

Name of college: Miranda House

Project Title: Miles on the Yamuna

Project Code: MH-104



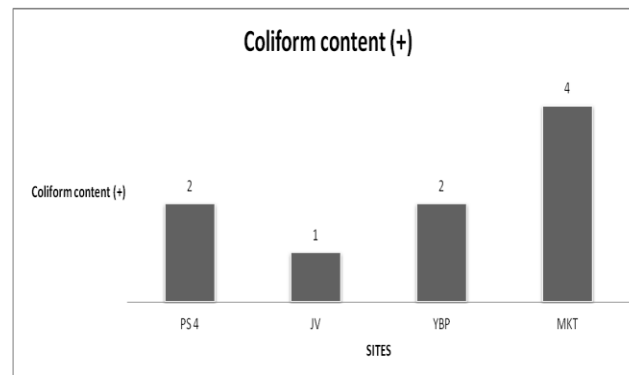
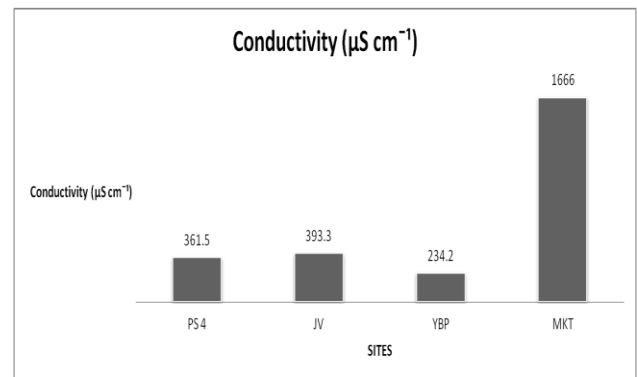
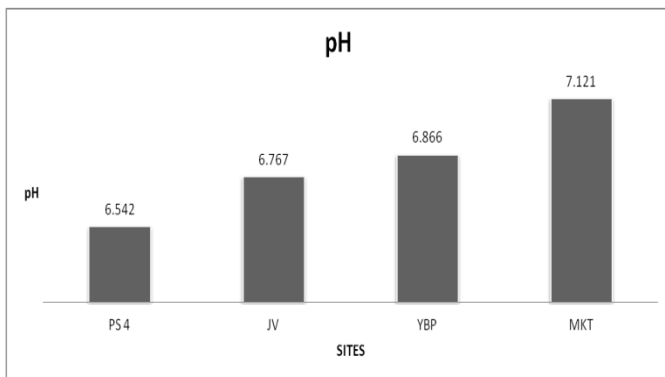
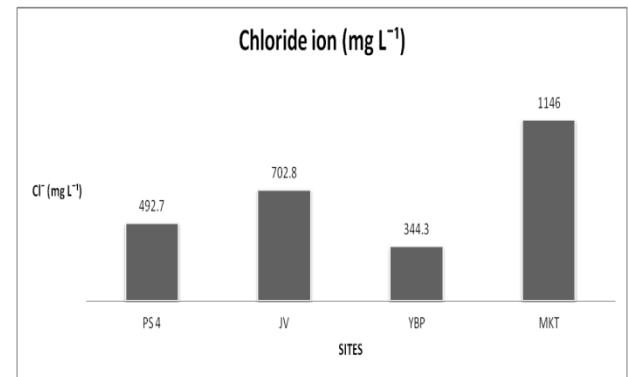
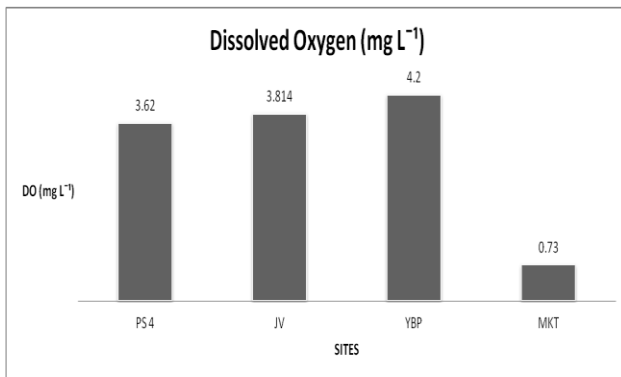
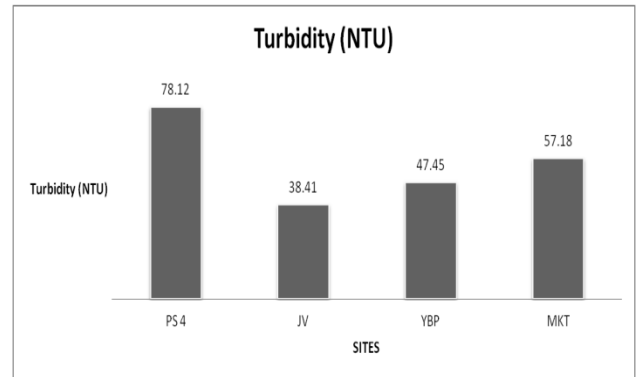
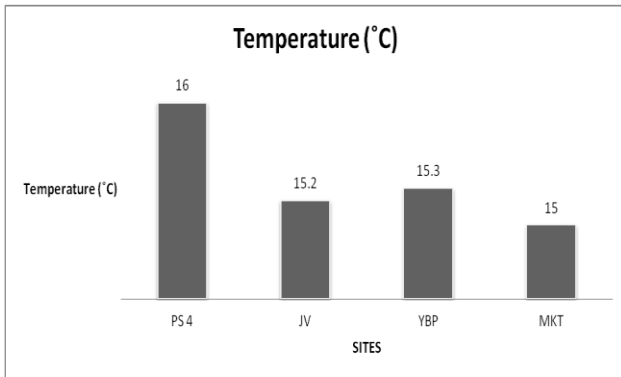
Team working at the banks of Yamuna

1. Objective (150 words):

The primary objective of the project has been to monitor the water quality of the river Yamuna at different locations in the NCT of Delhi and also the quality of the soil on the river banks. The first step was the familiarization with the river – and life on its banks – as it makes its way through Delhi after entering the city at Palla. The research methodology adopted included hands-on measurements of water quality parameters by using commercially available Vernier sensors and real-time data-acquisition system interfaced to computers. Water and soil quality was investigated for various parameters like Temperature, pH, Conductivity, Turbidity, Soil Moisture, Salinity, Chloride ions, Dissolved Oxygen (DO), coliform content and heavy metal content. The sites investigated included Palla Shank, Jagatpur Village, Yamuna Biodiversity Park, Majnu ka Tila, Wazirabad and Khajuri. The seasonal variation in water quality parameters was also studied.

2. Final Findings (300 words):

Water Quality Parameters:



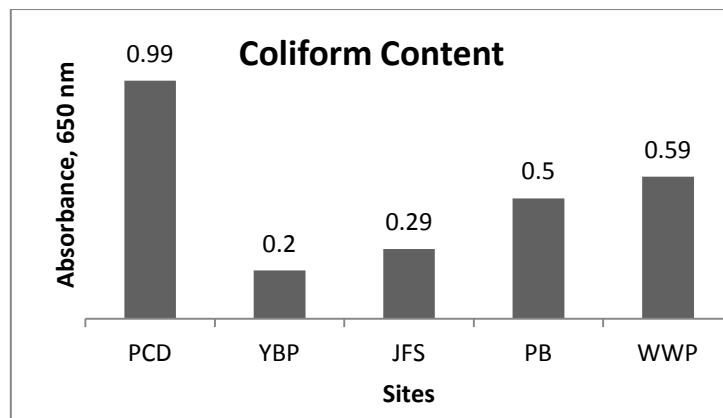
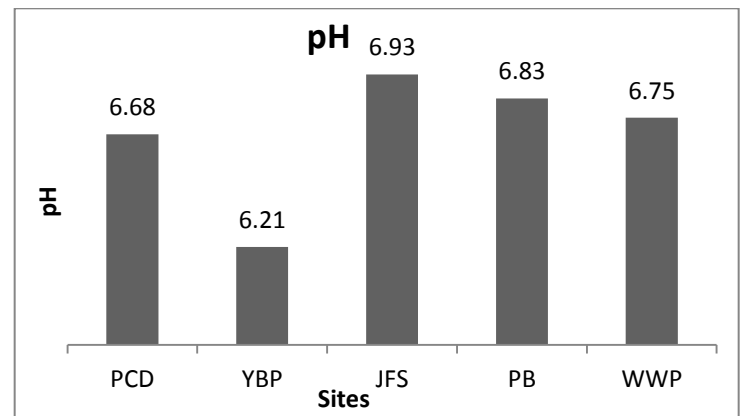
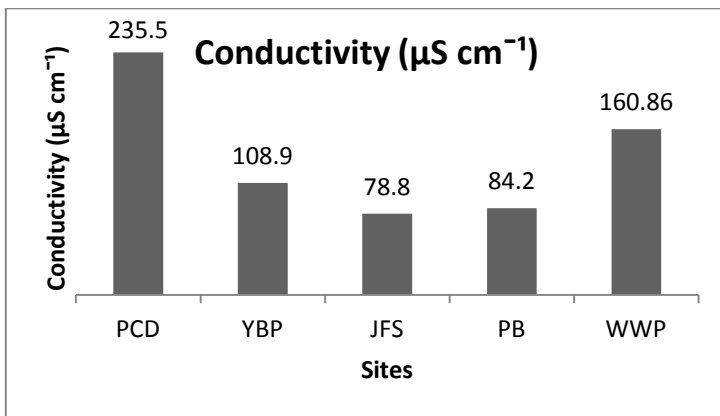
Key: PS – Palla Shank; JV – Jagatpur village ; YBP – Yamuna Biodiversity Park ; MKT – Majnu ka Tila

Majnu Ka Tila was found to be the most contaminated site as clear from the above data showing low DO and high values of Conductivity, Turbidity and Chloride ion concentration. It may probably be due to a combination of two factors: diversion of water to Wazirabad Water Treatment Plant and location of the Najafgarh drain opening close to the site, emptying sewage into the river. Most Probable Number (bacterial count) tests have shown that the samples from Wazirabad still water, Wazirabad flowing water and Majnu ka Tila were highly contaminated with more than 2500 bacterial cells per ml.

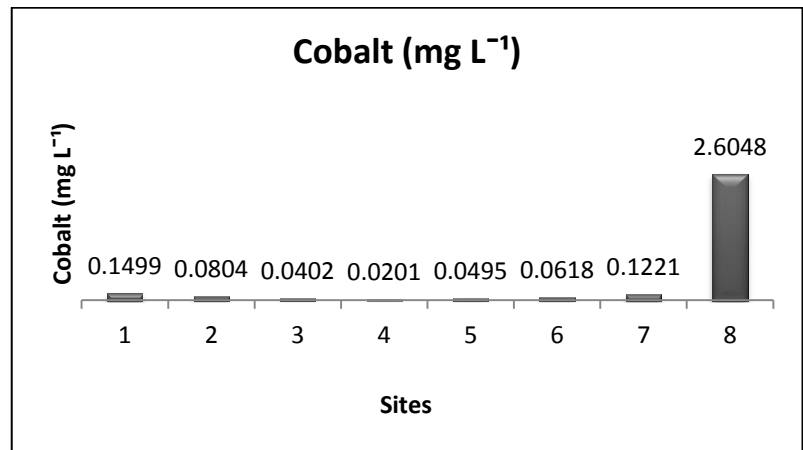
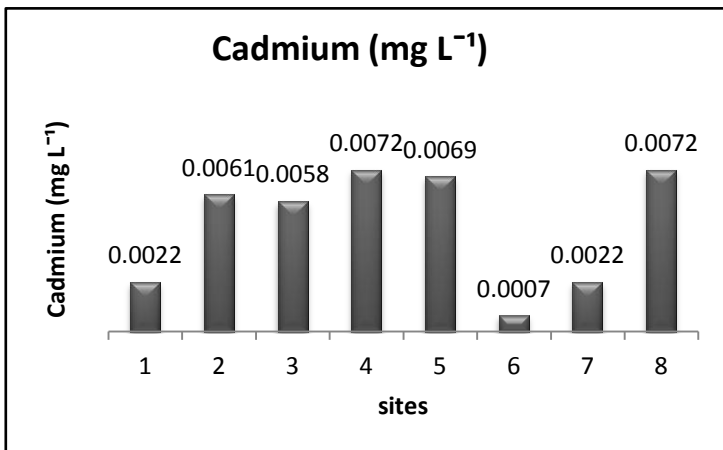
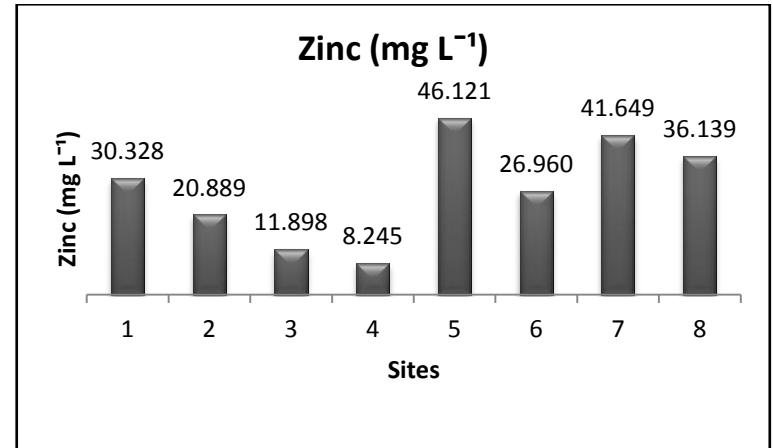
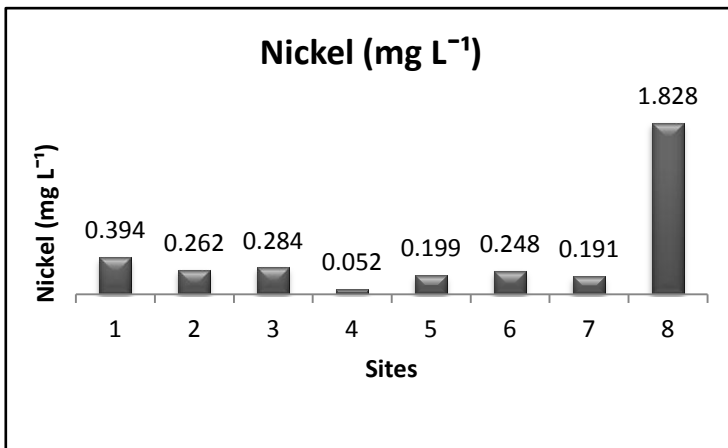
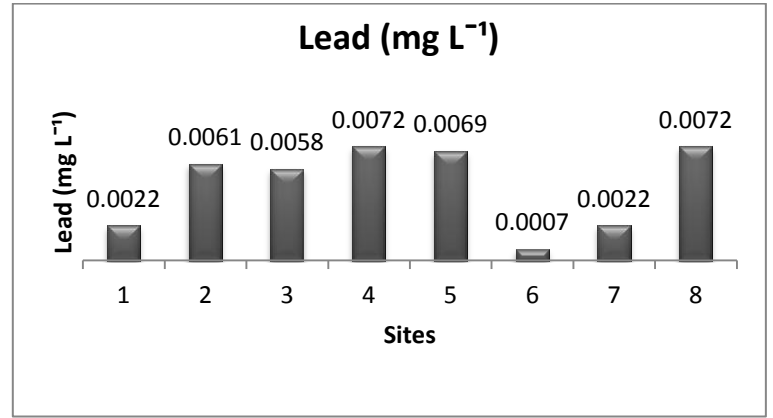
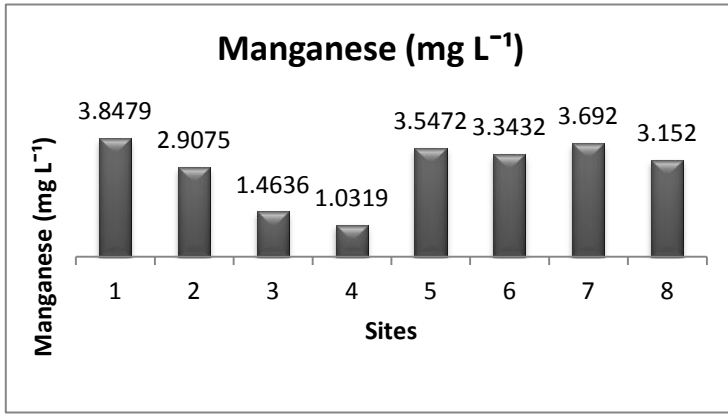
The effect of water volume on concentration of water pollutants can be seen by comparing the data for the water quality parameters in the dry season with that during the monsoon. For samples collected during the monsoon, the pollutant levels are found to be significantly lower.

It can thus be concluded that (a) preventing untreated sewage and effluents from being dumped into the river would help to a great extent to bring back the smile on the river Yamuna and (b) increase in water volume reduces the pollution load hence if less water is diverted during the dry season, it will help.

Soil Quality Parameters:



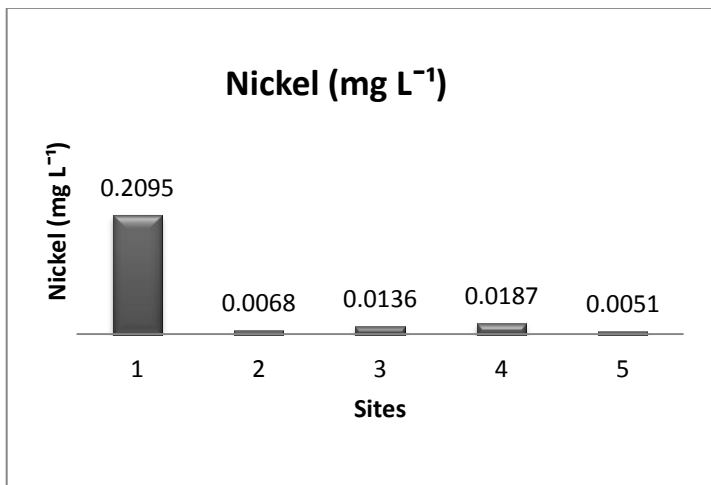
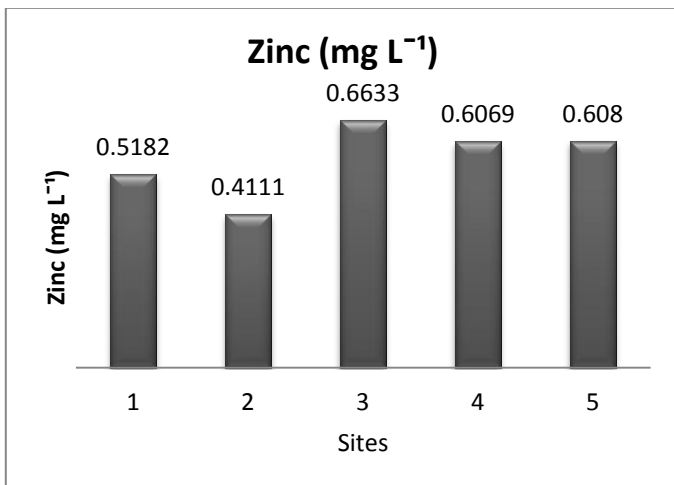
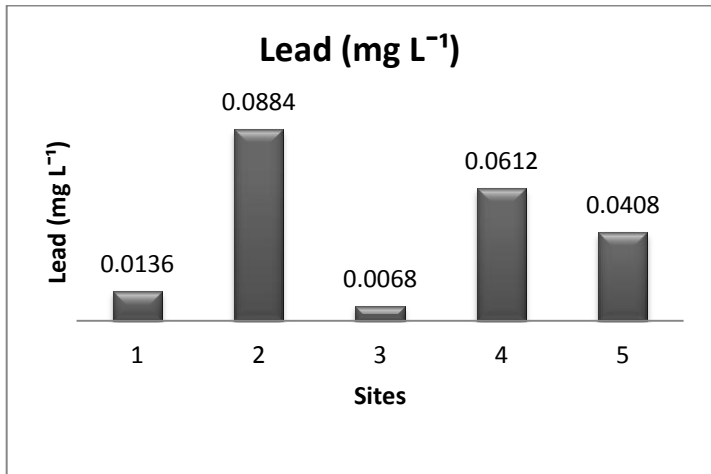
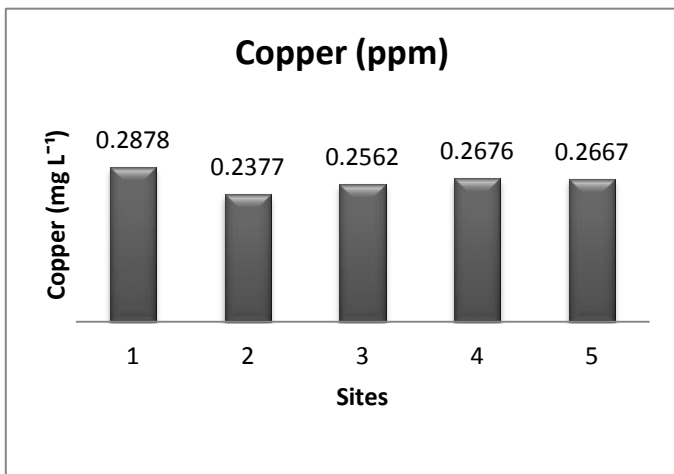
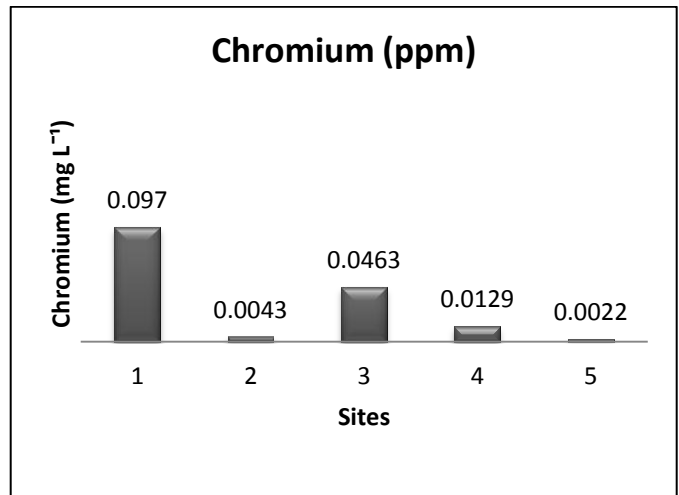
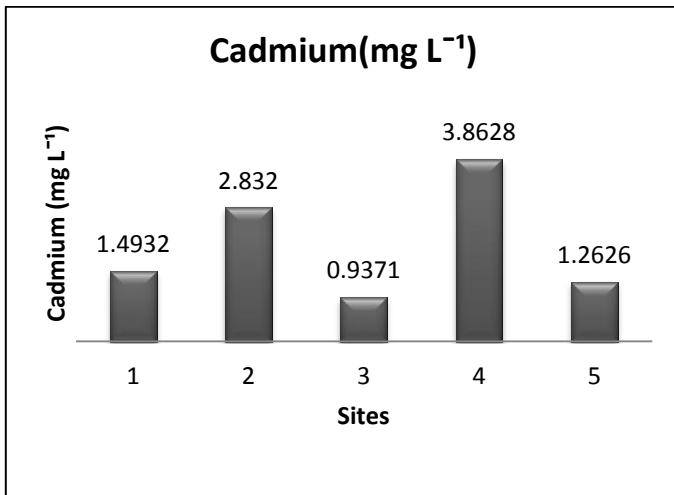
Heavy Metals in Soil:

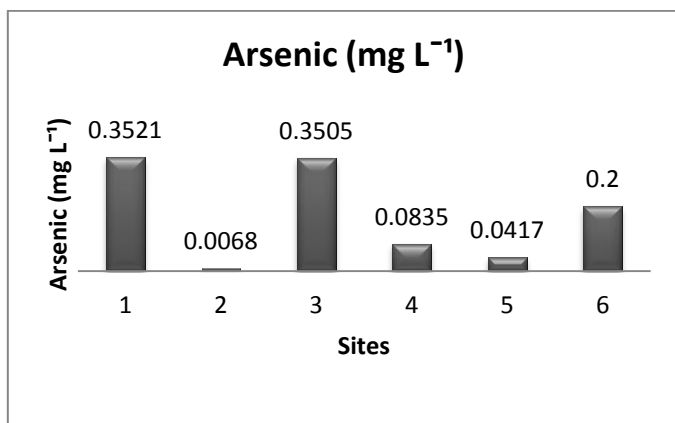


Key: 1. Palla village; 2. Palla check dam; 3. Jagatpur right; 4. YBP phase 2; 5.MKT; 6. Barrage; 7.Jagatpur; 8. MKT farm land

It can be seen that the soil samples are contaminated with Pb, Zn and Mn beyond the safe limits prescribed for these metals (Pb 0.05 ppm, Zn 5 ppm, Mn 0.1 ppm).

Heavy Metal Contamination in Vegetables:



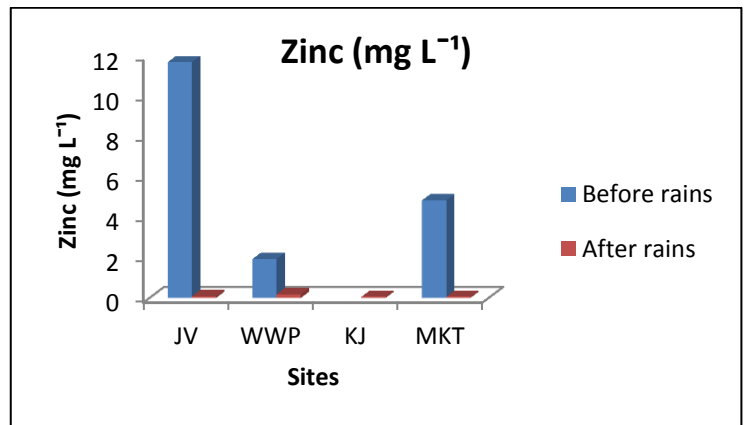
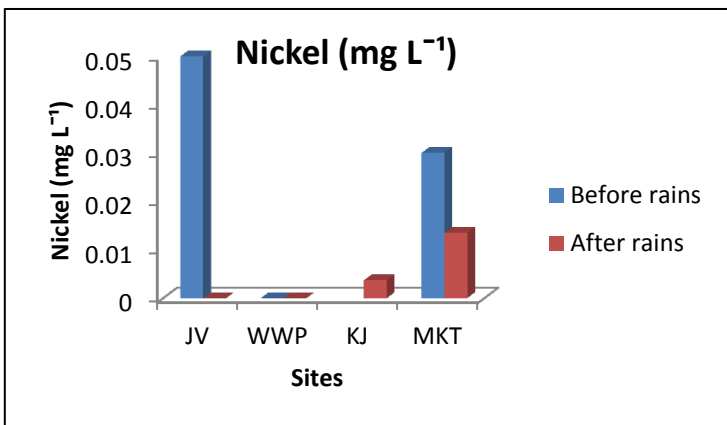
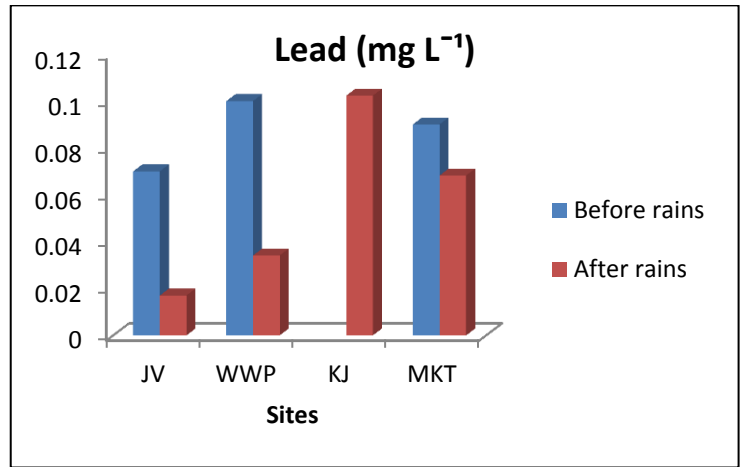
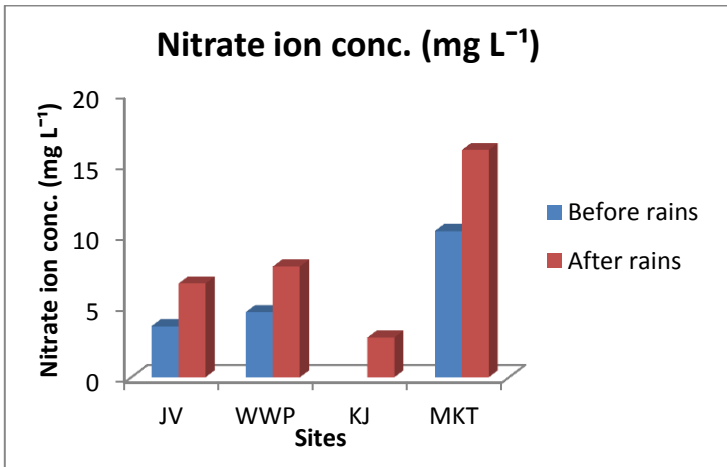
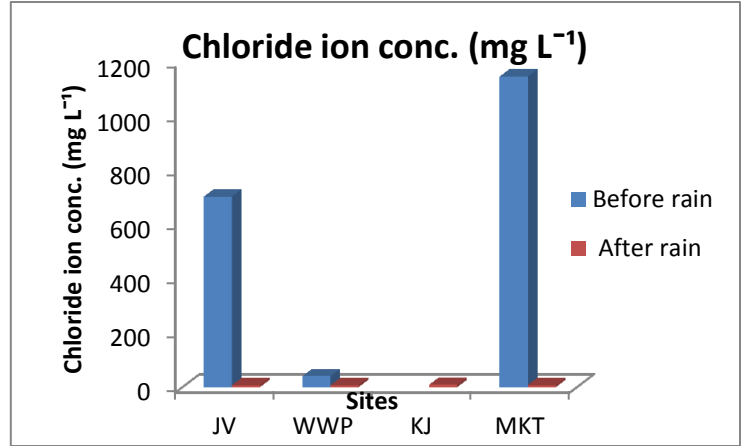
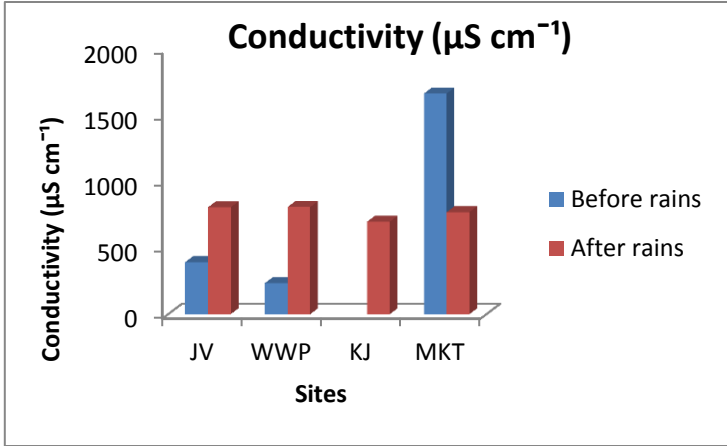


Key: 1. Turnip; 2. Spinach; 3. Bean; 4. Radish; 5. Cauliflower

For the above vegetables, Chromium, Arsenic and Cadmium were found to be in the toxic range. The high values of metal toxicity are due to the fact that the water used for irrigation as well as the soil itself is contaminated with corresponding metals as found during this study.

Seasonal variation in water quality:

Parameter	Jagatpur		Wazirabad		Khajuri		Majnu ka Tila	
	Before rains	After rains	Before rains	After rains	Before rains	After rains	Before rains	After rains
Conductivity ($\mu\text{S cm}^{-1}$)	393.3	807.1	233.9	809.2	-----	698.3	1666	770.3
Chloride ion (mg L^{-1})	702.8	6.7	40	6.8	-----	8.6	1146	7.1
Nitrate ion (mg L^{-1})	3.6	6.6	4.6	7.8	-----	2.8	10.3	16
Pb (mg L^{-1})	0.07	0.017	0.1	0.0341	-----	0.1023	0.09	0.0682
Ni (mg L^{-1})	0.05	0	0	0	-----	0.0037	0.03	0.0135
Zn (mg L^{-1})	11.69	0.0789	1.93	0.1831	-----	0.0552	4.84	0.0578



Prior to rains, the water was found to be highly polluted, owing to high values of ion concentration, conductivity and heavy metal content. But tests conducted after the onset of the monsoon, leading to an increase in the volume of water in the Yamuna, showed improved results; most of the parameters now being within safety limits. (Conductivity: 50 - 1500 $\mu\text{S cm}^{-1}$, Chloride ion concentration: 1-100 mg/L, nitrate ion concentration: 10mg/L, lead: 0.05 mg/L zinc: 1 mg/L.)

A seasonal comparison could not be made between the vegetable samples for heavy metal content due to flooding of the Yamuna banks and consequent submergence of the agricultural land. The higher conductivity and nitrate content of some of the samples is probably due to heavy rains in the catchment area of the Yamuna upstream which caused higher run-off from agricultural land treated with chemical fertilisers.

The above data clearly suggests that allowing more water into the Yamuna, by limiting diversion for irrigation and industrial purposes would prove to be a major step in saving the water body. This would allow the river to self-rejuvenate naturally.

The pollution and encroachment of the river banks has also led to a decrease in the number of migratory birds in the last ten years. Bird species which are indicators of pollution have been spotted like Black-winged stilt and Purple Swamp Moorhen as they feed on the waste dumped on the banks. On the other hand species like Common Kingfisher, indicator of clean water, are rarely sighted. However, the major portion of Yamuna bank is still being used for cultivation of economically important crops like wheat (*Triticum aestivum*), maize (*Zea mays*), rice (*Oryza sativa*), radish (*Raphanus sativus*), watermelon (*Citrullus lanatus*), spinach (*Spinacia oleracea*) and turnip (*Brassica campestris*).

3. Learning for Students (200 words):

The project enabled undergraduates from across courses to work together and learn research methodology through the hands-on investigation process. It brought every student member of the team closer to the Yamuna, the lifeline of Delhi. While exploring the Yamuna's fate in Delhi, students experienced the real-world problems and challenges first hand. The project engaged students in real and thought provoking issues and trained them to think independently, formulate problems and draw conclusions.

From background research to handling equipment, from field visits to brainstorming meetings, from interactions with the twin project members and mentors to interactions with the riparian communities, the project helped us to develop the mindset and skill for critically examining issues. We had to start from designing the project and in the process of doing this, we got to hone our organizational skills and learn time management. The periodic requirement for report submission helped us to assess ourselves on time and improve the design of our project. The preparation and management of the *Antardhwani* Project Stall enhanced our communication and presentation skills. The two-day conference organized in collaboration with TERI for societal sensitization and awareness building on the Yamuna helped us to achieve our goals of bringing various stakeholders together on one platform, awakening interest and awareness on the topic in a section of young people and setting up productive collaborations.

The Yamuna Project has added to our self-confidence, motivated us to do rigorous fieldwork, enhanced our awareness about important environmental issues and increased our inclination and dedication towards research.

4. Benefits to College (100 words):

The Yamuna Project left the team of student researchers enriched with first hand experiences of an environmental issue which impacts society. The awareness and sensitivity acquired by the team diffused into their peer group as well. It helped the core team to widen their understanding of academic achievement and motivate other students to be part of future innovation projects. The enthusiasm and excitement of the project teams were communicated to other students through peer interactions, both structured and non-structured. It highlighted the role of the hands-on approach in education especially with respect to real-life issues and has inspired another group of students to continue to study the problem beyond the term of the project. The project provided a platform for multidisciplinary interactions among students and mentors. It promoted originality, self-reliance, exchange of ideas and collaboration within and between groups of students and that cannot fail to benefit the institution.

5. Benefits to Society (100 words):

The team interacted with local people, including school students, living close to the Yamuna to make them aware of the impacts of their activities on Yamuna by showing them actual results of water and soil analysis. The report of the team's efforts published in a Hindi newspaper helped a number of people to understand the present degraded condition of the river and the heavy metal toxicity in vegetables grown with Yamuna water.

Through *Antardhwani*, the University Festival and *Rhythms Village*, the public seminar held in collaboration with TERI, people from different sectors of society gained awareness about water and soil quality parameters and the importance of preserving the Yamuna, the lifeline of Delhi.

6. Further Plans (100 words):

The remaining portion of the river Yamuna in Delhi can be mapped with respect to water and soil quality parameters, including their seasonal variations. A survey regarding people's feelings towards Yamuna and their perception of how it affects their lives can be conducted. Young people can be sensitized about the present situation of river Yamuna in Delhi, by conducting sensitization workshops with different schools and colleges of Delhi and NCR. The impact of pesticides on soil and water can also be studied. The impact of festival celebration on the water, such as immersion of idols after Durga Puja, can also be studied. The study of various health hazards affecting the riparian communities would also prove to be beneficial for society in general.