Effects of Experimental Warming and Irrigation on Water-Use and Growth of Sugar Maple (Acer saccharum)

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**Introduction**

- Average global surface temperatures have increased by about 0.74 °C over the past hundred years due to increased levels of CO2, and temperatures are expected to increase an additional 1-3 °C by 2100 (IPCC, 2007).
- Water supply will be affected by climate change because the temperature of the atmosphere affects the amount and timing of precipitation around the globe (Levin et al., 2002; Fig. 1).
- Annual mean temperature and precipitation are expected to increase in the northeast USA (IPCC, 2007; Fig. 1).
- Increasing temperature in the northeast USA may affect forest growth and water use (Bauerle et al., 2009).

**Expected Outcomes**

- Sap flow and growth in the warming treatment are expected to decrease. Increased canopy temperature and decreased water availability from high soil evaporation will likely reduce stomatal conductance and transpiration.
- Sap flow and growth in the water addition treatment are expected to increase because of increased stomatal conductance due to increased levels of soil available water.
- However, the addition of water will likely reduce the negative effects of the warming on sap flow and growth in the combination treatment, which will ultimately increase sap flow and growth.

**Materials and Methods**

- The study will be conducted in the Ford Research Forest located south of L'Anse, Michigan.
- 33 sugar maple trees will be studied during the 2011-2013 growing season.
- Water use will be measured with heat dissipation sap flow sensors (Figs. 2 & 3).
- Growth will be measured with dendrometer bands.
- Samples will be recorded in twelve 10 m x 10 m plots with three replicates each of four treatments:
  1. Warming (3-4 °C increase in ambient soil temperature; Fig. 4)
  2. Water addition (20% increase to ambient precipitation; Fig. 5)
  3. Combination of warming and water addition
  4. Control.
- Direct ground and canopy meteorological measurements will also be recorded.

**Objectives**

- To investigate the effects of experimental warming and water addition on water use and growth of sugar maple (Acer saccharum), in order to better understand how hardwood forests of the Upper Midwest may react to global climate change, especially changes in water supply.

**References**

