

Application Form
2008-09 TWRI Mills Scholarship Program

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4. Description of the student's proposed research

Title: Low Impact Development for Protecting Urban Riparian Ecosystem: Evaluation of Watershed Protection Ordinance in City of Austin, Texas

Low Impact Development (LID), a site design strategy to maintain predevelopment hydrology through various design techniques, has earned popularity as an alternative development strategy to mitigate the adverse impact of urbanization. Although there are some researches on the hydraulic effect of LID at site scale, there is no empirical research examining LID at watershed scale. The City of Austin, Texas has a long regulatory history of water resource protection, which meets the LID concept. The cornerstone event is the Save Our Springs (SOS) ordinance of 1992, adopting the principle of non-degradation for the development on watersheds hydraulically connected to the Barton Springs. Currently, Austin designates 5 watershed protection zones and regulates them with different levels of impervious cover limit, stormwater best management practices (BMPs), and the riparian buffer width, which makes Austin an interesting case for examining the effect of LID at watershed scale.

The effect of LID will be tested using stream hydrology and riparian vegetation communities between SOS and non-SOS streams. Since urban development increases stormwater runoff and decreases groundwater recharge, I hypothesize that

- 1) Conventional urban development changes stream hydrology flashier and the riparian zones more invaded by alien xerophytes, and
- 2) SOS ordinance mitigates these adverse impacts.

Study sites are 14 riparian zones (7 in SOS, 7 in non-SOS watershed zones) within Austin Metropolitan area at which U.S. Geological Survey (USGS) has monitored the daily stream discharge before the SOS ordinance was enacted. Prior to comparison, SOS and non-SOS sites will be paired based on pre-SOS hydraulic patterns to control for the natural variations. Autoregressive moving average (ARMA) model with Box Jenkins methodology is built to identify the hydraulic patterns, i.e., how watersheds respond to rainfalls. Watersheds will be

delineated for each study site using US Environmental Protection Agency's (EPA) BASINS and impervious cover percentage will be classified with Landsat satellite images taken before (1987) and after (2004) the SOS ordinance using support vector machine algorithm. All tree and shrub species are identified in 10m wide 20m long plots along the streamlines at USGS water gages. Then, cover percentages of invasive xerophytes are measured and compared between SOS and non-SOS pairs.

Today's riparian ecosystems in Austin are the results of long term impacts of urbanization and LID application. Therefore, postevaluation of Austin's watershed regulations can provide valuable implications for planners and ecosystem managers who want to adopt the LID based design in similar climate.

6. Proposed use of funds

This scholarship will be used for field trip to Austin for approximately two weeks and for travel expenses to academic conferences.

7. Career path

Upon completing my PhD degree, I would like to continue researching and teaching water and environmental issues of urban areas. I am particularly interested in developing planning tools to mitigate the adverse impacts of development on environment.