2010-2011 TWRI Mills Scholarship Application

Applicant's name	Tu, Min-cheng	
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Faculty advisor	Name	Dr. Bradford Wilcox
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Proposed research	My research focus deals with soil erosion and sediment transport. Uncontrolled soil erosion not only deprives soil fertility, but also degrades water quality and decreases service life of water supply infrastructures. A vivid example of the high cost that the society pays for soil erosion is the cost required to mitigate excessive sediment deposition in reservoirs, which can sum up to millions of dollars for a single reservoir[1]. One important tool for understanding and mitigating soil erosion is modeling, such as the family of empirical erosion models based on USLE (Universal Soil Loss Equation.) These equations work best only in certain environments[2]. Furthermore, challenges emerge in simulating sediment yield in large areas because the combining effect of soil erosion and transport is not fully documented yet. Large scale data for validating and testing existing models is very limited. The exciting aspect of my research is that I have the opportunity to take advantage of an extensive soil erosion database collected at a number of watersheds over many years. The database, which comprises both stream flow and sedimentation data, was collected by BREC (Blackland Research and Extension Center) from a network of gages in Cowhouse Creek, TX for the past two decades. Due to the huge spatial scale (more than one hundred thousand hectares for the largest sub-watershed) and long recording period of the Cowhouse Creek data set, it provides an excellent reference to computer models. Computer simulation results from SWAT (Soil and Water Assessment Tool) and APEX (Agricultural Policy/Environmental Extender Model) will be generated for Cowhouse Creek watershed and its sub-watersheds. We then can answer the questions: How good is the fit between the observed sediment yield and the results predicted by theoretical and computer models? According to our understanding to semi-arid environments, how do we improve the current models? This knowledge will greatly benefit future works in predicting available water resources in Texas. Ultimately, I plan to build a computer model that allows detailed evaluations of a myriad	

[1] A. Palmieri et. Al., Economics of reservoirs sedimentation and sustainable management of dams, Journal of Environmental Management (2001) 61, 149-163.

[2] Neal B. Stolpe, A comparison of the RUSLE, EPIC, and WEPP erosion models as calibrated to climate and soil of south-central Chile, Acta Agriculturae Scandinavica Section B-Soil and Plants, 2005; 55: 2-8

	combination of conservation strategies. This is an exciting approach that will allow for a very detailed evaluation of watershed conservation. In degraded watersheds, BMPs (Best Management Practices, such as contour ripping, gully plugs, and retention ponds) have been used as short-term mitigation measures to decrease excessive sediment yield. However their watershed-wise effectiveness is not well-documented or understood yet. By adopting the computer models from my research, I can generate the best BMP installation strategies for different sub-watersheds by utilizing optimization algorithms such as the Genetic Algorithm. Finally, the long-term and multiple-scale watershed data that have been collected at the Cowhouse Creek watershed offers an unprecedented opportunity to better understand fundamental relationships on semi-arid rangeland watersheds. We are analyzing the data in great detail to better understand what processes govern runoff and erosion on semi-arid watersheds. This kind of work has only been accomplished at a few locations because data of this kind is so limited. Texas is the pioneer of water resource modeling. The worldwide recognized computer model, SWAT, was created in BREC in Temple, TX. As we increasingly rely on computer models to predict change in available water resources, it is also important to understand the limitation and possible problems of existing models. From the Cowhouse Creek data set, I expect to refine existing computer models, and make contributions to the work of predicting sediment yield in semi-arid, particularly Texan, watersheds. I am confident and hopeful that the modeling and data analysis work that I am conducting will shed new light and offer a fundamentally better understanding of runoff and erosion on semi-arid Texan watersheds.

Academic qualification	GPR	Graduate: Undergrad:	
	GRE		
	Grad Courses taken	Soil and Hydrology	Soil Science, Soil interpretation, Vadose zone hydrology, Ecohydrology, Fluvial geomorphology
		System Modeling	Entropy theory application in environmental engineering, Community analysis, Small watershed modeling
		Ecosystem	Rangeland and forest management, Southeast wetland fieldtrip, Biogeochemistry of ecosystems
		Statistics	Statistics for research I
		Other	Research process

Proposed use of fund	1. Travel cost to attend out-of-state seminars and conferences. In the year of 2009, I have attended AGU (American Geophysical Union) fall meeting in San Francisco and Chapman meeting in Idaho. 2. Pay for tuition fees.

Intended career path	I intend to pursue a career path where I can utilize my skills and interest in erosion and landscape modeling. The ideal scenario would be to enter academia where I can both conduct research and teach. I understand that landing a job in academia is highly competitive and post-doctoral experience is usually required. I prepare to work as a post-doc for a number of years to improve my academic credentials and research skills. Alternatively, I would consider a career in governmental agencies where I could focus full time on advancing human knowledge in erosion prediction and modeling.