Impacts of reductions in water usage and CO_2 emissions

Now that we have taken a look at where this technology currently is, let's take a look at some of the possibilities.

As part of this project, we estimated regional water use for greenhouse, container, and field operations using information from the USDA Census of Agriculture Farm and Ranch Irrigation Survey (FRIS) and values from Majsztrik (2011) (for more information, see Majsztrik et al., 2013, which is at the end of this module). We then assumed that average water use would decline by 50% with the adoption of sensor networks. This 50% per operation reduction was combined with adoption rates of 25%, 50%, 75%, and 100% of growers in a region to determine long-term impacts. No attempt was made to estimate the rate or speed of adoption (the slope of the curve in Fig. 1). Other assumptions regarding percent reductions in water use and regional adoption rates were used to test the sensitivity of results. It is possible that water savings from the adoption of WSIN technology by growers who are water-limited, but not land-limited, would result in an increase in acreage of ornamental production rather than water use saving, but for the purposes of this analysis, we assumed that no additional land is used for ornamental production.

Reducing irrigation pumping volumes would also reduce electricity requirements, and greenhouse gas emissions.

Since sensors networks use less water to grow plants, this should lead to pumps running less often, and therefore fewer emissions, either from diesel pumps or power plants that produce electricity. Using a region-specific mix of energy production (coal, nuclear, diesel, renewables etc.), we estimated reductions in carbon dioxide (CO_2) emissions based on the amount of energy that would be saved by pumping less water.

Regional water volume and the amount of carbon dioxide used to move water were calculated using FRIS data and standard CO_2 calculators. The percent reductions using sensor networks were then applied across the whole region, depending on the percent adoption rate. For example the regional CO_2 totals were multiplied by 0.5 (50% percent reduction in an operation), and then multiplied by 0.25 (for the 25% adoption rate). The details about how these analyses were performed can be found in the full paper (Majsztrik et al., 2013).

Now let's take a look at some of the potential reductions that can be seen at the national scale with sensor network adoption.