

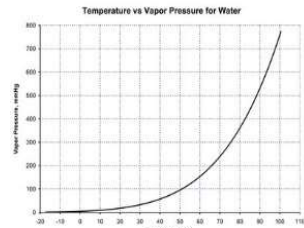
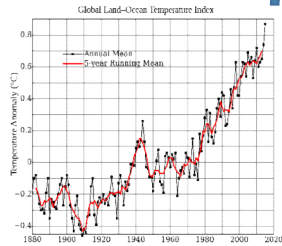
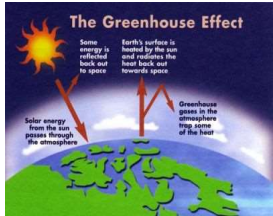
# CREST HIRES Summer 2016 Research Project

## **The Effects of Climate Change and Urbanization on the Runoff**

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# Climate Change Has Intensified the Global Water Cycle



Evidence for intensification of the global water cycle:  
 Review and synthesis

Thomas G. Huntington\*

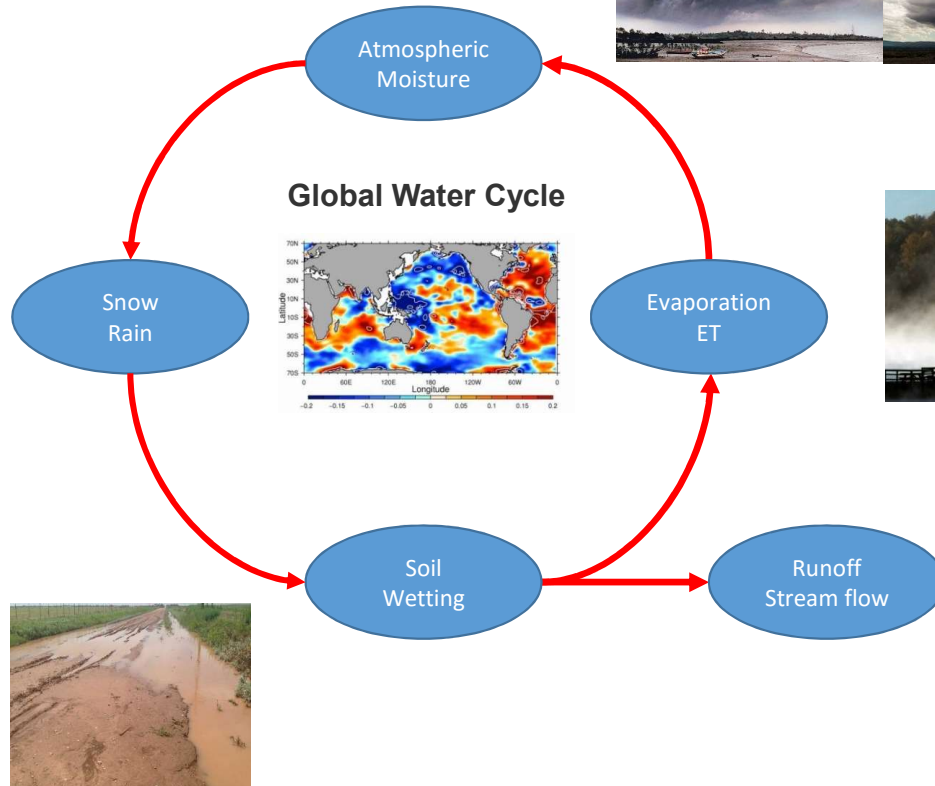
21 Geological Survey, 104 Whittier Ave., Amherst, MA 01003, USA  
 Received 1 February 2006; revised 20 June 2006; accepted 7 July 2007

**Abstract**

The rate of the water cycle has intensified in the 20th century. This is a result of the increase in the amount of water vapor in the atmosphere, which is a result of the increase in the amount of water vapor in the atmosphere. The increase in the amount of water vapor in the atmosphere is a result of the increase in the amount of water vapor in the atmosphere. The increase in the amount of water vapor in the atmosphere is a result of the increase in the amount of water vapor in the atmosphere.

**1. Introduction**

There is a general consensus that global average surface air temperature increased during the 20th century, and although there is great uncertainty about the magnitude of these increases, most assessments indicate that the increase is 0.5–1.0 °C. The increase in the amount of water vapor in the atmosphere is a result of the increase in the amount of water vapor in the atmosphere. The increase in the amount of water vapor in the atmosphere is a result of the increase in the amount of water vapor in the atmosphere.



**HOW CLIMATE CHANGE IMPACTS WEATHER**

**THE SCIENCE**

**CHANGES IN THE WATER CYCLE ARE INCREASING THE RISK OF DROUGHTS AND FLOODS.**

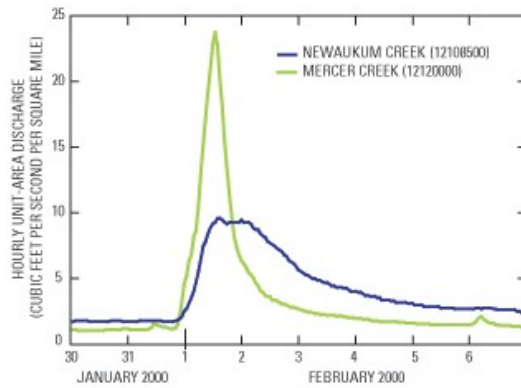
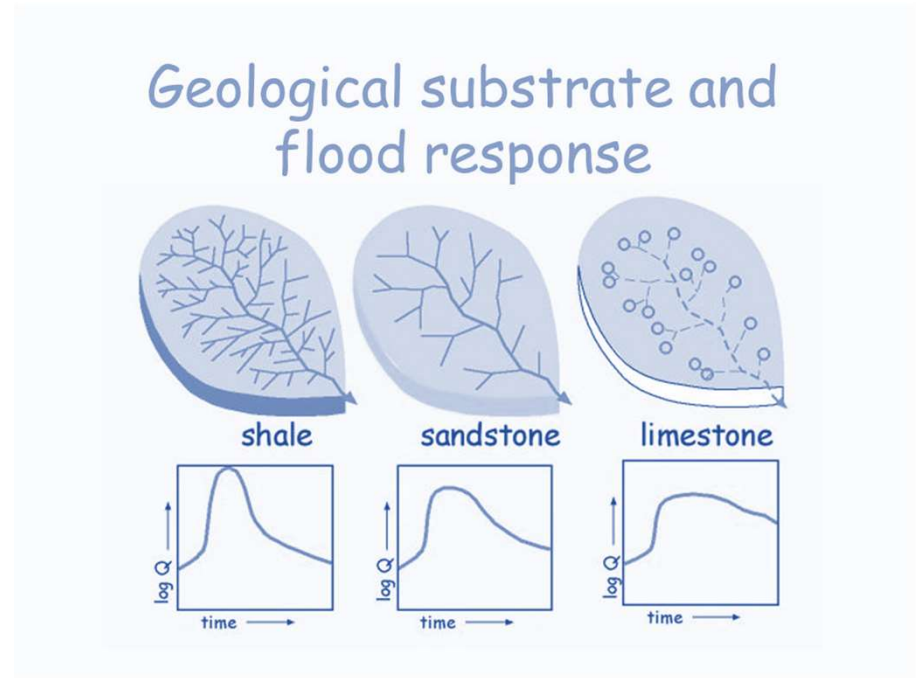
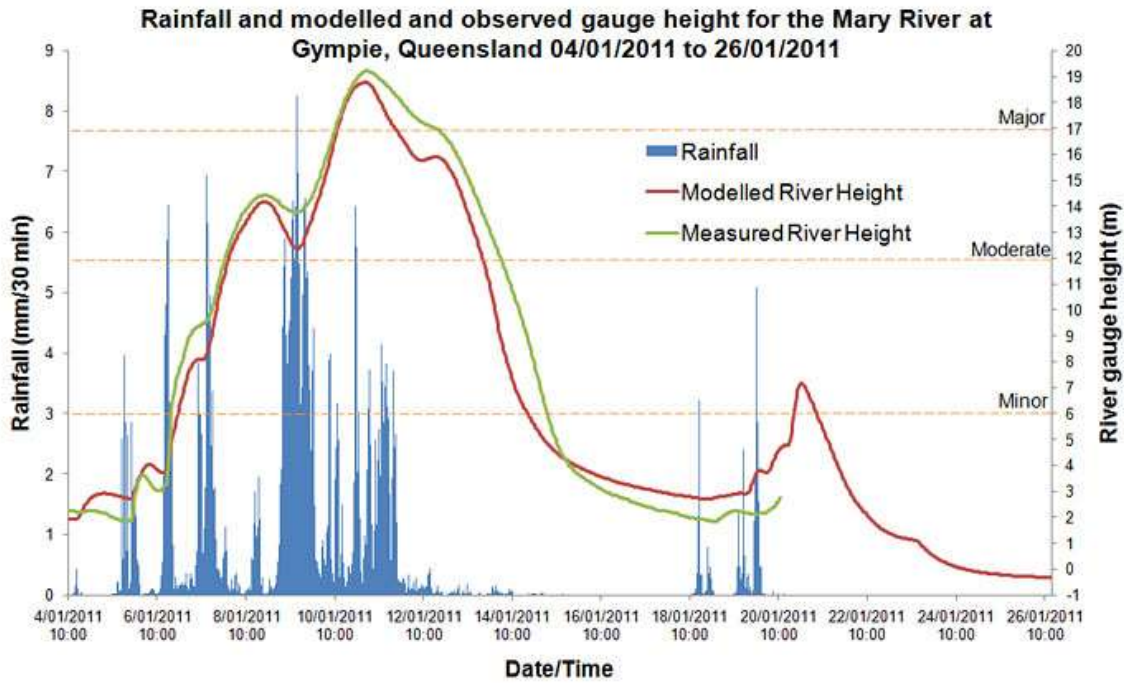
- Higher temperatures mean there is more evaporation from the land and sea into the atmosphere.
- As air gets warmer, it can hold more water vapor. This can lead to more intense rainstorms.
- Intense rainstorms increase the risk of flooding. Much of the water runs off into rivers and streams, doing little to dampen soil.
- This, combined with increased temperatures, increases the risk of drought.

**EVAPORATION**    **PRECIPITATION**

**WATER CYCLE**

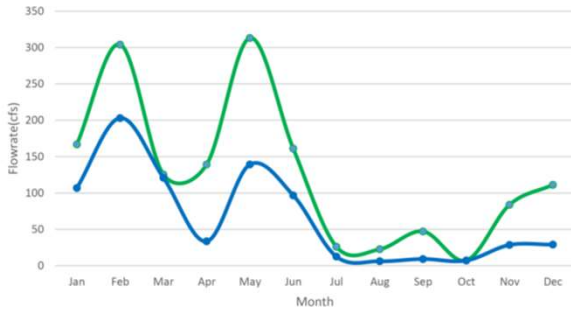
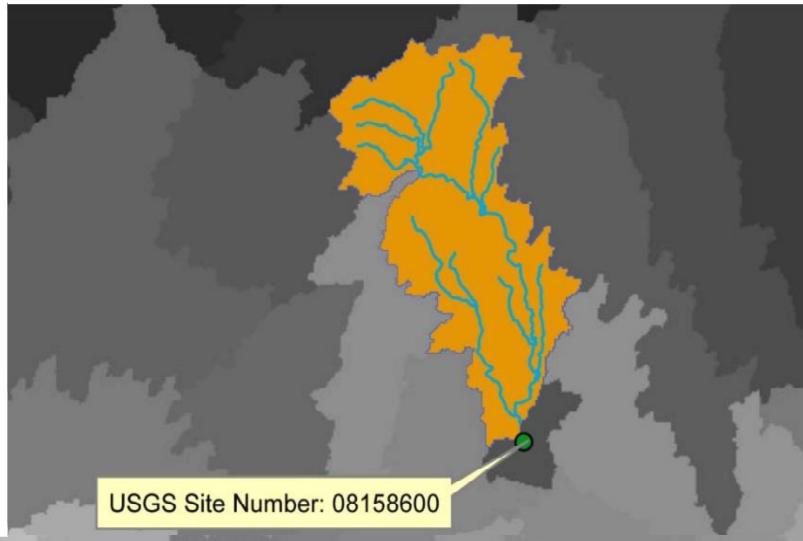
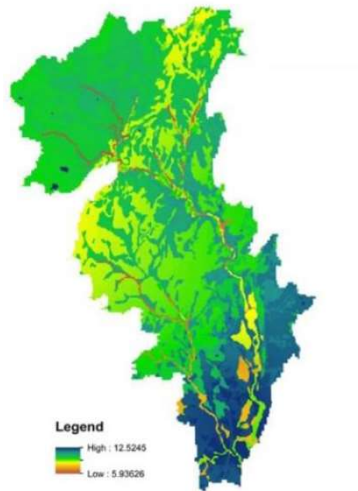
**RUNOFF**

The Climate Reality Project  
 www.climate-reality.org



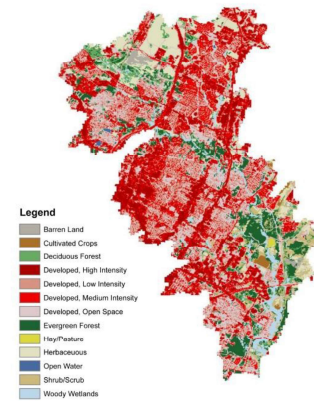
## Runoff Response and Urbanization

# Climate VS. Human Activities

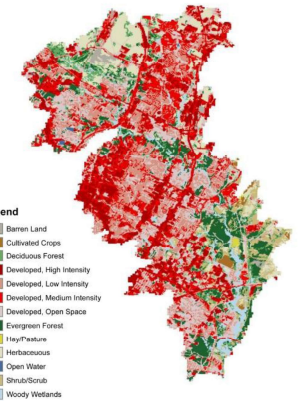
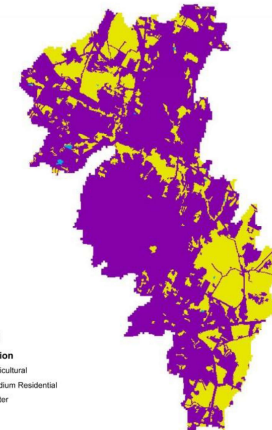


-To understand, Compare and interpret the relationship between weather data (Climate) and Runoff variation within the boundary of a delineated catchment.

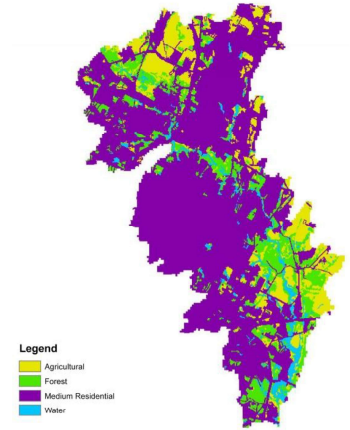
-To track the impact of land cover change and urbanization on stream flow alteration, Land Cover maps will be reclassified/regrouped.



▲ a-1. Land Cover Map, 1992  
 a-2. Reclassified Land Cover Map, 1992 ▼



▲ b-1. Land Cover Map, 2011  
 b-2. Reclassified Land Cover Map, 2011 ▼



# WHERE to meet and WHAT to do

- **Lab location : T424 Steinman Hall**
- **The Procedure :**
  - The boundary of watershed will be defined -ArcGIS
  - A streamflow monitoring point will be assigned to the outlet point of watershed- ArcGIS
  - The land cover change over period of two-decades will be quantified-ArcGIS/Map
  - To analyze the weather data, rainfall gauges will be chosen within the watershed boundary.
  - Statistical Analysis of Streamflow and Rainfall data will be performed -Matlab & MS Excel

# Goals

- To Provide a framework to understand the water cycle interaction with climate and land cover
- To learn the basic concept of hydrology and watershed science
- To handle time-series and perform a basic data analysis
- To enhance the problem solving skills
- To learn the application of Matlab/ArcGIS in a goal oriented project