTEL's efforts were focused on creating interest in Mathematics and Science, their programmes included improvement of teaching and learning, providing technology for advanced education, as well as research and advocacy to transform education. INTEL also supported science and engineering fairs with awards and donated computers to further the cause of education.

EPM on the other hand, created programmes to improve access to and opportunities for continuing education of 12,000 students belonging to the lower income group households. For instance, educational loans could be redeemed through good academic performance and social service. Brown and Cloke (2009) have brought forward the changing role of CSR in higher education in US and UK. According to them, partnerships related to CSR have been flourishing. They have also discussed two opposing viewpoints of benefits and disadvantages of corporate involvement in university education. These provide interesting insight into CSR and Education.

However, there is significant lacunae in literature on the specific challenges related to implementation of educational CSR programmes and this needs to be investigated. An attempt has been made in this paper to study the aforementioned and it is hoped that some insights may be generated through a specific investigation into this matter.

3. Methodology

The current study has leveraged case study method through interviews and content analysis of published and internet based secondary data. The study hence leveraged both primary and secondary data to accomplish the investigation into research objectives. Two organizations, one each from the chemical and infrastructure industry were selected with the help of a network of CSR professionals. These organizations had been working in the field of educational CSR and had wide experience. The two organizations were SRF Ltd. and Adani Group. Primary data was collected through personal interview of the Senior Director of SRF Foundation. In the case of Adani, a CSR volunteer and representative was met and interviewed and an information booklet containing the experiences with volunteering procured from the team for research purpose. Websites of both the organizations, as well as sustainability reports were also analyzed. This forms the basis of data collection in both the cases.

4. SRF – Mewat Rural School Education Programme

SRF, with a turnover of over $700 million (Rs. 4,000 crore), has been engaged in the manufacture of chemical based industrial intermediates. Its business portfolio covers technical textiles, fluoro-chemicals, speciality chemicals, packaging films and engineering plastics. Established in 1982 as the Society for Organizational Welfare, it was rebranded in 2007 as SRF Foundation. Since then, the Foundation has acted as the CSR arm of SRF to provide structured programmes for community development. Under the leadership of the Foundation Director, the CSR staff functions at three levels - corporate office, field office and village level.

The SRF Group has a strong history of delivering quality based education through distinguished institutions like SRF Vidyala, Lady Shri Ram College and The Shri Ram School. The aim of the CSR programmes in education is to extend the practice of academic excellence in the rural areas for the disadvantaged children. The four programmes under the SRF umbrella of educational CSR include SRF Vidyalaya (1991), project Shiksha at Bhiwadi (2005), Mewat Rural Education Programme (2010) and, Shri Sambandh (2010). SRF's CSR model is focused on *impact through collaborative partnerships*. The present case study aims to understand the journey of the Mewat Rural Education Programme (MREP) and challenges encountered along the way. The development of the initiatives reflects the needs of the community as have presented themselves from time to time, as responses to these needs.

4.1 School and Child Transformation at MREP

The Mewat Rural Education Programme (MREP) was formulated to provide value based quality education to children in Nuh Block of Mewat district in Haryana. The SRF Foundation has been involved in 28 primary and 19 middle schools, spanning 19 villages since 2010. The target beneficiaries were 16,000 children in the age group 6 to 14 years. The other beneficiaries were about 350 teachers with respect to the capabilities programmes. SRF followed the dual strategy of developing both the school and the child to meet programme objectives.

School Transformation

In order to transform the schools in ambit, SRF Foundation worked with the schools to understand the gap in facilities, capabilities and application of technology between what existed on the ground and that which must be present in a model 21st century school. To address the gap in technology application and also to provide a holistic learning experience, in 2010-11, SRF Foundation leveraged their partnership with IBM to launch the IBM Kidsmart programme in 18 primary schools. Each Kidsmart center catered to 400 students in the age group 3 to 8 years. The programme was designed to develop cognitive, reading and physical abilities as well as creative skills amongst students. To promote the spirit of scientific temper amongst the students, it launched *Avishkar*, a mobile science van in 2012. Fitted with science equipment and models to provide practical demonstration of theoretical concepts learnt in the classroom, the van also encouraged a keen interest in science amongst both students and the village community.

To address the gaps in facilities, the Foundation helped in the development of school infrastructure like drinking water, toilets, class room furniture, laboratories, libraries and sports facilities. Teacher and school leadership capabilities have an important role to play in overall child development. Under the Shri Sambandh programme, the Foundation provided academic services like need based teacher trainings and workshops on curriculum design, preparation of learning materials, leadership skills, designing co-curricular programmes, evaluation of academic programmes and evaluation of academic performances. It partnered with Aga Khan Foundation, Aga Khan Development Network, Mewat Development

Agency and Chemical Business of SRF to provide these services to schools in Delhi, Uri, Bhiwadi and Haryana. The programme impacted 5,000 children and around 200 teachers.

Transformation of the child

One of the biggest problems faced in Mewat district was student enrollment in schools. The Jazba–E–Taleem programme, launched in 2011, aimed at increasing student enrollment with the help of community outreach programmes. In the same year, Dastak–E–Taleem initiative was created to enable field workers to visit houses for this purpose. These programmes targeted around 3,500 students who were out of school. The aim of this programme was to ensure all children were enrolled and undergoing education.

Education of girls was a key focus area of the Foundation. To help school girls, aged eleven to fourteen years, to complete their primary level education Udaan was launched in 2011 in collaboration with CARE India. Udaan is an eleven month residential programme, aimed to teach Hindi, Mathematics, Environmental Studies, Urdu and Quran to the students, after completion of which, they would be free to enroll into regular schools.

4.2 Enablers and Challenges

While enhancing education in the rural areas was a mandate of SRF, one of the key enablers of this programme was strategic partnerships with other like-minded institutions. These included governments (Department of Elementary Education, Haryana Government and Mewat Development Agency), academia, non-profit (Care India and Agha Khan Foundation) as well as the corporate sector (IBM, Coca Cola, Schneider and Tetra Pak). A formal sharing of responsibility helped the foundation achieve its targets in a shorter time span on a larger scale.

The second enabling factor was synergy in goals through a structured need assessment of the community. A continuous evaluation framework spanning project leaders, school management, village functionaries, parents and government representatives helped ensure a smooth communication of past achievements, success stories and next steps. This helped the process of change management among the stakeholders. Key challenges external to the organization were observed to be about creating a need for change and building support for change. Rapport building with multiple stakeholders and understanding their needs, which formed the basis for CSR engagement, could take between 6 months to a year. The process of obtaining permissions from the state, district and block level functionaries also took time. It was also a difficult task to engage with village *sarpanches* and parents, to encourage them to send children to schools. This needed a prolonged and continuous interaction with the community.

Further, it was not sufficient to merely provide school infrastructure. Maintenance of the facilities like toilets required engagement of sweepers and avoidance of thefts of installations. The teachers also needed to play a more active role in ensuring adoption of hygienic practices by the school children. Key internal challenges included ensuring that the right individuals were assigned to the projects. The field office specifically was more challenging where the environment was not always conducive and required individuals to be mobile. Execution often became difficult. This required the organisation to have a nurturing environment, and to handhold staff with trainings and adequate mentoring to overcome the difficulties encountered. Staff motivation was ensured through an interesting 5R framework - where employees were encouraged to think creatively of *how fast, better, cheaper, larger and steadier* they could perform their role. A robust awards system for leading and implementing programmes helped keep the staff motivated.

5. Adani CSR Programme

Adani Group, with a turnover of $2,084 million (Rs. 12,504 crores) is an infra-structure entity engaged in coal mining & trading, edible oil & agro-commodities trading, logistics & infrastructure for horticulture trading, agro-storage business, port operation and electric power generation using solar power (AEL, 2013). The Adani Foundation is the nodal CSR entity of the Adani Group and it was set up in 1996. Influenced by Mahatma Gandhi's philosophy of Trusteeship, the foundation strived through various participatory projects to bridge the gaps in services delivered by the Government.

The foundation operated in 175 villages and towns within 6 states covering more than 1,65,000 families. It was found to focus on education, community health, sustainable livelihood, water resource development, community environment projects and rural infrastructure development as key activity areas. Within education, the Foundation was oriented to improvement of quality of education in the rural and urban areas along the lines of the UN MDGs. Their efforts included setting up their own schools as well as supporting the government schools. This took the form of Adani Vidya Mandir (AVM), Adani DAV Public School and support provided to government schools. Enhancement of student enrollment, retention,

bridging gaps in existing education system and promoting girl child education formed the key specific focus areas. Support in the form of programme, materials and infrastructure formed the backbone of their engagement.

5.1 Challenges and Enablers

This study is focused on challenges and enabling factors in the educational CSR space in Mundra Taluka in Kutch district of Gujarat. The district ranked amongst the lowest (23rd position out of 26 districts) in terms of literacy rate. The Taluka was observed as having two primary problems by the Foundation team. These were lack of enrollment and dilapidated school infrastructure. With the primary occupation of the population being agriculture and related activities, children chose to be occupied in helping their parents. For those who wanted to study, children in 60 villages were serviced by 103 government primary schools, but only 18 secondary schools and 2 higher secondary schools. A brief highlight of enrollment statistics is presented in Table 1.

Table 1: Enrollment of students in seventh standard, eighth standard and Pushed out of School (Source: Transforming Lives…Experiences of Adani Foundation in Mundra, Kutch, Gujarat, 2012, p 21).

Enrollment - Seventh Standard	
Boys	Girls
921	815
Enrollment - Eighth Standard	
Boys	Girls
747	357
Enrollment - Pushed out of School	
Boys	Girls
174	458

Apart from lack of education infrastructure, other factors like absence of safe transportation to schools, long walking distance to nearest school, social customs of lower age of marriage for girls and gender based discriminations were responsible for low school enrollment as well as school drop-outs. The inadequate infrastructure was reflected in high student to teacher ratio, 16% vacant teaching positions and lack of sufficient teachers from within the area. The staff noted that this could be one of the reasons leading to un-capitalized potential of emotional bondage to pull students to the school. The foundation focused on improving primary infrastructure facilities, provide teaching aids and train teachers to handle government grants better.

The team realized that democratic institutions like the village level education committee played an important role in the education system and took measures to involve them. To improve access of the students to the school, the Foundation team decided to provide bicycles to all girl students, irrespective of their socio-economic status. Additionally, all male students hailing from Below Poverty Line (BPL) households were also given cycles. The male students were prioritized in such a manner that children who had passed the 8th standard and lived at a distance more than 2 km from the school received the bicycles. In 2010-11, 745 cycles were distributed, with an additional 166 in 2011-12 that were given to new girl students who enrolled in class 9.

Many other initiatives aimed at improving student teacher interaction were undertaken. An education volunteer programme was initiated to recruit local youth who had passed the 12th standard, and needed jobs. They were provided training in teaching pedagogy and provided with an incentive for their efforts. They were required to provide support to the teaching staff and also help in administrative matters of the school. However, gradually with the initiation of the *Meena* Communication initiative by UNICEF and the *Sarv Shiksha Abhiyaan*, the Adani volunteers were given duties to participate in it.

The Meena Communication programme was focused on girl child education and gender sensitisation. It analyzed the attendance in school and empowered children from 3rd to 7th standard, through informal institutions like the Meena Manch and the Meena Cabinet. Weekly meetings of these groups helped regular students interact with the non- regular ones to understand the reasons for non-attendance and provide information to the teachers. This helped in increasing school attendance.

The roles and responsibilities of the volunteers hence became implementation of Meena communication programme in schools, developing co-curricular activities, remedial teaching and creating an environment for healthy reading habits. Since the volunteers were taken from the community and knew the parents and children on a personal basis, it helped create an atmosphere of trust between the foundation and the community. The programme could hence be scaled to 78 schools in 35 villages. The teachers too were provided with frequent training to enhance their skills resulting in higher child satisfaction.

5.2 Learnings from the Adani Case Study

The case study made it clear that one of the key enablers has been the support provided by various departments of the state and central government as well as organizations like UNICEF. Experience sharing and incorporation of inputs into programmes led to cordial and professional relationship with the government officials. Third party need assessment surveys, participatory rural appraisals, formation of village development committees, cluster development advisory committees, advisory council with anacompany led to high level of engagement and participation from the members, leading to ownership and sustained adoption. The volunteers were granted flexibility in scheduling visits to schools assigned to them, leading to better results. One of the other learning's was that gender inequality needed to be addressed in the rural areas. The provision of cycles to all girl students helped address this challenge to a great extent.

6. Conclusion

The case studies have highlighted two important focus areas in the sphere of education, development of the child and the school. Development of the child has many facets. It has been seen that working with the families to ensure enrollment and provision of multi-faceted quality education is perceived as beneficial for the child. This helps ensure attendance and successful course completion. Both the case studies show that the corporate sector needed to involve the community in the development of the school and its infrastructure. The needs assessment exercise should reflect the true requirements of the school and initial engagement may require that the organizations adopt a broader and more holistic approach, which may span over a period of two to three years. Since organizations may have prior experience in a particular service e.g. construction of sanitation facilities, playgrounds or advisory service to improve curriculum etc., various organisations functioning in a particular district may adopt a collaborative approach to develop those schools which need such interventions.

In this exercise, the role of the district authorities is pivotal in ensuring corporate resources are focused in the right direction. This is what could be potentially called a cluster or area approach. As has been seen in the case of SRF, collaborations have also helped in speed and scale of delivery. This is a demonstrated approach to making a difference in the area of education. The other important learning from the case studies was the importance of focusing on operational excellence matters. This helped develop trust with the communities being served. The governance mechanism needs to be robust and professional to ensure communication and escalation of issues, to be solved in a collaborative manner. The processes involved in service delivery need to be monitored with the right metrics to provide the right gauge into the system. It is proposed that the corporate sector should provide immersive training experience of six to eight months to university students by providing them with an opportunity to work with the community. This sensitisation exercise can be a win-win solution for the universities as well as corporate sector. This will help increase consciousness amongst the students who will be future leaders of our country and help them to look merely beyond the profit motive towards social and environmental responsibilities for the greater common good.

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Climate Change Denial and Psychological Barriers to Pro-Environmental Behaviour

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ABSTRACT: The purpose of the study is to examine the psychological barriers to environmental conservation and the dynamics of climate change denial among educated adults through focus group discussion. The participants were four young adults (18-21 years of age) and four middle aged adults (35-50 years). Through a semi-structured interview, the psychological aspects of pro-environmental behaviour and related emotions were analyzed. The various aspects explored were the preference people give to the issue of climate change as compared to other social issues, how people perceive their individual role in climate change, to what extent people are ready to bring changes in their lifestyle to address climate change, why do people do little for environment and consider it a petty issue despite widespread awareness. The data collected was transcribed and analysed through thematic analysis. This study provides critical information with respect to climate change denial and subsequently insights for encouraging pro-environmental behaviour in the Indian context.

Keywords: climate change denial, psychological barriers, pro-environmental behaviour, environmental awareness.

1. Introduction

High consequence risks such as human-induced climate change are central to the current age of advanced modernity. This global environmental problem has become extremely controversial in many countries. It has also provoked a significant degree of denial,- both of the reality of climate change and of its status as a problem deserving amelioration. Kleemann et al. (2001) have demonstrated the models of possible consequences of climate change by conducting a focus group discussion on adult Swiss population and their findings suggested that more attention was needed to be given to the social and psychological motivations as to why individuals erect barriers to their personal commitment to climate change mitigation, even when professing anxiety over climate futures.

Comfort interpretation (perceived unwillingness to abandon what appeared as personal comfort), the tragedy-of-the-commons interpretation (cost to individual freedom to choose and to be happy in an economy of beneficence are too great to contemplate for an uncertain climate future), the manager-fix interpretation (the belief in technological solutions) and the governance-distrust interpretation (deep distrust of government as a reliable locus for pursuing the public interest) have been observed (Kleemann et al., 2001). Researches undertaken in Western society have examined whether conservative white males are more likely than other adults in the U.S. general public to endorse climate change denial (McCright and Dunlap, 2011). They utilized public opinion data from ten Gallup surveys from 2001 to 2010, focusing specifically on five indicators of climate change denial and found that conservative white males are significantly more likely than other Americans to endorse denial views on all five items. These differences were found to be even greater for those conservative white males who self-reported understanding global warming very well.

A research by Lorenzoni, Nicholson-Cole and Whitmarsh (2007) reported on the barriers that members of the UK public perceive while engaging with climate change using mixed methodologies - qualitative and quantitative. The paper defined engagement as an individual's state, comprising three elements: cognitive, affective and behavioural. A number of common barriers emerged from the studies, which operate broadly at 'individual' and 'social' levels. These major constraints to individual engagement with climate change had implications for achieving significant reductions in greenhouse gases in

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the UK. (Lorenzoni et al., 2007). Climate change and environmental degradation are the major global problems which have serious consequences like natural calamities, but most of us do remain disengaged with these issues. Since a major objective of Psychology is to improve human wellbeing, it becomes imperative that psychologists intervene in the awareness programmes regarding pro- environmental behaviour. This is especially because the aforementioned includes complex human emotions, cognition and behaviour. In fact, the connection of climate change and pro-environmental behaviour with psychology can be surprising for many people but still conservation psychology is in its struggle to emerge as a new field.

In the book, "Climate Change Denial: Heads in the Sand", the author talks about Svante Arrhenius who first suggested that increase in atmospheric concentration of carbon dioxide from burning fossil fuels could lead to global climate change. It was a radical claim. It was a prediction that human activities could match the scale of natural forces. The first scientist to claim that climate change was under process was a British engineer named Stuart Callender. Climate change became an established scientific fact with time. In 1980s, scientists knew that it surely would happen. In 1979, the US National Academy of Sciences wrote, "If carbon dioxide continues to increase, the study group finds no reason to doubt that climate changes will result and no reason to believe that these changes will be negligible" (Washington and Cook, 2011).

There is no one definitive explanation of the term climate change denial as it has been used in different contexts. The term has popularly been used to explain the behaviour of people who would straightaway reject the scientific truth behind climate change and label it a part of a worldwide propaganda against the oil companies. But today, people have almost accepted the fact that climate change is happening. However, denial still prevails in other forms. The book by Kari Marie Norgard, "Living in Denial" talks about British sociologist Stanley Cohen (2001) who described three varieties of denial: literal, interpretive, and implicatory. Literal denial is the assertion that something did not happen or is not true (global warming skeptics). In interpretive denial the facts themselves are not denied but are instead given a different interpretation. The other is implicatory denial, in which information is not minimized, but the psychological, political or moral implications that conveniently follow are minimised. For example: William Nierenberg argued ideologically that results of climate change would be negligible, because people were highly adaptable, and technological innovation, flourishing under free market conditions would enable us to address any adverse impacts that arose. (Norgaard, 2011).

The present study is concerned with the implicatory and interpretative climate denial among educated adults. The major concern is why educated people live in a state of denial towards climate change and why are they stopped by certain psychological barriers for engaging in pro-environmental behaviour. A British Council research in the metro cities of India finds that 83% of the population is aware of the problem of climate change but only 12% of them are doing something about it. All of us in this nuclear age experience some kind of psychic numbing (Norgaard, 2011).

We know that our life can end in any moment, yet we live as we do not know this. This is often summarized in a term called "absurdity of double life". We live with the knowledge on the one hand that we, each of us could be consumed in a moment together with everyone and everything we have touched or loved, and on the other our tendency to go about business as usual - continue with our routines as though no such threat existed (Norgaard, 2011).

The purpose of the present study is to examine the psychological barriers to pro-environmental behaviour and dynamics of climate change denial among educated adults in Indian context through focus group discussion. The participants were four young adults (18-21 years of age) and four middle aged adults (35-50 years of age). Climate change and environmental degradation are major global level problems which need to be addressed.

However, despite widespread awareness and knowledge majority of people do and think little about environment. It is important to have knowledge of psychological aspects of pro-environmental behaviour for encouraging it. Focus group discussion was chosen as the method as it is was required to gather people together and discuss about the topic. It is the appropriate method for collecting varied opinions, beliefs and attitudes regarding certain topic of common interest.

2. Methodology

Participants: The participants were four young adults (18-21 years of age) and four middle aged adults (35-50 years of age) from heterogeneous groups of occupation, backgrounds and education. For the purpose of study, the names given to young adults were Y1, Y2, Y3 and Y4 and the middle aged participants were coded as A1, A2, A3 and A4.

Table 1: List of participants in the discussion.

Participants	Age	Gender
Y1	19	Female
Y2	18	Male
Y3	18	Male
Y4	19	Female
A1	43	Male
A2	51	Male
A3	49	Female
A4	41	Female

A semi-structured interview schedule was made on the topic of *Climate Change Denial*. The sub-topics included the use of plastic bags, preference of private and public transportation, their views on Odd-Even Rule and ways to conserve water and electricity. A video was also played for the participants. The detailed interview schedule is available in Appendix 1.

The focus group discussion was run in a community hall of an apartment complex in Rohini, Delhi. The room arranged was such that the group sits in a semicircle to aid discussion. Also a screen to play video clips was placed. A bottle of water was kept in front of each participant. It was made sure that there were no disturbances. After setting up the room, the participants were called inside and were made to sit at their designated places. The purpose of study was explained to them. Subsequently, consent was taken from the participants. The discussion was about an hour and a half long. The data collected from this focus group discussion was recorded, transcribed and then analysed by thematic analysis (Table 2). It is a method for identifying, analysing and reporting patterns (themes) within data. Thematic analysis is performed through the process of coding in six phases to create established, meaningful patterns. These phases are: familiarization with data, generating initial codes, searching for themes among codes, reviewing themes, defining and naming themes, and producing the final report.

3. Discussion

The purpose of the present study is to examine the psychological barriers to pro-environmental behaviour and dynamics of climate change denial among educated adults in Indian context through focus group discussion. Climate change and environmental degradation are major global level problems which need to be addressed. The first theme that arose from the study was *Awareness of environmental issues and lack of actions*. This theme is significant because our main concern is why people fail to take action despite being aware about climate change and other environmental issues. It was evident that the participants were aware about the problems, consequences and solutions to the problem of climate change. As stated by the participant A3, "Nature has changed. When the weather should be of harvesting, we have monsoon season. Now the harvest will get destroyed, the rates will go high." However, they agreed they don't take actions that they are capable of as pointed by participant A1, "It doesn't matter how much we talk about the issue, there is no implementation". This can be taken as a sign of implicatory denial. For instance, A4 stated, "We say we will save water, but we don't". And Y3 contended, "Yes I agree, more talks and less action". In her book Kari Marie Norgaard had coined the term "Double Reality" which meant that people in one reality, live with collectively constructed sense of normal everyday life and in another reality with the troubling knowledge of increased automobile use, melting of polar ice caps etc. This theme can related to this idea of "double reality", where participants agreed about both awareness and lack of action about climate change.

The next theme that appeared was *Convenience and Comfort as psychological barrier*. One aspect of this theme, which is prominent, is that participants find it convenient to ignore the problem related to climate change as they perceive them to exist far away in the future. According to them, these problems are not a priority as they are out of sight. They are more concerned with the problems that they are experiencing at present as pointed out by Y1, "Yes, human species can become extinct but in the future"; A3, "After a limit, there will be no food and no water"'; Y3, "Climate change is leading to problems for farmers, for people in coastal areas.

Another aspect is that people find it convenient to solve the issues which are personal to their experience, for instance, A1 stated, "We will eradicate it if we are affected by it in our vicinity, if I am affected by corruption I would like to eradicate it, people in Jammu and Kashmir would like to eradicate terrorism" and Y4, "If I had respiratory problems then I would like to eradicate environmental issues". This theme also highlighted that many participants have now become habitual of their comfortable lifestyle and they find it difficult to compromise their comfort or wealth as required for pro-environmental behaviour. Participants remarked, A2, "We have developed such a habit that we don't compromise anymore, A3, "My society has houses with fans in their kitchens". Also, it is convenient for the participants to not to think about environment as they have ample amount of resources.

Table 2. Themes that emerged from the study.

Themes	Codes	Verbatim
Awareness of environmental issues and lack of actions	Talk about the issue but don't do anything about it	A1: "It doesn't matter how much we talk about the issue, there is no implementation" A4: "We say we will save water, but we don't" Y3: "Yes I agree, more talks and less action" Y1: "The duration of Winter season is reducing, various animals are dying, ice-caps are melting"
	Knows about the consequences and ill effects	A3: "The nature has changed, when the weather should be of harvesting, we have monsoon season. Now the harvest will get destroyed, the rates will go high" Y3: "The whole cycle has been affected, not only for humans but every specie. However, we are not the ones who face the major impact"
	Knows what is climate change and why the climate is changing	Y1: "The environmental degradation may lead to natural disasters" Y4: "Yes of course, the weather is changing"
	Knows what may lead to what	A1: "Global Warming" A2: "Earlier we used ACs from May and now we need it from March"
	Knows the reasons for environment degradation	Y4: "We are molesting the environment by deforestation, pollution" Y4: "Yes, Farmers have to face major losses at the time of harvest due to climate change. Also, our body adaption for different weathers are now at risk"
	Knows what needs to be done in global as well has individual level	A2: "It is a global problem! Each and every country must come forward together and work towards the common goal"
	Knows the factors by which this problem can be controlled	A4: "Therefore, awareness and education are also important factors that should be considered" A2: "Apart from these two, sensitivity is also important" A3: "Plastics are ban in some states as it increases pollution and is non-biodegradable" Y1: "I don't know, I don't think we realise that all these natural disasters are because of us. I don't know what our contributions are. It's not visible explicitly that it's because of us"
Convenience and Comfort as psychological barriers	Convenient to forget since climate change perceived to exist in the future	A1: "We will eradicate if we are affected by it in our vicinity, if I am affected by corruption I would like to eradicate it, people in Jammu and Kashmir would like to eradicate terrorism". Y4: "If I had respiratory problems then I would like to eradicate environmental issues"
	People believe in eradicating problems which they experience in their daily life.	Y3: "The whole cycle is getting affected, not only humans but other species as well" Y1: "Yes, human species can become extinct but in the future" A3: "After a limit, there will be no food and no water" A3: "Time may come when we will have to import water" Y4: "World War IV will be fought on water"
	They would like to eradicate the environmental problems if affected by them directly.	Y1: "I don't know, I don't think we realise that all these natural disasters are because of us. I don't know what our contributions are. It's not visible explicitly that it's because of us" Y4: "Human extinction can happen in the future"

	Climate change is leading to problems for farmers, for people in coastal areas. The immediate affects will come in future. Climate change can lead to extinction of human species in future. No apparent consequences that would disturb daily life. Natural disasters don't happen immediately and in front of the eyes due to personal activities Comforting Habits Due to the habits we are not ready to compromise Comfort in quantity of resources Amount of consumption depends upon the availability. We value resources when they are scarce. Dependent on modern facilities Humans mould the environment they live in Lack of alternatives Expensive alternatives Alternatives must give the same level of comfort	Y3: "But the future is very uncertain, but it would be harmful for sure! Don't know about extinction but humans may be endangered as we are the root cause" A3: "This could be done in routine or made a habit. We should sit in a room and watch the same television that would save electricity more" A2: "We have developed such a habit that we don't compromise anymore" A3: "It's a habit now to watch TV alone as earlier joint families saw television together" A3: "It is more concerned with habit. Because if we want we can change our tastes" A3: "When we get less, we will obviously consume less" Y2: "Today we have availability and so we are not conserving" A1: "We have ample amount of resources today but will be harmful for coming generations" A1: "When resources are less then we will be scared but that would be too late" A2: "We only know the value when it is scarce" Y3: "As long as we don't face crisis, we don't value it" A1: "Whenever it gets a little hot, we need AC" A1: "Our body has lost the capability to bear heat, we need to switch on AC whole night. We used to play outside earlier hence we had more capability but now we are dependent on facilities." A1: "Every house needs ACs now" A3: "My society has houses with fans in their kitchens" Y2: "Bathroom has fans as well" Y3: "Any species adjust themselves according to their habitat but it is opposite for humans. We mould the habitat according to our convenience" Y2: "We can use other alternatives of plastic if it gives the same comfort level and is not expensive" A2: "Would prefer private transportation more due to comfort" Y3: "Yes, on the basis of comfort, private transportation. Also there is a lack of public transportation services" A3: "We, housewives, need a good substitute for plastic as we have to dump wet garbage as well. Paper bags won't do the required then" Y1: "Everyone would prefer private transportation due to comfort" A3: "People don't use alternatives maybe because they are costly and takes more place than plastic" Y1: "We use Plastic bags due to convenience" A3 : "I am ready to do it if it's convenient for me and my family" A2: "Or we could just sit in one room and minimise the usage of electricity because in today's world everything is electrical, our world would stop for an hour" Y1: "I can turn off everything just one tube light"
Solace in Comparison	Other world comparisons Western countries are better at disposal and recycling Better management in other countries Techniques used by western countries better	Y3: "They didn't see the present condition of India and just copied the rule from Singapore" Y2: "The quality should be checked, like the quality of petrol and diesel in America is better than ours and hence they emit less pollution" Y2: "In America, each person uses 7-8 kg of Plastic which is a lot more than the case in India but the people there are very less affected by the ill effects of plastic as there is proper disposal and recycling"

	Historical Comparisons In earlier time we had environmental friendly techniques. Busy lifestyle. Body has become used to the new technology. Individualistic lifestyle.	Y3: "In the western countries, one day is fixed for sprinklers to water in the garden and wash the cars" A1: "Earlier bricks were used to construct roads and drains so that water could reach the underground through gaps, but now underground water is not recharged, we dig deeper and deeper" A1: "Earlier we used to open the windows whenever we felt hot" A1:"Our body has lost the capability to bear heat, we need to switch on AC whole night. We used to play outside earlier hence we had more capability but now we are dependent on facilities." A4: "Or sometimes we spilled water on the terrace to keep our house cool" A2: "Now-a-days, we are so busy that we don't carry our own bags whenever we go to get things from the market" A2: "Or we could just sit in one room and minimise the usage of electricity because in today's world everything is electrical, our world would stop for an hour" A2: "Now we are dependent on money and facilities. We are becoming individualistic, we want own AC, own TV. All we get out of this is more privacy
Shifting of Blame	Government should do its job properly for environmental conservation. Developed countries are to be blamed. Uneducated people don't care for environment. Busy, comfortable lifestyle Government's focus is not on the appropriate areas to save environment.	Y4: "Government has not made any systems for rain water harvesting" Y1: "Developed countries think they can do whatever they want" A4: "My maid washes all the clothes and dishes and she does not know that we should conserve water, so she keeps the tap open for longer durations" Y4: "Developed countries are the main culprits, they harm the environment the most" A1: "Government take funds but they don't construct the infrastructure that may help in reducing the congestion and hence pollution" A4: "Politicians just hype the issue and don't act and hence people rebel against them. The work that should be done by the government is not done by them" Y2: "I tell my workers to save electricity but they don't listen to me" Y3: "They didn't see the present condition of India and just copied the rule from Singapore" Y2: "It's a political thing, if they genuinely cared the focus would have been on point. They are not seeing the pollution in Ganga and are focusing on the cars that are not that harmful" Y2: "In a way government has helped is by their campaigns, like Aamir Khan's Incredible India. People have actually understood and the rates of littering have gone down. The campaigns started in schools about awareness regarding this has also helped" Y3: "Government should not enforce things because enforcement leads to resistance" Y2: "Improvement is requires on the part of government and not on the part of individuals. If van comes to pick my garbage I'll dispose properly, if not, then what can I do?" A1: "Hype was created around it. The need was not fulfilled. We till now don't know the result of the implementation. There may be other problems as well like improper construction of roads, flaws in the lights etc."
Realisation of Individual responsibility	Don't relate to environment. Sees themselves as the root cause	Y1: "We don't relate to environment as much as other social issues. People still burn crackers in Diwali and waste water by playing Holi"

	Harm environment during festivals. Deforestation Consider themselves careless	A2: "Earlier we used ACs from May and now we need it from March" Y4: "We are molesting the environment by deforestation, pollution" Y3: "We are the reason" Y1: "We can't eradicate the problem in individual level but we can reduce the carbon footprint" Y3: "But the future is very uncertain, but it would be harmful for sure! Don't know about extinction but humans may be endangered as we are the root cause" Y2: "We don't recycle, collect and dispose properly" Y3: "We don't take up efforts initiated by other individuals" Y2: "Plastics are harmful if we don't dispose it nicely" A3: "Like, we can save the waste water from RO and use it for sweeping, watering plants etc, but we don't do!" Y1: "because of human activities the natural environment of earth is changing" Y1: "I don't know, I don't think we realise that all these natural disasters are because of us. I don't know what our contributions are. It's not visible explicitly that it's because of us" A2: "I have to waste paper because I have to save time" A3: "sometimes we have this thing in our mind, what difference shall it make if I am the only one conserving?" A3: "We want different designs of furniture every 10 years, trees are cut to make furniture" Y2: "I have TV in my bedroom and so I don't watch the TV in my drawing room"
Hoping for a better tomorrow	On a global level, countries must work together On an individual level, we can save electricity and water. Minimal use of plastics	Y3: "People should be made aware about the conditions of environment. Each and every country must work together" Y4: "On an individual level we can save electricity and water whenever possible at homes or offices" A3: "I scold my children when they don't switch the lights off" Y4: "We can plant trees outside our houses to keep the environment cool" Y3: "Minimal use of plastics" Y2: "There has to be a balance between how much growth you want and how eco-friendly are you" Y2: "We need to put our effort in the right place, instead of banning them we should check their disposal" Y2: "The quality should be checked, like the quality of petrol and diesel in America is better than ours and hence they emit less pollution" Y2: "Focus should be more on nuclear power" Y2: "We should not litter, and should have different types of dustbins for different type of garbage, can't do more than that" Y3: "Awareness is needed more than education as even educated people degrade the environment" A3: "We could conserve water by bathing one time with soap" Y2: "Or by using less water in car washing" A2: "We should point the importance of conservation to our family members

They feel that until and unless humans do not face scarcity, they will not understand the value of resources. For instance, A3: "When we get less, we will obviously consume less", Y2, "Today we have availability and so we are not conserving" and A1, "We have ample amount of resources today but will be harmful for coming generations". The participants were inclined to adjust only with the alternatives with equal comfort, convenience and cost efficiency. People find it easy to blame their busy lifestyle for their lack of actions or for adjustments and compromises for the environmental conservation. Similarly, people in Switzerland also have found to display this perceived unwillingness to abandon what appeared as personal comfort (Kleemann et al., 2001).

The next theme that emerged from the study was "Solace in Comparison". This theme incorporated two dimensions: The Other World comparisons and The Historical Comparisons. Participants drew comparisons with other countries like Singapore and America which clearly suggested that these countries gave 'environment' more importance than the people of India. According to the participants, the people in other countries have a better sense of disposal, hence keeping their country clean. As remarked by the participants, Y3, "They didn't see the present condition of India and just copied the rule from Singapore" and Y2, "The quality should be checked, like the quality of petrol and diesel in America is better than ours and hence they emit less pollution". They also made contrasts between the traditional way of living and the today's style of living. They felt that because of today's modern style of living they are unable to think about nature and environment. For instance, A2 stated, "Now we are dependent on money and facilities. We are becoming individualistic, we want own AC, own TV. All we get out of this is more privacy."

Another theme that emerged from the study was "Shifting of Blame". This theme embraces all the groups that individuals have blamed for their disengagement. The participants held accountable all the developed countries as a major polluting unit and thought that they should be the ones to start the initiative to do something about environmental degradation as said by Y4: "Developed countries are the main culprits, they harm the environment the most". People also accused the uneducated population like maids and workers who they think waste resources. Despite being told by the participants they still don't try to save the resources like water, electricity etc. Participant A4: "My maid washes all the clothes and dishes and she does not know that we should conserve water, so she keeps the tap open for longer durations". Lastly, they talked about the role of Government or political groups that how they have been careless or have been successful. Participants felt that the Government's focus is not on the main issue of environmental degradation but rather the Government uses these issues as political agendas to gain support.

However, people also appreciated the different campaigns started by the Government in schools and social media about being eco-friendly as said by Y2: "It's a political thing, if they genuinely cared the focus would have been on point. They are not seeing the pollution in Ganga and are focusing on the cars that are not that harmful" and also that "In a way government has helped by their campaigns, like Aamir Khan's Incredible India. People have actually understood and the rate of littering has gone down. The campaigns started in schools about awareness regarding this have also helped." A study conducted by Kleemann et al (2001) in Switzerland demonstrated the same interpretation of Governance-distrust and inferred that people have deep distrust in government as a reliable locus for pursuing the public interest.

The next theme that arose from the study was "Realization of individual Responsibility". Participants agreed to some extent that they don't feel much connected with the environment maybe because of their busy and modern lifestyle. In some cases, participants shun away from taking the responsibility for climate change as they find this to be a problem beyond individual's capacity and consider themselves helpless as said by A3, "Sometimes we have this thing in our mind, what difference shall it make if I am the only one conserving?" This statement gives a sign of implicatory denial. There is not much that can be done but still they were ready to do all that can be done to save environment. Participants consider themselves as the root cause of this humiliation of the environment. For instance, Y3 said, "But the future is very uncertain, but it would be harmful for sure! Don't know about extinction but humans may be endangered as we are the root cause". They accepted their carelessness and through this discussion realised some of the responsibilities that should be taken by the individuals to improve these conditions.

The final theme gave us the idea of *Hoping for a better tomorrow*. Findings of this study suggest that there is still hope as people feel some sense of individual responsibility. They suggested what can be done to reduce the ill effects of climate change at both the societal and individual level. On a global level, they felt that the need of the hour is that each country comes forward and work together against this glitch of "Climate Change", as

pointed out by, Y3, "People should be made aware about the conditions of environment. Each and every country must work together". At the individual level they suggested very minimal actions that can be taken by individuals in their day-to-day life activities. Participants like Y4 said, "We can plant trees outside our houses to keep the environment cool" or Y3, "Minimal use of plastics. They also suggested that certain actions should be taken by the government like in checking the qualities of fuels and better disposal of garbage. Families should point each other regarding the conservation of environment whenever and wherever necessary. There is still hope as long as people have the sense of individual responsibility.

4. Conclusion

Through the study, we may conclude that despite being aware of the problems, consequences and implications there is a lack of public engagement on the issue of environment and climate change. It is convenient for the individuals to ignore the problems related to climate change as they perceive them to exist in the future and faraway places. Due to the ample visible availability of resources, it is probably easier to overlook the glitches related to environment. Also, individuals may find it difficult to be related with the environment as they are far away from the traditional way of living. There was a tendency to shift the responsibility of environmental protection to other groups (developed countries, government etc.). The participants suggested minimal actions on individual's part that should be taken up by people like planting trees, saving water, etc. Each country must work together to curb out this problem at the global level. In some way this focus group discussion facilitated this group to realize their duties and faults towards the environment and gave hope for a better tomorrow.

5. Implications

Through this study, an attempt has been made to initiate researches on the topic of climate change denial and explore the field of conservation psychology. Hence, this research may be considered as a pilot study, as an effort to initiate future researches in the aforementioned field. The need of the hour is that psychologists intervene in the environmental conservation programmes in a large way to identify and address climate change denial in Indian society. Findings of this study suggest that there is still hope as people feel some sense of individual responsibility. Thus, awareness programmes and workshops can be held that may help individuals to understand the present status of environment. Such programmes will certainly exhibit high participation from individuals.

6. Scope and Limitations

Since the study conducted was a much more of a pilot study the participants for the discussion were chosen by convenience sampling method and only one focus group discussion was held. Since conservation psychology is an emerging field and not many researches have been done in the Indian context, the results from this study should not be taken as generalised. Rigorous sampling using mixed methodologies need to be carried out in order to collect as much information possible from wider population as not much literature is available in this field.

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8. Appendix I

1. If given a chance, which problem would you like to eradicate from the society and why? (Open-ended) Gender equality, religious intolerance, environment, corruption, terrorism, reservation and anti-nationalism. 2. I am a member of the street play society and I want your help to choose the topic (from the list) for next year. On what should I make the play and why? 3. Where do you think you'll be happier? In a natural environment like park or in a man-made entertainment centre like malls? 4. How often do you talk about environment and its degradation? 5. Do you believe that climate is changing? 6. What is climate change? What according to you are the reasons for it? 7. Do you think human activities can bring changes in the climate? 8. Do you think the activities of your daily routine have contributed to the changes in climate? 9. What according to you are the consequences of these changes in climate? 10. Do you believe environmental problems are a danger to human species? 11. On a global level, what can be done to improve these conditions? 12. What do you think about the Odd-Even Rule that was recently implemented? (why they agree or disagree (car pooling)? What is the importance of the environmental motives behind this rule? 13. Do you think it should be implemented again? 14. Which mode of transportation do you prefer more? Public or Private and why? 15. How many of you use plastic bags in everyday life? 16. Do you know some states in India have banned the use of plastic bags to some extent and why? 17. Why do you use plastic bags when you know that they are harmful? 18. If you are asked to switch off all the electrical devices for an

hour, say 8-9 p.m., every day for saving electricity, would you be willing to adjust to it? 19. Where do you think you can conserve water in your daily routine? 20. What all you think can be done to conserve environment on your behalf? 21. How many things you actually do?

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Kuttu (Buckwheat): A Promising Staple Food Grain for Our Diet

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Abstract: Buckwheat is a multifarious pseudocereal with high nutritional benefits including absence of gluten, richness in water soluble fibres, presence of high quality proteins, unsaturated fatty acids and appreciable mineral and vitamin content. Buckwheat has excellent amino acid composition that is complementary to cereal grains. It is very high in lysine, having nearly twice the amount found in wheat and rice. Buckwheat seeds contain various phenols, bioflavonoids including rutin and sugar cyclitols, flavonoids which act as anti-inflammatory, anti-allergic, provide protect against cardiovascular disease and treat Diabetes mellitus. Buckwheat can thus prove to be a promising grain and an important introduction in the future food basket in context of its high nutritional value.

Keywords: kuttu, pseudocereal, buckwheat, staple food.

In most northern and western states of India, the buckwheat flour is known as *kuttu ka atta* and is consumed on fasting days, especially during Navaratri (religious days according to Hindu religion). Buckwheat is an important pseudocereal with excellent nutritional profile, high in lysine, mineral content, vitamins, bioflavonoid rutin, and quercetin (Rana, 2004). Buckwheat proteins show a strong supplemental feature with other proteins to improve the dietary amino acid balance especially in biological activities of cholesterol lowering property and antihypertension effects.

The most attractive ones among these compounds are flavones, flavonoids, phytosterols, D-chiro-inositol and myo-inositol. Buckwehat is also emerging as a healthy substitute to gluten containing grains in a gluten free diet as buckwheat seeds are naturally gluten free (Mann et al., 2012; Huang et al., 2014). The main constituent of the developing seeds of buckwheat are galactosides of D-chiro-inositol, fagopyritols, used in the treatment of blood-sugar levels regulation. Fagopyritols are useful in regulating the non-insulin dependent diabetes mellitus and their derivatives are used in the treatment of Polycystic ovary syndrome (Obendorf et al., 2012).

The most active compound in buckwheat leaves is a flavonoid rutin, which shows a wide range of employment in medicines by enhancing the anti-inflammatory and anti-microbial activities. Rutin preserves the insulin signaling and regulates the disorders related to glucose and lipids levels. Interestingly, studies have revealed role of flavonoids as UV- B absorbants where rutin, quercetin and quercitrin act as UV-B absorbing compounds and protect the cells by preventing UV radiation from reaching and damaging the vital molecules, such as nucleic acids, and especially DNA (Hader et al., 1998, Bjorn, 1999, Germ et al., 2002).

The diterpenes exhibit vaso-relaxant action and hamper the contractility of the muscles and show therapeutic use in cardiovascular diseases. The glycosides and alkaloids present in kuttu seeds are used as anti-microbial agents and the former in treatment of cancerous cells. Hence, buckwheat is very crucial in treating many chronic diseases due to its chemical composition, rare components as well as their functional effects.

An attempt was made to unravel the untapped information on the nutritional composition of buckwheat growing in different agro-climatic conditions and facilitate its introduction in the future food basket. Buckwheat seeds were sown in the month of September 2015 and flowering was observed in end of December 2015 (Fig. 1). The preliminary screening studies of bioactive components performed with the mature seeds of this plant showed the presence of alkaloids, glycosides, coumarins, diterpenes and flavonoids. These secondary metabolites have been reported to be of high medicinal and functional value.

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Figure 1. Buckwheat seeds and plants growing in Deshbandhu college garden.

With respect to the cultivation of buckwheat, the plant often experiences root rot disease caused by the fungal growth of *Rhizoctonia solani*. This affects the crop yield with poor economic returns. It is suggested that instead of using chemical based pesticides to suppress this fungal growth, environmental friendly alternative should be explored. Therefore, the use of weed based botanicals is proposed to be a promising initiative to suppress the fungal growth and enhance crop yield.

The project also carried out molecular characterization of the gene *Fagopyritol synthase* which synthesises a sugar cyclitol called fagopyritol. This was done using *in silico* approach that exhibited the variations within *fagopyritol synthase* isomers and highlighted the importance of proper characterization of the enzyme for utilizing better synthesis and production of fagopyritols. The latter possess high medicinal value.

Ongoing studies have revealed high dietary value of Buckwehat flour along with intensive market prospects. These prospects, if actually realized, are more than that of the present day cereal grains. Therefore, enhanced utilization and promotion of this nutrient rich grain in the mainstream, as a staple crop, could be an important and profitable initiative. The crop is already gaining interest in the world market as a health food. This would certainly lead to better food security by reducing our dependency on major crops for food and non-food uses. It will also diversify income generating opportunities for small and medium-scale farmers and consequently can prove as a promising pseudocereal in context of its high nutritional value and can therefore help feed the starving world.

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Developing Community Outreach Programme for Government Schools in Delhi, India

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Abstract: The present research work focuses around the know-how and attitudinal perceptions of people in the society towards areas such as disaster management, gender sensitization and library management, especially in the fast-growing world of computers and mobiles. The research methodology selected Government school students since it is believed that students in the Government schools in India are underprivileged and are often not able to perceive education in the right manner. The research also wanted to begin with young minds, to read them, understand them and possibly mould them in a beneficial manner.

Keywords: awareness, disaster, gender, sensitization. books.

The present research was started in early October 2015 and had its soul embedded in outreach, that is, the extent of reaching out to those who are always at the receiving end, those sections of the community who live a life of misery, poverty and bear-minimum subsistence level. These were the young minds in Government schools, majority of whom could enter an educational institution only due to some government initiative, and who returned to their cruel destiny and circumstances after the school winded for the day (cf. Kaur and Kapil, 2008). An attempt has been made to fill the gap between the underprivileged and the privileged sections by addressing issues that are of immediate ecological and societal concerns. The objective of the research was to raise awareness among the Government school students and to identify best methods of reaching out to them. Tools and methodologies such as lectures, workshops, documentaries and open discussions were used. Students from classes 9th to 12th were selected for this study. Students from this age bracket were chosen since they are not merely at the receiving end but also retaliate and even criticize through their talks and discussions. The research collected the views and suggestions of these students while also developing a methodology of engaging this section of the society in a meaningful manner. The selected students lived with meagre resources, faced apathy and were trained and tamed to believe that their existence is part of their destiny. It was therefore important to intervene in their growth and development. It was felt that exposing such students to the realms of disaster management, library management and gender sensitization will aid in broadening their horizons and allow them to have a holistic view on their own education.

The first focus of the research for engaging students was disaster management. Overtime, disasters have become frequent happening in the world and so in this ever changing world it becomes necessary for a person to be aware of her surroundings and types of possible disasters. Overtime these disasters have changed in form, intensity and their frequency. But the society still lacks adequate information and awareness regarding these disasters. Earlier natural disaster like earthquake, floods etc. used to dominate in the disaster realm, but nowadays with advancement and development, man-made disaster like pollution, fires, oil spills etc. have also increased. Thus, it is important that every locality should have proper knowledge and should be aware about the disasters and should know how to safeguard themselves. It was felt that conducting interactive workshops was the best method for engaging students. It did prove to be fruitful and students could be oriented about disasters and also the causes and ways to deal with them. The workshop remained focused on earthquake disaster, to which Delhi is highly prone.

The second focus of the project was library. Books are rivers of knowledge and teach us to be more pragmatic in our lives. Library is a place from where we can access

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books easily. Therefore, it becomes necessary to have enough information about having and accessing libraries around us. It was felt that to create the interest of the students, they could be informed about classification and cataloguing of books instead of just making them read books right away. Students were also made aware on how books are created and the history of publication. Students did find this manner of engaging them with the library interesting and exhibited curiosity to learn more about the library system. Hands-on training was also provided and students were made to arrange books in the library and were also encouraged to do so in their homes.

The third focus of the research was to understand gender perception in students and find ways to meaningfully engage them on this topic. With time, our society and its culture are also changing. Nature has provided equality to both genders but with time one began to be preferred over another which resulted in gender inequality. Therefore, attempts were made to identify methods for creating gender sensitization in students. It was felt that this could be best carried out by engaging students on real time issue such as female foeticide, domestic violence and acid attacks. Cybercrime against women was another issue that was selected for such discussions. This indirect way of engaging the students on gender issues did prove useful. Students were also provided with information about cyber laws and were provided with helpline numbers. This was necessary to make the students better equipped and well informed about the situations and challenges being faced by our society today.

The face to face interaction with students from the Government school brought forward some interesting insights. Many of these students were already aware about disasters, especially since many of them had faced at least one disaster (natural or man-made) in their recent past. The selected students were provided training in order to equip them with the knowledge to cope with these disasters and thus become leaders and trainers in their own rights and privileges. Perception of these students on gender issues was also noted. The opinion of the majority of the students was such that they held women responsible for the perverted mindset of the society. Patriarchy was prominently noted in thee young minds. The idea of a library was known to these students but majority of them had never been to one. In most cases, students found it difficult to understand what actually existed in the name of a Library.

During a lifetime, a human being constantly interacts with her environment and becomes a part of it in this process. This relationship between human and nature has been going on for ages and will continue in the future as well. This age of industrialization has made mankind accustomed to a range of amenities which have created a distance between man and nature and between man and man. This is diminishing the interaction between the two. Through this community outreach programme, we attempted to have some hands-on experience and do some brain-storming sessions with the students, at a level where it matters the most.

Awareness about disasters, gender sensitivity and the importance of learning and knowledge through books thus became three vehicles for engaging with the students and for teaching and learning with them. What was also perceived during the research was that the students from Government schools live in harsh environments and face mental and physical violence which pressurizes them to develop compulsive attitudes. They also feel remorse for not having the resources to be able to chase their dreams. The system brackets them. It was therefore felt that these students were facing several micro-disaster on a daily basis. The moment resources are minimal, opportunities to explore the world is minimized. There is thus a need to ensure these students are provided at least the bare minimum that they need for taking them out of the poverty cycle.

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Pregnancy in Women Above Age 35: An Emerging Concern for the Health Sector

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Abstract: The development and growth of the Indian economy, along with the need and desire to work, are factors which are facilitating women to enter the workforce in large numbers. Women start working in formal workplaces anywhere between the age bracket of 21 and 26 years. The primary objective of most women in the next few years is to establish themselves in their respective fields. This very often leads to late marriages and delayed pregnancies. The latter are sometimes seen as hindrance to career advancement and are postponed until the third decade of a working woman's life. This paper attempts to bring out the impacts of late pregnancy on the health of women and the fate of their children. The paper highlights the various pregnancy related risks to which women expose themselves by delaying pregnancy beyond 35 years. The need for raising awareness among young women about this issue and adopting women-friendly policies by workplaces has been found to be the need of the hour.

Keywords: maternal health, age, pregnancy risks, workplace

The proportion of women who are delaying childbearing beyond the age of 35 years has greatly increased in the present day (Mathews and Hamilton, 2014). Increasing opportunities for higher education, inclination towards career and economic independence combined with availability of highly effective contraception are all factors leading to more and more women delaying their first child birth beyond the age of 30 years. Most women are falsely reassured by popular beliefs that advances in reproductive technologies can compensate for age-related decline in fertility. This is despite the fact that clinical research guideline state that assisted reproductive technology success (except in the case of egg donation) is significantly lower for women who are in their late 30s and beyond (Liu and Case, 2011). Advancing maternal age has consequences such as increased risk in assisted conception as well as in the outcome of normal/ spontaneous pregnancy. Despite such risks, most women remain unaware of the potential consequences of delayed childbearing.

The association between increasing maternal age and perinatal complications is emerging to be a significant challenge for the healthcare sector. There is thus a need for information dissemination on the consequences of delayed childbearing and the simultaneous maternal and obstetric care that it requires. It needs to be clarified here that many women who are delaying pregnancy well into their 30s and beyond are indeed delivering healthy babies. However, women must be made aware and sensitized about the increased risks associated with pregnancy during advanced age. A question often asked with regards to the latter is that how advanced is too advanced? An immediate answer often given is 35 years. However, the biological clock is a fact of life and there is nothing unique about age 35. It is simply an age at which various risks become worth exploring (Heffner, 2004; TPCASRM, 2006). Age 35 was first designated as the threshold for being labelled as *elderly* while pregnant during a National Institutes of Health (NIH) Conference in 1978 (Horsager-Boehrer, 2015). The risk associated with pregnancies over age 35 is shared equally with both the mother and the baby.

As per existing studies, the optimal maternal age with the least risks of maternal, pregnancy, and neonatal complications is 25.0 to 29.9 years. Short-term neonatal outcomes are most favourable for women aged 25.0 to 29.9 years. There is an increased rate of adverse maternal outcomes at both extremes of maternal age, younger than 20 years and 35 years or older (Timofeev et al., 2013). A

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woman is born with a limited number of eggs which are required for conception. As she reaches late or mid-thirties, her eggs decrease in quantity and quality. Hence there is a difficulty in conceiving which sometimes leads to infertility (Mathew and Hamilton, 2014; ESHRE, 2005). In many instances, older women become pregnant through fertility treatments. These treatments can lead to multiple births, which presents additional challenges and higher rates of complications (Timofeev, 2013). With age, faults in egg leads to increase incidence of chromosomal abnormalities in the baby, e.g. Down's syndrome. Following are the rates of having a baby born with Down's syndrome with progressing age: 1 in 1,250 at age 25, 1 in 1000 at age 30, 1 in 400 at age 35, 1 in 100 at age 40 and 1 in 35 at age 45 (ACOG, 2005).

Women over 35 are more likely to develop gestational diabetes or high blood pressure during pregnancy. These conditions can also lead to premature birth, low birth weight or other complications during child birth (Luke and Mortran, 2007; Cleary-Goldman et al., 2005). There is also a higher chance for women in this age group to have underlying health problems, such as obesity or heart disease. Becoming pregnant with these medical conditions puts the mother at more risk of complications than younger women without them. A women with older age is more likely to have premature babies and babies with low birth weight, both of which can increase death rate in newborn (Bell et al, 2001).

Older mothers have a higher risk of pregnancy-related complications that can lead to greater chances of a C-section delivery (Cleary-Goldman et al., 2005; Bell et al., 2001; Le Ray et al., 2006). Placenta praevia is a common example of such a complication in which the placenta blocks the cervix. The risk of pregnancy loss - by miscarriage (death of foetus in uterus which is less than 20 weeks) and stillbirth (death of fetus in uterus which is more than 20 weeks) - increases as a woman get older, due to pre-existing medical conditions or foetal chromosomal abnormalities. The rate of spontaneous miscarriage climbs gradually with age, from an 8.7% miscarriage rate among 22 years old women, to 18% among 30 years old women, 20% at age 35, 40% at age 40 and 84% at age 48 (Nybo et al., 2000). Studies have also established that older women are more likely to have a stillbirth than younger women (Table 1).

Postpartum hemorrhage (excess bleeding from genital tract after delivery) and particularly the risk of postpartum hysterectomy (removal of uterus after delivery) also have an association with maternal age. This is mostly due to the association of these complications with the strongest

Table 1. Stillbirth rates for women of different ages giving birth for the first time (Source: Reddy et al., 2006).

	Stillbirth Rates	
Age Group	First pregnancy	Later Pregnancy
Under 35	3.72	1.29
Between 35-39	6.41	1.99
Above 40	8.65	3.29

All stillbirth rates are per 1,000 ongoing pregnancies.

predictors of risk, i.e. multiparity, abnormal placentation and history of cesarean section (Luke and Mortran, 2007; Rossi et al., 2010). There is a strong trend of increasing maternal mortality in women of older age in all developed countries (Wildman et al., 2004). The risk of death during delivery is twice as high if the woman is 35 to 44 years old than if she is younger than 35 years. However, in actual occurrence it has been found to be 1 in 10,000 for woman aged 35 years or elder. Hence it is recommended that women in their 20s and 30s should be counselled about age related risk of infertility as part of their primary well-woman care. Reproductive-age women should be aware that natural fertility and assisted reproductive technology success (except with egg donation) is significantly lower for women in their late 30s and 40s. Because of the decline in fertility and the increased time to conception that occurs after the age of 35, women above the age of 35 years should consult their doctors after 6 months of trying to naturally conceive.

There is need for generating awareness among women about the risk of spontaneous pregnancy loss and chromosomal abnormalities, both of which increase with age. Women should be counselled about the need and importance of appropriate prenatal screening, once pregnancy is established. The aforementioned is especially important for women above the age of 35 years. Pre-conception counselling regarding the risks of pregnancy with advanced maternal age, promotion of the importance of maintaining optimal health and weight and screening for concurrent medical conditions such as hypertension and diabetes should be made essential for all women and particularly for those above the age of 40 (SOGC, 2011).

Strategies need to be designed and implemented in our country to improve informed decision-making by prospective parents. This is because more and more women are now entering the work force in India each year. Barriers to healthy reproduction, including workplace policies, should be reviewed to optimize the likelihood of healthy pregnancies. The recent amendment

to the Maternity Benefit Act, providing 26 weeks of maternity leave (as against 12 weeks) certainly seems to be a suitable step to achieve the goal of healthy motherhood and therefore a healthy nation. The amendment also provides an enabling provision of 12 weeks of *work from home* for nursing mothers. In addition, it has made it mandatory for firms with 50 employees or more to have crèche arrangements for its work force. Just this one amendment stands to benefit 1.8 million women who are engaged in the organised sector. However, the above discussed provisions for working women should not be seen as all that is, but should actually be adopted as the first step in the direction of ensuring healthy mothers and a healthy future generation which continues to contribute for India's growth and development.

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Analysing Institutional Capacity for Flood Risk Reduction at the Community Level

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Abstract: Flood related risks have compounded across the globe in the last few years. This is largely due to increasing vulnerability caused by changing climate and rapid urbanisation. This has resulted in making the poor and marginalized sections of society, especially those inhabiting hazardous topographies, more vulnerable to disasters. Although there have been efforts to shift from a response centric approach to a more proactive approach towards disaster risk reduction, institutions continue to face hurdles in implementing disaster related initiatives. To identify these challenges faced by institutions while responding to disasters, the present research collected primary data through field visits, personal interviews and focus group discussions with officials engaged in managing disasters from national to local level in India The affected community was also surveyed. It is suggested that policy makers must consider factors like institutional arrangements, human resources, policy and plans, financial, technical, leadership, perception and awareness programs for enhancing the current state of readiness of institutions to respond to flood disasters.

Keywords: community, disaster management, flood, institutional capacity, disaster preparedness.

Delhi is one among the three megacities in the world which at high risk of floods (IPCC, 2014). The situation in Delhi is aggravated by high density of settlements, habitation in floodplains, impenetrable concrete surfaces, poor drainage system and lack of proper waste management system (Douglas et al., 2008). As a result, risks, vulnerabilities and impacts induced by hazards are on a rise in Delhi, as it is worldwide (Gaillard and Texier, 2010). Such impacts include loss of life, houses, possession, livestock, and livelihood and an increased vulnerability to diseases (Fox, 2014). This has significant impact on the wellbeing of the community and acts as a huge burden on the local institutions managing disasters. Although existing literature stresses the significant role played by local governments in undertaking disaster risk reduction (Kusumasari, 2010; Pearce, 2003), limited attention has been given to the ability and willingness of local governments to meet people's expectations and responsibilities (Kusumasari et al., 2010).

Institutions play an active role in disaster management (Perry and Mushkatel, 1984) due to familiarity with local conditions, communities and culture (Herman, 1982, Stewart et al., 2009; Kusumasari et al., 2010). Institutions can thus also help in identifying needs and capacities of communities for reducing their vulnerability to disasters. Recent disasters have brought forward the non-existent disaster management chain of command and mistakes that local governments can make such as rigid institutional beliefs, ignoring complaints, difficulty in handling multiple sources of information and the tendency to minimize danger or risk. Further, the relationship between local authorities and individual community influences the latter's capacity to prevent future hazards. Thus, developing collective capacities of communities and institutions with the necessary skills and resources helps position these two for providing better support in time of disasters (Madan and Routray, 2015).

The present research work collected primary data through field visits, personal interviews and focus groups discussions with officials engaged in managing disasters from national to local level in Delhi, India. The research work also surveyed the affected community living alongside River Yamuna and attempted to identify the range of challenges faced by institutions which limits their ability to manage flood related risks and meet the needs of the community during such disasters. This is particularly important since River Yamuna crosses the warning water level almost every year thereby threatening to cause floods in low-lying areas (Fig. 1). The data

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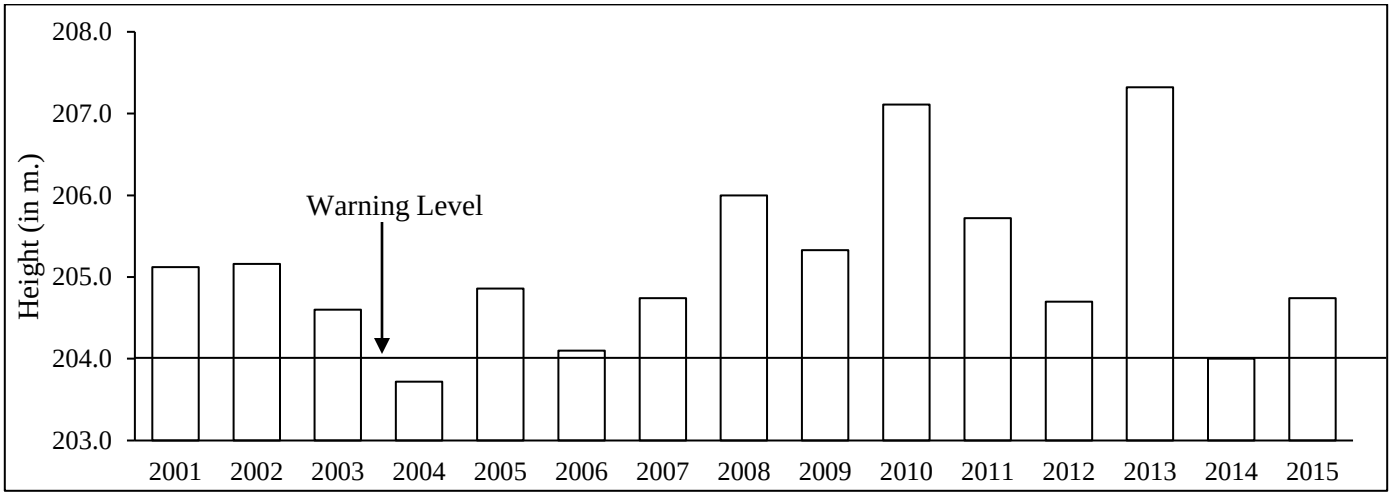

Figure 1. Highest height of water level reached by River Yamuna in Delhi in the last 15 years (Source: GNCTD, 2016; cf. Singh, 2012).

generated indicates that although existing institutional setups are well coordinated at the district level, they need enhancement and improvement at the local level. The data further highlights that disaster risk reduction needs to focus greatly towards inclusivity of urban local bodies. In order to overcome the wide variations in disaster awareness and perception among officials handling disasters, awareness and training programmes should be conducted more frequently. Further, for effective community participation, it is important to address the social and economic problems being faced by respective communities. This is because otherwise such issues are being observed to overshadow attempts made for reducing disaster risks in flood prone communities in Delhi (Madan and Routray, 2015).

This study recommends the adoption of strategies based on identified needs and existing gaps in managing disasters by disaster management institutions. In order to ensure greater involvement of local authorities for flood risk reduction, more power and resources need to be allocated to local authorities. Decentralization of decision making and responsibilities and budget allocations for programmes on reducing disaster risk at local level need to be made more significant. Preparation of disaster plans should be undertaken through participatory planning involving community stakeholders and the local government. Thus both, local institutions and the community together need to develop direct linkages following a participatory approach for reducing risk from disasters.

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Environmental Data: Resources and Access in India

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Environmental data comprises information primarily pertaining to natural resources - use and status. It is generated by institutions involved in ensuring statutory compliance and/or research. Database and statistical inference forms the basis of environmental governance in the form of general management, new policy formulation, hypothesis testing, consideration of alternatives, amendment of existing laws and regulations and public awareness. Such data is indispensable for both descriptive and inferential research. Data driven research with the aid of statistical evidence provides compelling conclusions for empirical observations. Therefore, precision, accuracy and integrity of data are of paramount importance. The data collection methodology and the analytical tools should be thus, robust and rigorous.

Environment plays an integral role in the regional and global development and contributes to the quality of people's lives in innumerable ways. Seventeen Sustainable Development Goals (SDGs), adopted at the United Nations Sustainable Development Summit in New York in 2015, involve commitment from an environmental perspective and outlines a plan for action for the next fifteen years. Monitoring the SDGs will involve data and consequently demand more partnerships among international agencies, statistical offices, government and development partners (World Bank, 2016). It is realized that much of the data will originate from public institutions, public-private partnerships, research enterprises and national statistical systems.

One of the most widely known data source in the field of environment is that of Environmental Data Explorer by United Nation Environment Programme (UNEP). Its online database holds more than 500 different variables, as national, sub-regional, regional and global statistics or as geospatial data sets (maps), covering themes like Freshwater, Population, Forests, Emissions, Climate, Disasters, Health and Gross Domestic Product (GDP) (UNEP, 2016).

There is a need to highlight available resources pertaining to environmental parameters accessible to public in India. One of the most useful portals is the Environmental Information System, commonly known as ENVIS. The scheme, implemented by the Ministry of Environment, Forest and Climate Change (MoEFCC) in 1982, is entrusted with the responsibility of collection and dissemination of environmental information on a national scale. The focal point of ENVIS is located in Delhi; with ENVIS centres located in various states and union territories. In addition, ENVIS centres are located in various governmental and nongovernmental agencies with focus on one of the five broad thematic areas: i) Ecology and Ecosystem services, ii) Environment and Society, iii) Environment and Technology, iv) Environment and Policy and v) Biodiversity. ENVIS is web based and contains descriptive as well as numerical data. Such information holds the key to policy formulation and environmental management at all levels of government as well as decision-making aimed at environmental protection and conservation (ENVIS, 2016). Indian State-Level Basic Environmental Information Database (ISBEID), an outcome of collaboration between MoEFCC, Government of India (GoI) and National Informatics Centre (NIC), is another portal for environment related data. It is primarily intended to provide (a) internet-based Geographic Information System (GIS) application, (b) one-stop information source to users, (c) interactive maps capable of handling operations like zoom in/out, pan, print, measure etc. and (d) querying ISBEID interactively (ISBEID, 2016). Information on several themes such as ecology, infrastructure, energy, agriculture, industries, natural resources, forests, water, air and water pollution, biodiversity, disaster, waste, sanitation etc. are available for public access.

The Central Pollution Control Board (CBCB), formed in 1974 under the Water (Prevention and Control of Pollution) Act, 1974 and further bestowed with the

powers and functions under the Air (Prevention and Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986, is a statutory body in the field of environmental pollution in India. Pollution monitoring data with respect to air and water pollution is available for public access. Pollution monitoring data for episodic pollution events such as Diwali festival and *Ardh Kumbh* festival are also available for public access. National Air Monitoring Programme (NAMP) and National Water Quality Monitoring Network (NWQMN) are elaborate programmes for pollution monitoring in India. Real time air pollution monitoring data from selected sites for criteria and non-criteria air pollutants are available for public. Similarly water pollution data with respect to physico-chemical parameters at different cities on banks of River Ganga and its tributaries is available for public: http://cpcb.rtwqms.com. Real time noise data at selected cities in India can also be accessed by public: http://www.cpcbnoise.com. Apart from the above, air and water quality standards, industry specific emission guidelines, vehicular exhaust norms, auto fuel quality standards, incinerator and generator set emissions guidelines, and noise standards are regulated by CPCB (CBCB, 2016).

Open Government Data (OGD) platform of the Indian Government (https://data.gov.in/) is yet another portal for public access to extensive data sets in a variety of sectors. As a scheme of Digital India Initiative, OGD is an outcome of joint efforts of Government of India and United States of America. The objective of the endeavour has been to promote transparency and greater citizen engagement in decision making. Interested public is also invited to suggest required datasets. Datasets from ministries and affiliated departments of Government of India are available for public use. Most importantly, the scheme intends to engage interested public to brainstorm and come up with innovative uses of government data from various perspectives. Environment features as a prominent domain on the OGD platform. A variety of environmental data such as Comprehensive Environment Pollution Index (CEPI) for critically polluted industrial area/ clusters in India, state wise tiger mortality, compensatory afforestation, annual fuel wood consumption, change in carbon stock in forest land, revenue and expenditure from/on forests, total consumption of Ozone Depleting Substances (ODS), estimated number of species in various taxonomic groups etc. are available for public access.

One of the first steps to tackle environmental challenges is to be aware of problems and resources available to combat it. Decision making involves goal oriented selection of available choices with the support of best accessible data. Quality control and quality assurance of such data is of prime importance. It is stressed that there is a strong need to carry out high quality research in order to identify the need of datasets in newer domains, deliberate on the suitability of the existing methodologies for data collection and draw meaningful conclusions from datasets available for public access.

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