Agriculture and Water Availability Issues: An Overview
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Water and Agriculture. Irrigated agriculture is very important for both state and national economies. Irrigated farms account for 40% of the value of U.S. agricultural production, generating revenue for local and state budgets, and contributing to job creation, poverty alleviation, and food security (Schaible and Aillery 2012; USDA 2012). Water is a key production input for irrigated agriculture. In Florida, approximately 40% of total freshwater withdrawals are attributed to agricultural irrigation, and among all the crops, citrus and sugarcane account for more than two-thirds of total agricultural water withdrawals (Marella 2008). Water availability will play an important role in the future of the industry.

Future Water Availability. It is expected that in the future the demand for water for various uses will continue to increase, intensifying the competition for available water resources. The increase in water demands will likely be driven by population growth (increasing the demand for drinking water supply and agricultural production) and economic growth (raising the water demand for industrial production and power generation, including bioenergy). In addition, as society becomes more aware and concerned about the potential impacts of human activities on the environment, the demand for water to support aquatic ecosystems and in-stream water uses will also rise (resulting in environmental regulations such as establishing minimal flows and levels for streams, or more restrictive water quality regulations) (Turral et al. 2010).

While water demand is likely to rise, the strategies to augment the stock of available water resources (such as building desalination plants or storage reservoirs) have proven to be expensive. For example, the cost of treating saltwater at a desalination plant with a 10 million gallon per day capacity is estimated to range from $3.20 to $5 per thousand gallon (depending on the quality of the treated water) (FDEP 2010). And although future technological advances will likely decrease the costs of supply augmentation projects, the costs are likely to remain relatively high (e.g., Zhou and Tol 2005).

Other factors that can affect the stock of available water resources are weather and climate. Although the forecasts of future climate on regional or state scales are subject to considerable uncertainty, it is expected that climate changes and rising sea levels will likely intensify the saltwater intrusion affecting the water supplies in Florida’s coastal areas. Changes in tropical cyclone intensity, as well as the frequency and intensity of droughts, are also projected to alter the amount of water available for withdrawals or storage, as well as the timing of water availability (Misra et al. 2011; NRDC 2011).

Addressing Water Availability Challenges. Agriculture is a dynamic industry that has constantly changed in response to shifting consumer preferences, technological advances, market competition, and government programs and regulation (Turral et al. 2010). Competition for water resources and societal
concerns about water impairment are important factors influencing the future of the agricultural industry (Turral et al. 2010).

In addition to re-allocating the agricultural industry from water-deficit to water-abandon areas or changing the production to grow more valuable crops, improving the technical efficiency is an important strategy for increasing future water availability. Technical efficiency is the amount of water per unit of agricultural output. Technical efficiency can be increased using the following strategies (based on de Fraiture et al. 2007; Schaible and Aillery 2012; Turral et al. 2010; Zotarelli et al. 2012; Biello 2012):

- growing more drought-resistant or salt-tolerant crop varieties and cultivars
- installing more efficient irrigation systems, such as microirrigation, systems with soil- or plant-moisture sensing devices, variable-rate systems (allowing for different rates in different field sections), or systems using computer-based plant growth simulation models
- lessening nonproductive evaporation (e.g., through mulching or decreasing the areas of exposed water surface)
- reusing return flows (e.g., though tailwater recovery and reuse)
- using alternative freeze protection methods
- minimizing nonproductive depletion of water flows (e.g., through canal and reservoir lining)

To meet the future challenge of reduced water availability, water use efficiency should be increased significantly. 2030 Water Resources Group (2009) reports that globally “the annual rate of efficiency improvement in agricultural water use between 1990 and 2004 was approximately 1 percent across both rain-fed and irrigated areas” (p. 6). On the global scale, given the rate of increase in water demand, such rate of efficiency increase is not sufficient to close the gap between available water resources and rising water demands (2030 Water Resources Group 2009).

In addition to improving water use efficiency, the agriculture industry can also explore alternative water sources, such as reclaimed water from municipalities, or captured stormwater. Finally, and producers can help address the water availability challenges faced by the agricultural industry and the region as a whole by storing water on their lands and allowing it to percolate and replenish aquifers.

Selecting the Strategies to Address Water Availability Challenges. The choice of specific strategies to adapt to changing water availability depends on the relative benefits and costs of individual strategies. In selecting a specific strategy, agricultural producers will need to answer such questions as (de Fraiture et al. 2007): Are the costs of this strategy acceptable? How long is the payback period on the investment? Will I be able to sell my produce and make profit? When will the water be available and in what quantities? Both the benefits and costs of alternative strategies are not perfectly known, and may vary depending on the market and climate conditions. Educational and outreach programs can increase producers’ willingness to adopt individual strategies. Existing policies and regulations also influence producers’ strategy choices (de Fraiture, et al. 2007). For example, cost-share programs can increase the use of more efficient irrigation technologies. Policies and regulations to encourage water conservation should account for the complexity of agricultural decision-making.
**Incentives for agricultural water conservation.** In Florida, Water Management Districts provide cost-share programs to agricultural producers to cover part of the costs of implementing water conservation strategies. Additional information about these cost-share programs (such as project eligibility, application deadlines and form, and examples of past funded projects) is available from the following websites:

- Southwest Florida Water Management District, Facilitating Agricultural Resource Management Systems (FARMS); [http://www.swfwmd.state.fl.us/agriculture/farms/](http://www.swfwmd.state.fl.us/agriculture/farms/)
- Northwest Florida Water Management District: information about possible cost-share programs for agricultural water conservation can be requested from the District’s Headquarter; see ‘Contact US’ web-site at [http://www.nwfwmd.state.fl.us/contactus.html](http://www.nwfwmd.state.fl.us/contactus.html)

Funding for water conservation projects is also available from USDA / NRCS. Additional information can be found at the following websites:


In addition, the South Florida Water Management District has been implementing a program to incentivize water storage on agricultural lands to support the provision of such ecosystems services as (a) moderation of the water flow to mimic historic natural water level fluctuations in Lake Okeechobee, and (b) reduction in nutrient loading to the Lake and the downstream estuaries and wetlands. More information about this program can be found at:

- Northern Everglades - Payment for Environmental Services (NE-PES) Program; web-site developed by Florida Ranchlands Environmental Services Project (FRESP), [http://www.fresp.org/ne_pes.php](http://www.fresp.org/ne_pes.php)

**Consumptive Water Use Permitting Consistency.** In Florida, consumptive water use permits are required to withdraw water (if water withdrawals are above certain thresholds; see Olexa and Broome 2011). The permits are issued by Florida’s Water Management Districts (see Olexa et al. 2011). For a long time, the permit holders have been concerned that their permits can be revised downward if they do not use the total amount of water allocated to them.
Currently, the Florida Department of Environmental Protection (FDEP) is leading the effort to revise the consumptive use permitting programs implemented by Florida’s Water Management Districts, with the goals to make the program consistent statewide and to remove existing barriers for water conservation. Specifically, the effort includes proposing revisions to the Water Resource Implementation Rule (Rule 62-40, F.A.C.), specifying that no changes in agricultural consumptive use permits can be made if water use is reduced due to changes in growth or economic conditions, growth of different crops, or implementation of water conservation strategies (a few exceptions from these proposed provisions are discussed). Additional incentives for agricultural water conservation may include longer-term permits for the most efficient irrigation systems, reduced reporting requirements, or exceptions from irrigation restrictions for permit holders with efficient irrigation systems (CUPcon 2012).

Additional information about the Consumptive Use Permitting Consistency effort can be found on the dedicated FDEP website at http://www.dep.state.fl.us/water/waterpolicy/cupcon.htm. Among the documents available at this website, are the drafts of the application forms for agricultural water use, annual crop summary, and crop protection.

**Conclusions.** Water availability will continue to be an important factor shaping agricultural industry in Florida. Similar challenges are also faced by urban water suppliers and other industries. On the statewide scale, alternative strategies are being considered to close the gap between the growing demand for water and the limited stock of available water resources. The final mix of strategies adopted on the statewide scale should be based on comparing the cost-effectiveness of alternative strategies (2030 Water Resources Group 2009). Improving water use efficiency in agriculture and other sectors will likely be an important part of the final strategy to address future water challenges.

**References and Additional Reading:**


http://www.scientificamerican.com/article.cfm?id=soil-sensors-and-better-irrigation-for-georgia


http://www.dep.state.fl.us/water/waterpolicy/docs/cupcon/ppt/II_f_conservat.pdf


