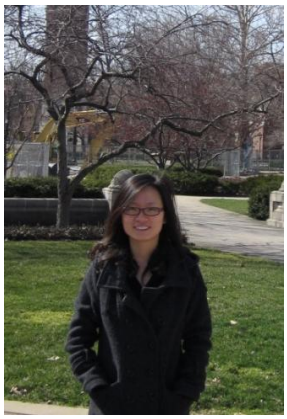

Jing Tan is enrolled in the Ecological Sciences and Engineering (ESE) interdisciplinary program and now a Master's Student in Agricultural & Biological Engineering (ABE) at Purdue University. She received her B.S. in Geographical Information System (GIS) from the department of Geography, Beijing Normal University, China in 2009. Her current research interest is remote sensing/GIS and hydrology. After completing her MS, she will continue her PhD in ABE and focus on estimating in-stream nutrient concentrations by remote sensing technology.

Agricultural & Biological ENGINEERING

Thesis Defense

Speaker: **Jing Tan**

Title: **ASSESSING STREAM TEMPERATURE VARIATIONS AND ITS RELATIONSHIP WITH URBANIZATION IN THE PACIFIC NORTHWEST**

Major Professor: **Dr. Keith A Cherkauer**

Date: **Wednesday, May 4, 2011**

Time: **9:30 am – 11:30 am**

Place: **ABE 212**

Abstract:

In the Pacific Northwest, water quality degradation due to elevated stream temperature and the threat it imposes on cold-water fish species, especially the economically important salmon fisheries, has been of great concern during recent years. Stream temperature, like other water quality parameters, is believed to be largely affected by a number of factors, but land use change, especially urbanizaton are of particular concern. The accurate measurement of stream temperatures is important for both identifying environmentally detrimental temperatures as well as being able to monitor compliance with water quality standards relating to water temperature. In this thesis I use two different measurement systems for stream temperature, thermal infrared (TIR) imagery and in-stream temperature loggers, to relate the spatial and temporal variability in water temperatures to environmental conditions. This research first utilizes both five-meter and fifteen-meter airborne TIR imagery collected for the Green-Duwamish River basin in Washington State, USA to assess how stream temperature changes over different time intervals from minutes to hours to days. Longitudinal profiles of stream temperature from upstream to downstream were also analyzed to identify the possible impacts of land use on stream temperature. In the second part of this research, daily in-stream temperature data for the mainstem Green-Duwamish River basin and a tributary, Soos Creek, were analyzed to identify relationships between urban development and stream temperature.

Analysis of overlapping TIR images indicated that stream temperature did not experience significant changes over a time interval of several minutes; however, as the time interval increased observed water temperatures began to increase significantly. Increases were attributed to a warming environment as measurements were made from mid-morning to early-afternoon so solar heating increased throughout the period of image collection. Spatial mean stream temperature was lower in areas with less urbanization and thus more riparian vegetation and increased with urbanization. Spatial variability was found to decrease with urbanization, suggesting a reduction in shading from riparian zone vegetation and in-stream materials such a rocks and woody-debris. In-stream temperature observations in the Soos Creek watershed identified a statistically significant increase in cold season water temperatures and decrease in variability with increased urban land use within the riparian buffer zone upstream of the sampling sites. This is directly related to an increase in cold season minimum water temperatures, which is indicative of increased overland flow due to impervious surfaces. Both observation methods found an increase in water temperature and decrease in variability as urban area along the stream channel increased. Each measurement system provided insight into the thermal regime of the Green-Duwamish River basin but together they provided more insight into the temporal and spatial variation of the system than either could alone.