Global & Ecological Health Engineering:

Second Student Project in the Thar Desert, Rajasthan, India

Under the direction and supervision of Professor Kimberly Gray, the second group of Environmental Engineering students traveled to Jodhpur, Rajasthan, India in July 2012 to study textile wastewater management in the Marwar Desert region. Ben Shorofsky, Beau Garrett and Regan Radcliffe, all BS/MS students in Environmental Engineering, received technical support from the Jal Bhagirathi Foundation (JBF) and programming and accommodations from the Foundation for Sustainable Development (FSD) for one month while they studied the major issues related to the textile industry in the region. JBF has taken up the initiative of the Luni River under the project titled "Poverty Reduction of Desert Communities in the Dry Lands of Western Rajasthan through Integrated Community Based Water Resource Management" being implemented with the support of the European Union.

Textile workers in Jasol, India.

Throughout the Thar Desert, the textile industry is being forced to reevaluate its water intensive practices following increased public pressure and legal actions against the industry. Public concern is largely due to the exhaustion of regional groundwater resources and the degradation of water quality in the Luni River Basin. A recent verdict from the Rajasthan High Court mandates a zero-discharge policy for effluent into the basin, a decision that has left not only the industrialists looking for economically viable solutions to keep the industry alive through water recycling, but also the Pollution Control Board struggling to keep up with enforcement requirements. While some community leaders have advocated for a diversification of the industrial activities in the district, the fact remains that the textile industry will remain the short-term lifeblood of the regional economy, and the immediate partial shutdown that has resulted from the court decree will dampen economic progress. On the other hand, this verdict provides an opportunity to make substantial improvements related to the management, regulation, and monitoring of water and effluent quality. The Northwestern team evaluated the efficacy of the proposed treatment scheme to achieve a closed-loop water treatment system for textile plants and recommended viable alternatives, specifically tailored to the local conditions around the village of Jasol. Jasol serves as a perfect test site for innovative textile wastewater treatment due to its relatively small size and strong community organization.

A group of farmers discussing land degradation in Jasol.

The team's research presented the full scope of environmental, socioeconomic, and political issues at hand within the textile industry in hopes of finding a powerful solution to the present environmental problems. They described the current textile wastewater effluent treatment process, which has been designed using a standard conventional treatment that was likely never properly sized or tested for the unique characteristics of the effluent. Based on these observations and analysis of monitoring data, it was concluded that the existing treatment process fails to remove total dissolved solids (TDS) and color. The efficacy of the newly added tertiary treatment and the planned reverse osmosis (RO) plant addition were also challenged. There were uncertainties surrounding the sizing of the system and its ability to accommodate the entire flow from the industrial cluster, as well as clear inconsistencies in monitoring that limited effective management of the treatment train.

Jasol Industrial Association leaders demonstrating how their treatment train works; Regan Radcliffe in partial view to the right.

Improvements such as better piping of effluent and improved optimization through data collection at the Jasol Common Effluent Treatment Plant (CETP) are presented as ways to enhance the existing treatment train. The NU team also presented an alternative, relatively low-cost, low-maintenance, ecologically based treatment train that would be better suited to the industrial capabilities of the region. This treatment would begin with standard pretreatment and primary treatment, utilize a constructed subsurface wetland for secondary treatment, and end with an industrial-scale solar distillation process to remove the excess salts in the water. Future researchers can pilot test this treatment for textile effluent and thereby, create a viable plan for closed-loop water processing. Successful implementation of the team's recommendations could significantly affect the way that industry leaders think about environmental management, as alternative sustainable designs are not only suited for the available resources in Rajasthan, but would enhance the environmental quality and long-term economic growth in the region.

A potential next step to continue the relationship between NU and JBF could be to help the industrial community in Jasol establish an effective monitoring and record keeping system in order to prepare for a closed-loop textile processing system that employs a treatment train with zero discharge. Additionally, pilot scale testing and research must be conducted to implement alternative design recommendations. It will be essential to track the progress of the Rajasthan High Court case, as well as the efforts of the industrialists to mitigate industrial pollution in order to succeed in this crucial effort to mitigate environmental, socioeconomic and political deterioration within the Marwar region.

Regan Radcliffe, who graduated with a BS in Mechanical Engineering in June, 2011 and MS in Environmental Engineering in June, 2012, completed the GEHE Certificate in August, 2012 and is now working for Lockheed Martin as a systems engineer on a satellite program

and hoping to rotate onto projects related to ocean and wind energy. Benjamin Shorofsky and Beau Garrett both graduated with from the BS/MS program in Environmental Engineering and completed their GEHE Certificates in December, 2012. Beau is working in the Center of Excellence in downtown Chicago at a young sustainable building consulting company called Goby, LLC. He is a member of a team that focuses on streamlining and improving data management. He also supports LEED credit documentation, Energy Star award maintenance, and energy modeling. Ben is working at Wabashco, LLC, a small environmental sustainability development firm in Chicago that mainly tackles carbon offset projects. Ben is working on a project dealing with the destruction of ozone depleting substances for admission as carbon offsets on the California Cap and Trade market. Ben has also applied for a Fulbright Fellowship in order to continue to work with JBF and the Jasol community to test the efficacy of wetland systems to create a closed loop water system for the textile industry. He application has been recommended on the U.S. side and he is awaiting the final decision from India.

Regan, Ben, and Beau sitting with Mr. Rajendra Singh the Vice Chair of JBF's Board.

There are currently seven students participating in the GEHE program in the 2012-2013 academic year. Planning is underway for these students to work on a new set of projects in collaboration with JBF.