WATERING GEORGIA:

The State of Water and Agriculture in Georgia

GEORGIA WATER COALITION

A Report by the Georgia Water Coalition | November 2017

About the Georgia Water Coalition

Founded in 2002, the Georgia Water Coalition's (GWC) mission is to protect and care for Georgia's surface water and groundwater resources, which are essential for sustaining economic prosperity, providing clean and abundant drinking water, preserving diverse aquatic habitats for wildlife and recreation, strengthening property values, and protecting the quality of life for current and future generations. The GWC is a group of more than 240 organizations representing well over a quarter of a million Georgians including farmers, homeowner and lake associations, business owners, sportsmen's clubs, conservation organizations, professional associations and religious groups who work collaboratively and transparently with each other to achieve specific conservation goals.

About Chattahoochee Riverkeeper, Inc.

Chattahoochee Riverkeeper's (CRK) mission is to advocate and secure the protection and stewardship of the Chattahoochee River, including its lakes, tributaries and watershed, in order to restore and conserve their ecological health for the people and wildlife that depend on the river system.

Established in 1994, CRK is an environmental advocacy education organization with more than 7,300 members dedicated solely to protecting and restoring the Chattahoochee River Basin. CRK was the 11th licensed program in the international Waterkeeper Alliance, now more than 300 organizations strong. CRK is also a founding member of the GWC.

Acknowledgements

Written by Dr. Chris Manganiello-
CRK Water Policy Director
(cmanganiello@chattahoochee.org)

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1

Introduction

The significance of agriculture in Georgia cannot be overstated. The Farm Gate value—or the gross cash payments to producers—of Georgia's agricultural products is nearly $14 billion. This sum includes the "value of all food and fiber commodities" from row crops to forestry to livestock in Georgia.[1] In a state with approximately 41,000 farms and 9,300,000 acres of agricultural land, water is essential to these commodities and for Georgia's 1,500,000 acres of irrigated cropland.[2]

The energy and agricultural sectors utilize more water than any other economic interests in the United States. Agricultural water withdrawals are surpassed only by withdrawals for generation of energy. And in Georgia agricultural water demands—like all other water demands—are expected to increase as production shifts to the southeast from other parts of the country. Between 2007 and 2013, total irrigated area declined in the American West while it increased east of the Mississippi River. In Mississippi, Georgia, and South Carolina, irrigated acreage increased by more than 50 percent.[3]

This report discusses agricultural demands on surface water and groundwater resources in Georgia. These two resources are separate but inextricably interconnected. Groundwater—particularly in the Floridan Aquifer, which is found across south Georgia—contributes and discharges water into our rivers and reservoirs. At least 2.8 million people live in coastal and south Georgia, and most get their drinking water from the Floridan Aquifer, a massive, underground, porous sponge lying beneath 100,000 square miles of land stretching from South Carolina to Mississippi and south into Florida.[4] Savannah, Brunswick, Waycross, Valdosta, Cairo, and a host of other communities draw some or all of their drinking water from the Floridan. It supplies a paper plant in Jesup, a nuclear power plant in Baxley and small manufacturing facilities across dozens of counties. Across the Dougherty and Coastal Plains from Augusta to Bainbridge the aquifer irrigates hundreds of thousands of acres of crops every year. A workhorse for farms and factories, it is also responsible for some of our state's most breathtakingly beautiful places as it bubbles to the surface creating "blue holes" like Radium Springs in Albany—considered one of the Seven Natural Wonders of Georgia.[5]

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Excessive groundwater withdrawals can diminish—and in fact already have diminished—the Floridan Aquifer and groundwater reserves that feed Radium Springs. If people pump too much groundwater, then springs and tributary streams can go dry and river flows drop. This happens in Georgia. Major spring-fed streams and small rivers like Ichawaynochaway, Kinchafoonee, and Muckalee Creeks have seen their flows diminished by 50 to 100 percent during drought periods.[6] Less water in a spring, stream, or river can negatively impact recreation, diminish habitat for fish and wildlife, affect water quality, and reduce availability of water supply for downstream uses. Appropriate stewardship of Georgia's water resources and the state's economic success are mutually beneficial.

The Georgia Water Coalition produced this report so partners and members can be better advocates for water supply and quality. Many environmentalists and conservationists have a sense of municipal and industrial water demands, and how to implement water conservation and efficiency measures at home. And they may know about the demands energy generation places on water resources, also known as the "energy-water nexus." However, many lack understanding about the agricultural sector's water footprint, what the associated issues are, and what appropriate solutions exist. Georgians must have a full understanding of the state's complete water budget in order to appreciate the challenges their communities, state, and region face while seeking healthy flows to meet the growing and competing demands multiple sectors place on freshwater. An objective understanding of agricultural effects on, and the policy and technical opportunities to improve, healthy flows in Georgia and the southeast will position the Georgia Water Coalition's partners and their members to build better relationships with stakeholders in the agricultural sector and decision makers at the local, state, and agency levels.

Old and New Titans: Cotton and Blueberries (UGA CAES)

2

The Economics of Agriculture in Georgia

Peaches. Cotton. Peanuts. Southern states rightfully have cultivated a successful agricultural legacy. That history can be best appreciated by understanding the role of water in food and fiber production. Georgia farmers, growers, and producers so successfully transformed agricultural goods into lucrative commodities in large part because of their access to water. Furthermore, predictable "on-demand" irrigation has become a central component of a producer's business plan that reduces an inherent risk that historically comes with farming—a timely and consistent source of water for growing crops. Irrigation, simply defined, is the "artificial application of water to plants to sustain or enhance plant growth."[7] The future of agriculture in Georgia is now inextricably tied to access to clean and plentiful supplies of surface water and groundwater for irrigation purposes.

Today, Georgia is a major player in the global commodities exchange. And, agricultural commodities—their values and futures—continue to shift. *The 2015 Georgia Farm Gate Value Report* and the *2017 Georgia Ag Forecast* highlight these trends.[8] In 2015, the state's total agricultural production value was $13.84 billion. Of the top ten Georgia commodities, five are in an "animal" category, and include poultry (broilers ranked #1 and eggs #2), beef (#3) and dairy (#8). The other half falls in a "leaves and roots" category, and includes cotton (#4), peanuts (#5), greenhouse (#7), pecans (#9) and timber (#10). For a sense of scale, the value of the broiler chickens produced for consumption ranked number one and fetched a $4.4 billion farm gate value. Broilers vastly outperformed the number two ranked commodity: eggs ($937 million).

Traditionally, growers have cultivated and generated tremendous value in Georgia's trio of row crops: corn (ranked #12), cotton, and peanuts. However, as a result of global economic trends, the value of Georgia's cotton and corn is declining, and income from agri-tourism and livestock is also down. On the upswing, the value of timber, ornamental horticulture (i.e. "green industry"), and vegetables is rising.[9]

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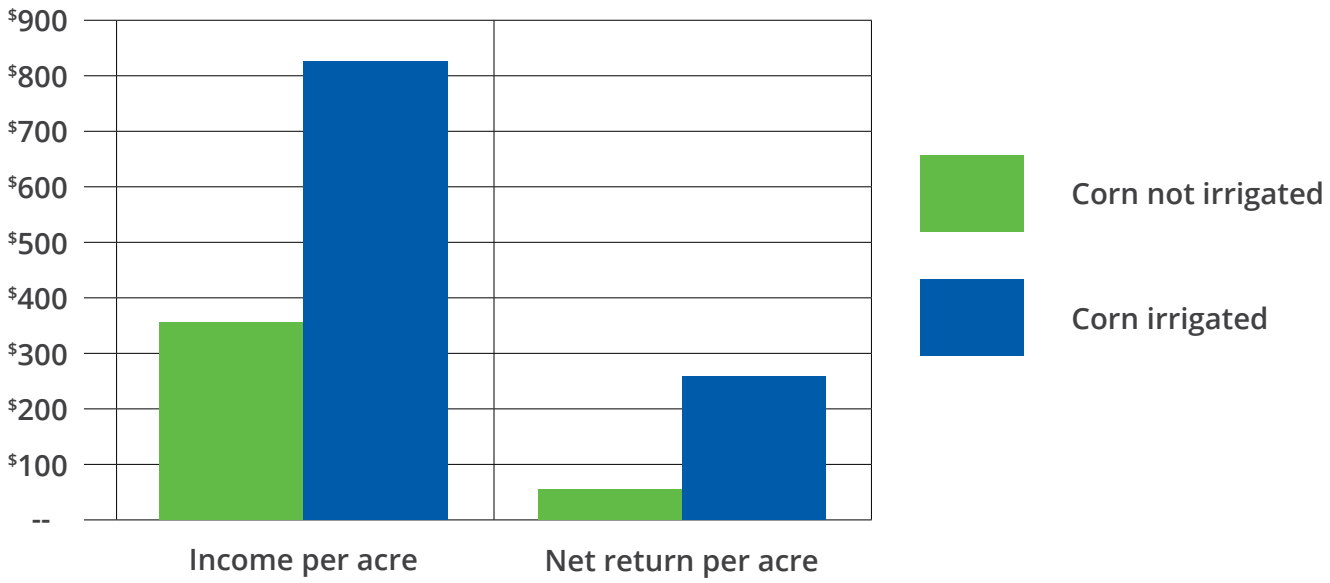
The Georgia trio—plus soybeans—account for the majority of irrigated row crops in the state. The quantity and quality of all four of these crops is enhanced by irrigation, and farmers often grow these crops in rotation on the same land and use the same irrigation infrastructure. Irrigating crops is incredibly lucrative because it enhances growth rates and eliminates a major risk. A corn producer utilizing irrigation more than doubles income on a per-acre basis and the net return can be five times greater. [*See* Figure 1] To achieve these significant returns, producers must also incur significant costs and debt to pay for seeds, fertilizer, irrigation equipment, energy to fuel pumps, labor, et. cetera.

Figure 1. **Per-acre income & net return: Corn**



The financial margins on irrigated cotton and peanuts versus non-irrigated are not as wide, but remain significant.[10] Nationally, Georgia is second only to Texas for cotton production. However, cotton production and surpluses outside of the United States in countries like China can lower the market value for Georgia's cotton. Recently, both peanut and cotton production have increased, but only peanuts have shown an overall increase in value due to global commodity patterns. Georgia is the nation's number one producer of peanuts, and scheduled irrigation results in a higher quality and more valuable goober.[11]

Beyond the Georgia trio, the value of the state's agricultural sector may be quantifiable but cannot be overestimated, because beyond the economic values accrued, the industry's cultural and other societal values bring incalculable benefits. Likewise, the value of water should not and must not be disconnected from the business and investment decisions embedded in modern farming.

3

National and Regional Agricultural Water Use

When it comes to water use nationally, the two primary economic sectors responsible for withdrawing the most water from our streams and groundwater reserves (i.e. aquifers) are the energy and agricultural sectors. There are two key points to consider when evaluating these uses.

First, there is a difference between water "withdrawal" and "consumption." For the purposes of this document, withdrawal is the total amount of water removed from surface or groundwater sources. Not all water withdrawn is "consumed" by crops, people, animals, and products. Some surface water that is withdrawn—including a lot of the water used by power plants—ultimately returns to its source for future or downstream use.[12]

A second key point: the vast majority of agricultural withdrawals occur only during the growing season. In comparison, municipal and industrial withdrawals occur consistently throughout the year with some seasonal variation. It must be noted that droughts can amplify agricultural withdrawals. Historically all of these withdrawals could take place with little conflict. However, hot summers and drought conditions exacerbated by climate change are increasingly causing conflict among all water users.

According to the most recent U.S. Geological Survey (USGS) data from 2010, water withdrawals for thermoelectric power generation in the U.S. utilized an estimated 161 billion gallons per day (BGD). And the total estimated withdrawals for agriculture in the U.S. amounted to 115 BGD. In percentages, power generation accounted for 45 percent of all water withdrawals and irrigated agriculture accounted for 33 percent. For comparison sake, public drinking water supplies were responsible for 12 percent (42 BGD) of water withdrawals in the U.S.[13] Consumptive use values vary between modes of thermoelectric generation, irrigation methods, and the wide array of efficiencies among public drinking water supply systems. But, generally, agricultural irrigation is highly consumptive as a percentage of the sector's withdrawals. For planning purposes in Georgia, agricultural water use is considered 100 percent consumptive.[14]

In 2010, Georgia ranked fourth in the southeast for total agricultural withdrawals behind Florida, Mississippi, and North Carolina.

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In 2010, the USGS ranked Georgia fourth in the southeast for total agricultural withdrawals—an estimated 918,000,000 gallons per day (GPD) from surface water and groundwater sources for irrigation purposes and livestock operations.[15] The data indicate Georgia growers irrigated an estimated 1,438,000 acres of land via sprinkler technologies, utilizing 839,000,000 GPD.

For the sake of comparison, the amount of water used in Georgia by various sectors mirrors national trends. [*See* Figure 2] Historically, the energy sector used more water than the municipal and industrial sectors combined, but those numbers are shifting. [*See* Figure 6] Water intensive coal fired power plants are shutting down as utilities shift to natural gas facilities to generate electricity.

Figure 2. Total Water Demand in Georgia in 2010 by Sector (MGD)

Regional Water Council	Energy	Agriculture	Municipal	Industrial	Total
Altamaha	57	59	26	61	203
Coastal Georgia	284	10	107	104	505
Coosa North Georgia	432	35	102	37	606
Lower Flint - Ochlockonee	50	438	50	122	660
Middle Chattahoochee	53	31	77	1	162
Middle Ocmulgee	55	32	76	26	189
Savannah-Upper Ogeechee	66	38	94	82	280
Suwanee-Satilla	0	117	47	11	175
Upper Flint	0	109	34	15	158
Upper Oconee	952	36	63	44	1095
Total	**1949**	**905**	**676**	**503**	**4033**

Source: Regional Water Plans (2017). The 2010 demand data was originally sourced from USGS reports and can be found in the 2017 Regional Water Plans.

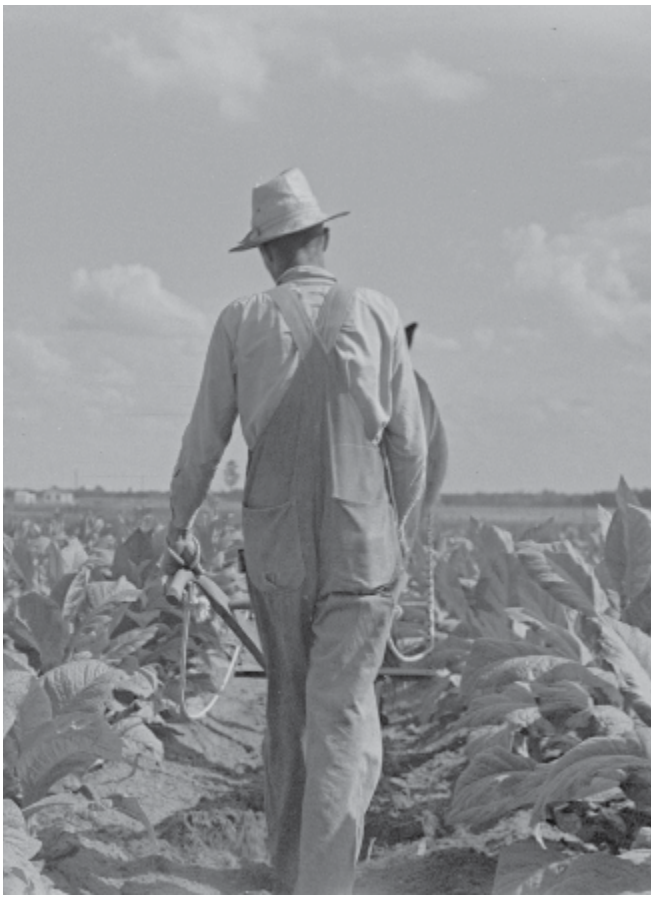
Florida (2,920,000,000 GPD) and Mississippi (2,090,000,000 GPD) rank in the top two slots in the southeast for irrigation withdrawals. Mississippi farmers irrigated more total land, and predominantly utilized the surface flooding technique. And Florida irrigated more land than any other state in the region by using a combination of sprinkler technologies and surface flooding.[16] Neighboring Alabama (245,000,000 GPD) and South Carolina (148,000,000 GPD) rank near the bottom. When compared to "big" agriculture states, Georgia's withdrawals are tiny: California (23,100,000,000 GPD) and Idaho (14,000,000,000 GPD) lead the nation in total irrigation-related water use.[17]

4

History of Water and Agriculture in Georgia

Centuries ago, European settlers attempted to establish viable agricultural staples to build Georgia's colonial economy. But their experiments with silk worms and grapes failed to generate sufficient returns before Georgia's ban on slavery was eliminated in 1751. After farmers and planters turned to slave labor and commodity crops like rice and cotton—and then timber more than 100 years later—the American South became a major player in the global economy.

As the state's agricultural production shifted from one commodity to another, the sector's water sources and demands also shifted. Coastal rice plantations provide an illustrative historical example. To water the production fields, plantations relied on highly-altered tidal river deltas with fresh water channeled through an elaborate network of dikes and dams. Following the American Civil War, rice production virtually ceased after the abolition of slavery made it infeasible to manage the labor intensive water delivery system. Some of the fields limped along as rice-production facilities into the early 20th century, and a few were utilized for vegetable or livestock production. Today all of them have either returned to natural tidal flow or are utilized as waterfowl and wildlife management areas incorporating the 18th and 19th century technologies.



Cultivating tobacco on Irwinville Farms, Georgia, 1938 (Library of Congress[68])

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Intensive management of labor and water made Southern rice a valuble global commodity before the American Civil War[18]

Cotton, corn, tobacco, and other commodities persisted in Georgia and relied entirely on rainfall (i.e. "dryland farming") until very recently. Only in the last 50 years has irrigation become an integral component to the processing of global agricultural commodities like row crops and poultry products.[19]

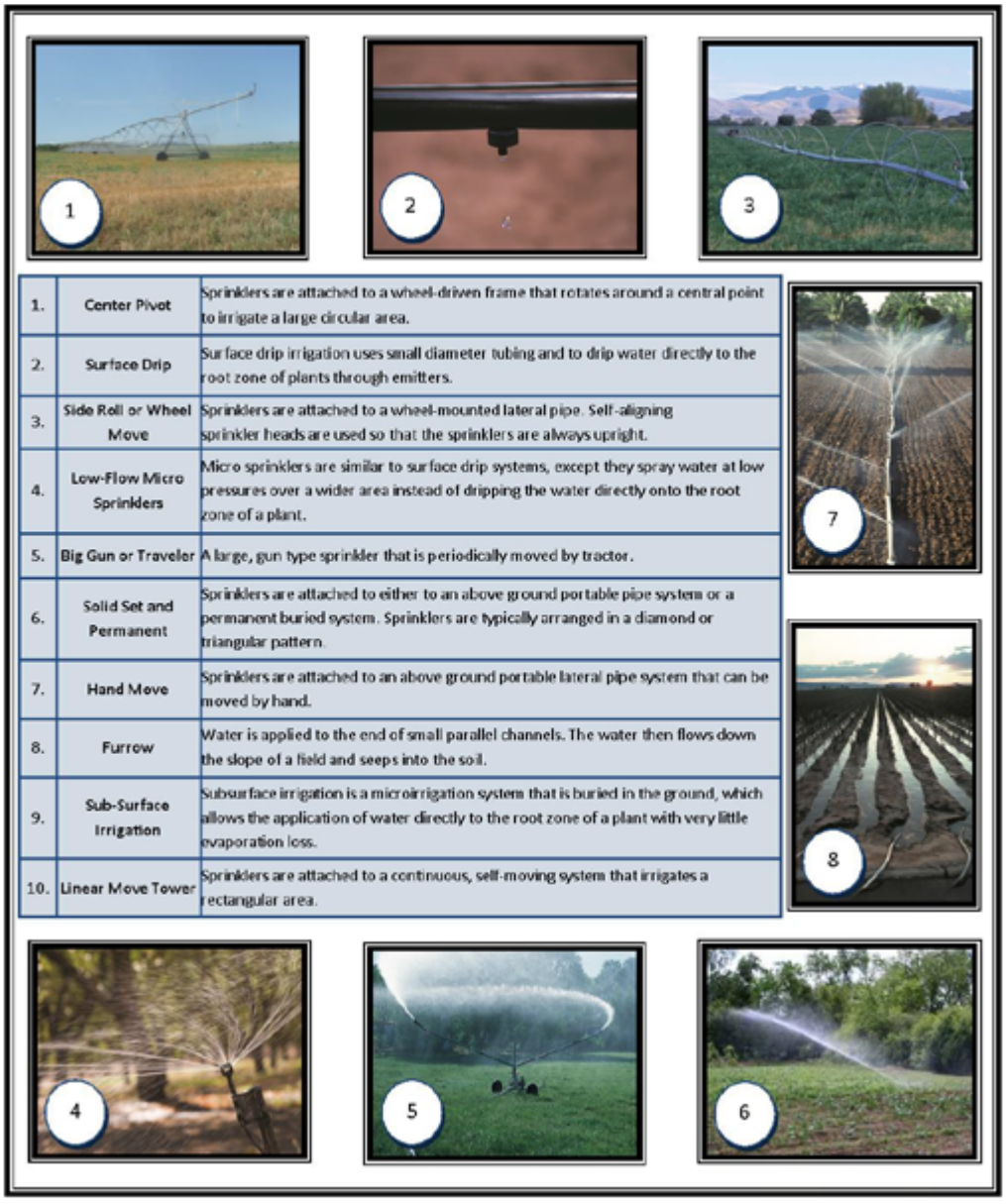
In the early 1900s, irrigated agriculture was not a focus for Georgians. In 1908, a Georgia surveyor compared the American South and West, and put forth an interpretation of rainfall that persists today: "In the arid region of the Western States, where the rainfall is not sufficient or is not properly distributed through the year for making crops, the most important use of water is for irrigation. In Georgia and other Southern and Eastern States the rainfall is much greater and more evenly distributed through the year, but, nevertheless, the lack of rain at the proper time often cuts a crop to one-half or one-third what it would have been with one additional wetting at the time most needed. Thus a small amount of water in storage and ready for use will do more good in the East, where it has the help of frequent rains through a large part of the crop season" as opposed to "the arid West, where artificial irrigation must be depended on exclusively."[20] More than one hundred years ago, Georgians knew rainfall could be seasonally erratic and water at the right time could save a crop from persistent drought. But they also perceived that the return on investment in irrigation systems in Georgia at that time was poor.

Why did irrigated agriculture in Georgia only become "common" after the 1970s?

Irrigated agriculture took-off in the state in a two-step process. Georgia took the first step in response to drought in the 1950s. And the second step occurred when irrigators deployed new technologies and discovered a positive return on investment.

Assumptions about irrigation in the American South changed dramatically a half-century after our intrepid surveyor shared his opinion. The southeastern drought of 1954—which was the worst regional drought until 2007—resulted in greater investment by the U.S. Department of Agriculture (USDA) in southern irrigation. After this drought, the region witnessed a significant proliferation of farm ponds in response to USDA programs that provided loans to farmers to build the ponds and purchase irrigation pumps, wheeled pipes, and travelers.[21] [*See* Figure 3]

The southeast took the second step in the mid-1960s. Florida citrus growers began systematically applying water to orange groves. After a brief period of experimentation with micro-sprinkler irrigation and scheduled watering, they were rewarded with improved yields and convinced that the extra investment was worth the return.[22]



1.	Center Pivot	Sprinklers are attached to a wheel-driven frame that rotates around a central point to irrigate a large circular area.
2.	Surface Drip	Surface drip irrigation uses small diameter tubing and to drip water directly to the root zone of plants through emitters.
3.	Side Roll or Wheel Move	Sprinklers are attached to a wheel-mounted lateral pipe. Self-aligning sprinkler heads are used so that the sprinklers are always upright.
4.	Low-Flow Micro Sprinklers	Micro sprinklers are similar to surface drip systems, except they spray water at low pressures over a wider area instead of dripping the water directly onto the root zone of a plant.
5.	Big Gun or Traveler	A large, gun type sprinkler that is periodically moved by tractor.
6.	Solid Set and Permanent	Sprinklers are attached to either to an above ground portable pipe system or a permanent buried system. Sprinklers are typically arranged in a diamond or triangular pattern.
7.	Hand Move	Sprinklers are attached to an above ground portable lateral pipe system that can be moved by hand.
8.	Furrow	Water is applied to the end of small parallel channels. The water then flows down the slope of a field and seeps into the soil.
9.	Sub-Surface Irrigation	Subsurface irrigation is a microirrigation system that is buried in the ground, which allows the application of water directly to the root zone of a plant with very little evaporation loss.
10.	Linear Move Tower	Sprinklers are attached to a continuous, self-moving system that irrigates a rectangular area.

Figure 3.
Common Irrigation Techniques[23]

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In Georgia, farmers who elected to irrigate in the 1950s deployed labor and fuel-intensive irrigation technologies like portable-pipes, pump guns, and groundwater pumps to water approximately 20,000 acres. Initially they irrigated tobacco and peanuts before adding cotton and corn to the mix. Irrigation began in the southwestern portion of the state and spread east across the Coastal Plain. Nearly a decade later, 6,400 farmers artificially watered 110,000 acres of tobacco, corn, vegetables, orchards, and pastures. While growers used streams and groundwater wells, 66 percent of the water was derived from farm ponds that resulted from damming streams and their ephemeral or intermittent tributaries.[24]

Tractor towing a hose-pull traveler away from the spool and into place[25]

In the 1960s, farmers who elected to irrigate continued to use labor intensive practices such as portable-pipe sections, cable-tow systems, and diesel-fueled pumps. By 1970, Georgia followed Florida and took a big step: a farmer installed the first center-pivot system in Georgia. These systems include sprinklers mounted on a mechanized wheeled metal frame that circles a field and is anchored by a water and energy supply source.

More than one hundred years ago, Georgians knew rainfall could be seasonally erratic and water at the right time could save a crop from persistent drought.

At first, most farmers continued to use cable-tow systems as opposed to center pivots because the latter cost between $78,000 to $80,000 in 1970s dollars, which represented a limiting factor for many farmers. However, by the close of the decade the number of farmers who used irrigation systems grew by 12 percent as the successes of early adopters became readily apparent.

By 1980, producers applied water to 975,000 acres of cotton, peanuts, soybeans, pecans, peaches, and trufgrass. Over the course of the decade, they shifted from diesel and gasoline power to electric power to run pumps and equipment. There was no single reason why Georgia was soon ranked as the state with the highest rate of growth in irrigation the southeast. Farmers in large part shifted to irrigation systems in response to and to take advantage of rising commodity prices for corn and the availability of "inputs" (i.e., fertilizers, herbicides, and pesticides). [26]

A 2008 survey revealed farmers irrigated about 1,500,00 million acres. Approximately 80 percent of that acreage was watered by more than 16,000 center pivots. Corn, cotton, and peanuts accounted for 67 percent of all irrigated crops.[27] There was a dip in total irrigated acres in 2009, but by 2015 the total number of irrigated acres remained near 2008 levels—1,571,448 acres.

The history of irrigated agriculture in Georgia—a humid region where rainfall can range between 45 and 70 inches annually depending on geography—developed quickly after following the two-step process, and is a short yet significant chapter in the region's water and agricultural past.

5

Regional Planning Reveals Key Trends

Analysis of recent and fine-grained data collected by the Georgia Water Planning and Policy Center at Albany State University in conjunction with the statewide water planning process illustrates many trends in irrigated agriculture in Georgia's ten water planning regions. This report identifies some of those key trends—including water source switching, new geographical areas of growth, and observed declines in water demand—in Georgia's irrigated agriculture.

The analysis in this chapter relied entirely on data collected and published as a result of the state's regional water planning process.[28] Georgia's statewide water planning process began in 2004, and ultimately produced ten Regional Water Plans in 2011. The Regional Water Councils updated their plans in 2017. Georgia's regional water planning approach has one inherent problem. Since the process began, the Georgia Water Coalition has advocated for water planning that follows river basin boundaries [*See* Figure 4], and not geopolitical boundaries. Politically drawn boundary lines can adversely affect the planning process by separating water resource and water quality problems and solutions. Despite these reservations, this report hewed to the existing water planning boundaries and relied on data that was assembled according to the Water Planning Regions [*See* Figure 5] to identify the key trends in irrigated agriculture in Georgia. It is worth noting that this data can be filtered by hydrologic unit code (HUC) and aquifer, as was done to inform the resource assessments completed as part of the regional planning process.

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Figure 4. River Basins of Georgia

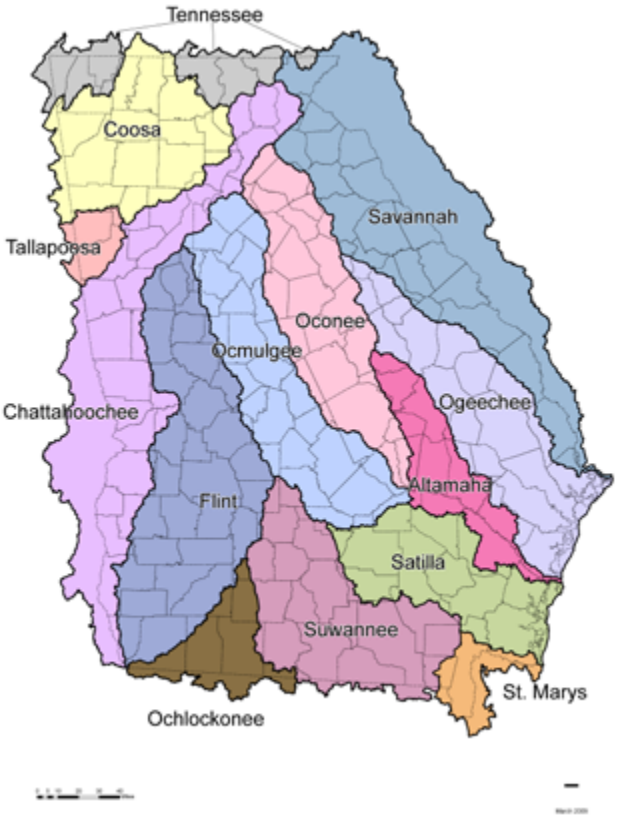
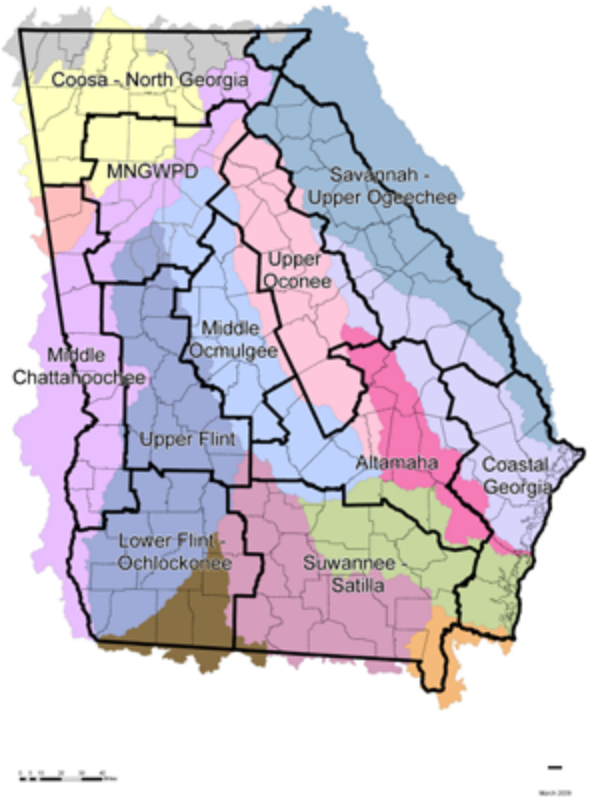


Figure 5. Water Planning Regions



Source Switching

Between 2010 and 2015, source switching was the most obvious trend across all regions of Georgia. All across Georgia, irrigators are switching from surface water sources to groundwater sources. The region that saw the greatest growth—by a measure of percent increase and not volume—in groundwater irrigation was the Savannah-Upper Ogeechee region. Why? This trend of switching from surface to groundwater across Georgia has been a conscious choice: a moratorium on new surface water withdrawals in the Flint River basin led irrigators to drill new groundwater wells in other parts of the state, and many producers believe groundwater is a more reliable source that can ensure consistent crop yields and eliminate the risk of waning surface flows. This trend to switch from a less reliable surface water source to a more dependable groundwater source may have contributed to the removal of nearly 30,000 acres of irrigated land from production in the Flint and Chattahoochee River basins. Overall, the region that saw the greatest decrease in surface water irrigation was the Coastal region.

Floating surface water withdrawal pump on the Chattahoochee River

Photograph courtesy of Joe Cook

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Horticultural Nursery Water Use

The greatest increase in horticultural water use (by percentage and not by total volume) took place in the Middle Ocmulgee region. The data for nursery and greenhouse operations indicate a state-wide shift in horticultural water consumption to three regions: the Savannah-Upper Ogeechee, the Upper Oconee, and Middle Ocmulgee. The Middle Chattahoochee region experienced the greatest decline.

Animal Agricultural Water Use

Statewide, between 2010 and 2015, the estimated water use by hog farmers increased 116 percent (from 2.26 to 4.9 MGD). Within the livestock category, the greatest water use could be found in beef (15 MGD) and dairy (9.6 MGD) operations. The water use estimates for goats, sheep, horses, and broiler chickens all declined. The region with the greatest increase in animal water use (by percentage) was in the Altamaha region, and the greatest decline in animal water use was in the Coastal region.

Where is Irrigated Agriculture Growing in Georgia?

The Flint River basin region uses more water to irrigate crops than any other region in the state, particularly during dry years. Agricultural water use in the upper Flint (which actually encompasses the important agricultural lands of the upper Coastal Plain portion of the Flint, a.k.a. the "middle" Flint) is not all that different from water use in the Suwanee-Satilla, perhaps due to similar soil types and general availability of water. However, when the upper Flint's agricultural water footprint is combined with the Lower Flint-Ochlockonee's water footprint, the numbers are astonishing. According to 2011 agricultural meter data, which reflects water use during actual drought conditions, irrigators in the Flint and Ochlockonee regions applied more than 973.35 MGD (753 MGD in the lower Flint and over 220 MGD in the Upper Flint) to fields during the growing season. For comparison, the utilities in the Metropolitan North Georgia Water Planning District—which represents approximately 5 million people living in 15 counties and 93 municipalities in the Atlanta region—logged an average withdrawal rate of 521 MGD in 2014.[29]

While agricultural water use in the Flint and Ochlocknee regions is far greater than in any other region in the state, this region's growth in the total number of irrigated fields and acreage is relatively flat. The growth in irrigated agriculture is taking place in other parts of the state, specifically in the Coastal and Savannah-Upper Ogeechee regions. Additionally, each sub-basin of the Altamaha River system—the Oconee, Ocmulgee and Altamaha—witnessed modest growth in irrigated agriculture. The Savannah-Upper Ogeechee region experienced the greatest increase in irrigated acreage. And the Coastal region witnessed the greatest percent increase in the number of center pivot systems installed.

The Regional Water Plans' agricultural water demand forecast for 2050 indicates that every region will witness new growth. [*See* Figure 9] For example, the Middle Ocmulgee region is expected to see a 43 percent increase in agricultural water demand by 2050. Other regions with significant agricultural water demand forecasts include the Upper Flint (22%), the Lower Flint (16%), Upper Oconee (16%), Suwanee-Satilla (14%), and Altamaha (13%). These forecasts are conservative: they account for water use that would take place in very dry and drought conditions. At any rate, this growth should be expected to place additional and new stresses on groundwater supplies as more irrigation operations are established, and as users continue the source-switching trend from surface water to groundwater.

Figure 6. Water Demand Forecast for 2050 by Sector (MGD)

Regional Water Council	Energy	Agriculture	Municipal	Industrial	Total
Altamaha	68	143	28	73	312
Coastal Georgia	97	15	122	162	395
Coosa North Georgia	405	15	122	125	667
Lower Flint - Ochlockonee	6	687	48	133	874
Middle Chattahoochee	44	36	108	4	192
Middle Ocmulgee	63	108	101	66	337
Savannah-Upper Ogeechee	175	96	109	107	487
Suwanee-Satilla	0	241	56	17	314
Upper Flint	0	213	28	31	272
Upper Oconee	1	35	103	87	226
Total	**859**	**1588**	**825**	**804**	**4076**

The 2050 agricultural forecast was based a 75th percentile value, which represents dry year conditions and high water demand. Energy withdrawals have declined as old coal units with once-through cooling systems are retired, but evaporative cooling systems will result in total increased consumption. The Metro District is not included here, but if added, would add 899 MGD to the total statewide 2050 forecast, which represents the District's highest demand forecast scenario, and includes a mix of municipal, industrial, and agricultural water use. Sources: Regional Water Plans (2017) and Metropolitan North Georgia Water Planning District (2017).

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Middle Chattahoochee Regional Council

Between 2010 and 2015, the Middle Chattahoochee region saw a slight decline in the number of irrigated fields and acreage. It is not known if these are a result of land use changes such as fallowing, timber planting, dryland crops, or residential/commercial development. Of the remaining fields, there was a more than 20 percent increase in fields irrigated with groundwater and a 12 percent decline in fields irrigated with surface water. Of all the irrigated fields, 90 percent utilize center pivot irrigation. In the Middle Chattahoochee Region, the primary commodity in the crop mix is cotton, followed by peanuts and corn. Estimates of water use by animal operations increased by 7 percent. Water use by horticultural operations declined by nearly 68 percent—the steepest decline in the state. The agricultural water use forecast for this region projects water use to increase by 5 percent by 2050.

Upper Flint Regional Council

Between 2010 and 2015, the Upper Flint region saw a 12 percent increase in the number of irrigated fields. There was a more than 25 percent increase in fields irrigated with groundwater and a 17 percent decline in fields irrigated with surface water. Additionally, the total number of center pivots increased by nearly 35 percent. Of all the irrigated fields, 73 percent utilize center pivot technology. In the upper Flint region, cotton represents 45 percent of the crop mix, followed by peanuts, corn, and other commodities. Estimates of water use by animal and horticultural operations declined by 15 and 1 percent, respectively. The agricultural water use forecast for this region projects water use to increase by 22 percent by 2050.

Lower Flint-Ochlockonee Regional Council

Between 2010 and 2015, the region saw a nearly 10 percent increase in the number of irrigated fields. There was a 10 percent increase in acreage irrigated by groundwater and a 12 percent decline in acreage irrigated by surface water. These trends manifested despite a state-promulgated moratorium on new surface and Floridan withdrawals instituted in 2012. Additionally, fields irrigated by center pivots increased by 30 percent. In the Lower Flint and Ochlockonee region, cotton represents 35 percent of the crop mix, followed by peanuts (27 percent) and corn (5 percent). Estimates of water use by animal and horticultural operations declined by 4 and 49 percent respectively. The agricultural water use forecast for this region projects water use to increase by 18 percent by 2050.

Irrigated fields surround Donalsonville in the lower Chattahoochee and Flint River Basin. (Bing)

Coastal Regional Council

While this Council is comprised of nine coastal counties, the Council also includes a significant portion of the lower Ogeechee River basin. This region is one of the fastest growing in Georgia in terms of growth in irrigated agriculture. The agricultural water use forecast for this region projects water use to increase by 6 percent by 2050, and Bulloch County is projected to have the greatest growth in agricultural water use.

Between 2010 and 2015, the Coastal region experienced a 16 percent increase in the total number of irrigated fields and a 10 percent increase in irrigated acreage. This region—when compared to other regions—witnessed the most dramatic percentage increase in total number of acres irrigated by groundwater: an increase from 7,469 acres to 12,833, which is a 72 percent increase. And the region reduced the use of surface water for irrigation by 25 percent—the single greatest decline as a percentage of any region in the state. Additionally, the total number of center pivots increased by 78 percent and the total number of acres irrigated by center pivots increased by 60 percent. When it comes to the crop mix, corn is the primary commodity, representing 32 percent of the crop mix, followed by cotton (26 percent) and peanuts (17 percent). Soybeans represent 12 percent of the mix, second only to the Coosa North Georgia region's soybean production.

There was an obvious increase in water use for crops, but the region witnessed a decline in water use estimates for animals: a nearly 24 percent decrease between 2010 and 2015. Horticultural water use also declined, by 20 percent.

While the actual total metered water use is small compared the Flint River basin, this region should be consider one of the fastest growing in Georgia in terms of growth in irrigated agriculture. This region should be expected to feel stress on groundwater supplies as more irrigation operations are established and as users continue the trend of switching from surface water to groundwater. Similar patterns appear to be unfolding in neighboring South Carolina with new crops and expanded acreage.

Irrigated agriculture is growing fastest in the Coastal and Savannah-Upper Ogeechee Regions

Savannah-Upper Ogeechee Regional Council

Between 2010 and 2015, the Savannah and Upper Ogeechee region experienced the state's greatest percent increase in total number of irrigated fields: a 42.9 percent increase. Additionally and not unlike the Coastal region, which includes the lower Ogeechee River, this region witnessed a dramatic percentage increase in total number of acres irrigated by groundwater: an increase from 50,856 acres to 87,466 acres, which is a 72 percent increase. The total number of center pivots increased by 65.4 percent and the total number of acres irrigated by center pivots increased by 58.6 percent. When it comes to the crop mix, corn is the primary commodity, representing 35 percent of the crop mix, followed by cotton (31 percent) and peanuts (17 percent).

While the actual total metered water use is small compared to the Flint River basin, for example, this region—and particularly the Ogeechee River portion—should be consider one of the fastest growing in Georgia in terms of growth in irrigated agriculture. The agricultural water use forecast for this region projects water use to increase by 10 percent by 2050.

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Upper Oconee Regional Council

The Altamaha River Basin is the largest river system entirely contained within Georgia. Each sub-basin—the Oconee, Ocmulgee, and Altamaha—witnessed modest growth in irrigated agriculture. The Upper Oconee and the Middle Ocmulgee regions' baseline crop mix (by percentage) can be considered the most diverse when compared to the other nine regions. Additionally, the Altamaha Region's animal water use estimate increased by the greatest percentage in the state—by 61 percent—and the region is the leader in water use for livestock production.

Between 2010 and 2015, the Upper Oconee region experienced a 22 percent increase in the total number of irrigated fields and a 30 percent increase in irrigated acreage. Like nearly every other region, there was a decline in surface water use (by 57 percent) and an increase in groundwater use (30 percent). There was also a 50 percent increase in the total number of center pivots and acreage irrigated by center pivots. In terms of crop mix, the Upper Oconee includes corn (26 percent), peanuts (20 percent) and cotton (19 percent). Between 2010 and 2015, the Upper Oconee's animal water use estimates declined by 4 percent and the horticultural water use estimates declined by 24 percent. The agricultural water use forecast for this region projects water use to increase by 16 percent by 2050.

Georgia grown peanuts (left) and olives (right). (UGA CAES)

Middle Ocmulgee Regional Council

Between 2010 and 2015, the number of irrigated fields increased by 25 percent and the total irrigated acreage increased by 20 percent in the Middle Ocmulgee region. Like nearly every other region, there was a decline in surface water use (by 8 percent) and an increase in groundwater use (25 percent). In terms of crop mix, the Middle Ocmulgee includes cotton (30 percent), pecans (23 percent) and peanuts (17 percent). Between 2010 and 2015, the Upper Oconee's animal water use estimates declined by 2 percent.

The region witnessed the state's highest percent increase in horticultural water use estimates: a whopping increase of 102 percent. The data indicate a state-wide shift in horticultural water consumption to three regions with significant declines in nearly every region. In actual consumption in 2015, the Middle Ocmulgee is third in the state for horticultural irrigation, registering 6.6 MGD, behind the Savannah-Upper Ogeechee (9.68 MGD) and the Upper Oconee (6.97). The agricultural water use forecast for this region projects water use to increase by 43 percent by 2050, which is the greatest increase of all regions in the state.

Altamaha Regional Council

Between 2009 and 2015, the Altamaha region experienced a 27 percent increase in the total number of irrigated fields and a 25 percent increase in irrigated acreage. While the decline in surface water use was small (by 1.5 percent), the increase in groundwater use was significant (47 percent). There was also a 55 percent increase in the total number of center pivots and a 48 percent increase in acreage irrigated by center pivots. In terms of crop mix, the Altamaha includes cotton (30 percent), peanuts (20 percent) and corn (19 percent). Between 2010 and 2015, the Altamaha's Region's animal water use estimates increased by the greatest percentage in the state—by 61 percent—and the region is the leader in water use by animals (5 MGD). Horticultural water use estimates declined by 16 percent. The agricultural water use forecast for this region projects water use to increase by 13 percent by 2050, with the greatest increase occurring in Montgomery County (29 percent increase).

Suwannee-Satilla Regional Council

Between 2010 and 2015, the Suwannee-Satilla region experienced a 26 percent increase in the total number of irrigated fields and a 22 percent increase in irrigated acreage. While the decline in surface water use for irrigation was small (by 5.5 percent), the increase in groundwater use was 40 percent. There was also a 64 percent increase in the total number of center pivots and a 50 percent increase in acreage irrigated by center pivots. In terms of crop mix, the Suwannee-Satilla region's primary crops are cotton (40 percent), peanuts (24 percent) and corn (15 percent). The region's animal water use estimates declined slightly (by 1.7 percent). Horticultural water use estimates declined by 53 percent—the state's second steepest decline by percentage behind the Middle Chattahoochee region (69 percent).

The agricultural water use forecast for this region projects water use to increase by 14 percent by 2050, and zooming in within the region Lowndes County water demand is projected to have a 40 percent increase. In general, the "forecasted agricultural water demand for the region is approximately 3 times the combined municipal and industrial water demand."[30]

Coosa North Georgia Regional Council

Unlike nearly every other region that has experienced growth in irrigated agriculture, the Coosa North Georgia region witnessed declines in irrigated agriculture. Between 2010 and 2014, the number of irrigated fields declined by 30 percent (from 194 fields to 135). The total number of irrigated acres declined slightly by 3 percent. And in a shift that bucks the state trend, the region experienced a 100 percent decline in acres utilizing groundwater withdrawals from 313 acres to zero. And there was only a minor increase in surface water irrigation (3.7 percent). In terms of crop mix, the Coosa North Georgia region's primary crops are corn (48 percent), soybeans (17 percent) and sod, or turfgrass (11 percent). Between 2010 and 2015, the region's animal water use estimates increased by 7 percent, and horticultural water use estimates declined by 32 percent.

The key trends identified in this report—source switching, new areas of growth, and observed declines—indicate where irrigated agriculture water stress may occur. The next section addresses the regulatory framework that governs water withdrawals.

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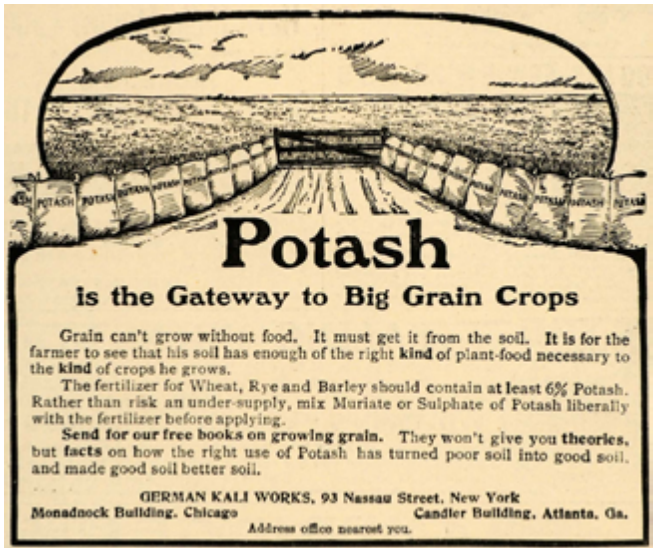
6

Regulatory Arena

Georgia's agricultural production has been regulated for centuries. Slave labor was prohibited in the Georgia colony until 1751. Railroad corporations supported fencing laws in the 1800s that brought open-range livestock grazing to an end by requiring farmers to contain animals on private property. And in 1874, Georgia was the first state in the nation to establish a Department of Agriculture tasked, in part, with inspecting the purity of fertilizer to protect farmers from dishonest salesmen and "fertilizer fraud."[31]

Fertilizer advertisement (1907)



Water Withdrawal Permitting

Georgia's Groundwater Use Act (1972) was the state's first attempt to regulate water withdrawals. The General Assembly instituted the act to address excessive withdrawals on the coast and avoid a "water war" with South Carolina. At the time, significant withdrawals by Georgia's paper and pulp mills in Savannah were contributing to saltwater intrusion into drinking water supplies. The measure specifically required all *non-farm groundwater* use in excess of 100,000 gallons per day to be permitted but did not limit the withdrawal's volume.

In 1977, the state amended the Georgia Water Quality Control Act (1964) to regulate waste water discharges. Additionally, water withdrawals for municipal and industrial (*non-farm*) users in excess of 100,000 gallons per day also required permits, but the law did not limit the withdrawal's volume. Agricultural water withdrawals, however, remained un-regulated for another decade.

In 1988 and in response to drought, the General Assembly amended the Georgia Water Quality Control Act (1964) and Groundwater Use Act (1972) to require farmers to obtain permits for surface water and groundwater withdrawals in excess of 100,000 gallons per day *for farm uses*. The volume of a withdrawal is not limited, and few permits are conditioned in any way except for surface withdrawals on Spring Creek and Ichawaynochaway Creek in the lower Flint River basin (see more detail, below).

An individual seeking a groundwater and surface water withdrawal permit for farm use is required to submit the following information: the number of acres to be irrigated, a description of the type of irrigation system used, the capacity of a well's pump, and other basic permittee information. After review and evaluation, EPD will issue a Letter of Concurrence that enables a permittee to begin constructing and installing a withdrawal's necessary infrastructure. After the permittee builds-out the infrastructure to required specifications, EPD will inspect and issue a withdrawal permit. If an applicant does not act on a Letter of Concurrence within two years, they must begin the process again.

In general, withdrawal permits have no expiration date, unless the permits are for locations in specific parts of the lower Flint River basin where a permit must be renewed after 25 years. Permits can be transferred with ownership of the property, but the permit conditions—how much is withdrawn, how many acres are watered—cannot be altered during the transaction. Permittees can request modifications to their permits at any other time.

Farm use permits fall into one of three categories: active, inactive, and unused. Active permits mean just that: these are permits that have been used at least once. Permittees can request a permit be placed in the inactive category when not in use but when a property owner wishes to retain the permit for possible future use or to maintain the value of the property. Anecdotally, sales data in southwest Georgia and the Lower Flint River basin suggest that agricultural land with and without a permit can differ in price 3 to 5 fold. An unused permit is a permit that has never been used and will expire if not used within two years of issue.

If a permittee violates a permit's terms, they are subject to a $1,000 fine in addition to a fine of up to $500 per day if the violation continues.[32]

A Water Conservation Plan is required of all permit holders operating in the Flint River basin. The Plans ask permit holders to identify what types of irrigation technology (e.g. sprinkler type) delivery system (permeant or portable pipes), and shut-off systems are in place "to reduce water withdrawals and minimize waste."[33]

Animal operations require water for production and waste treatment. (NESPAL)

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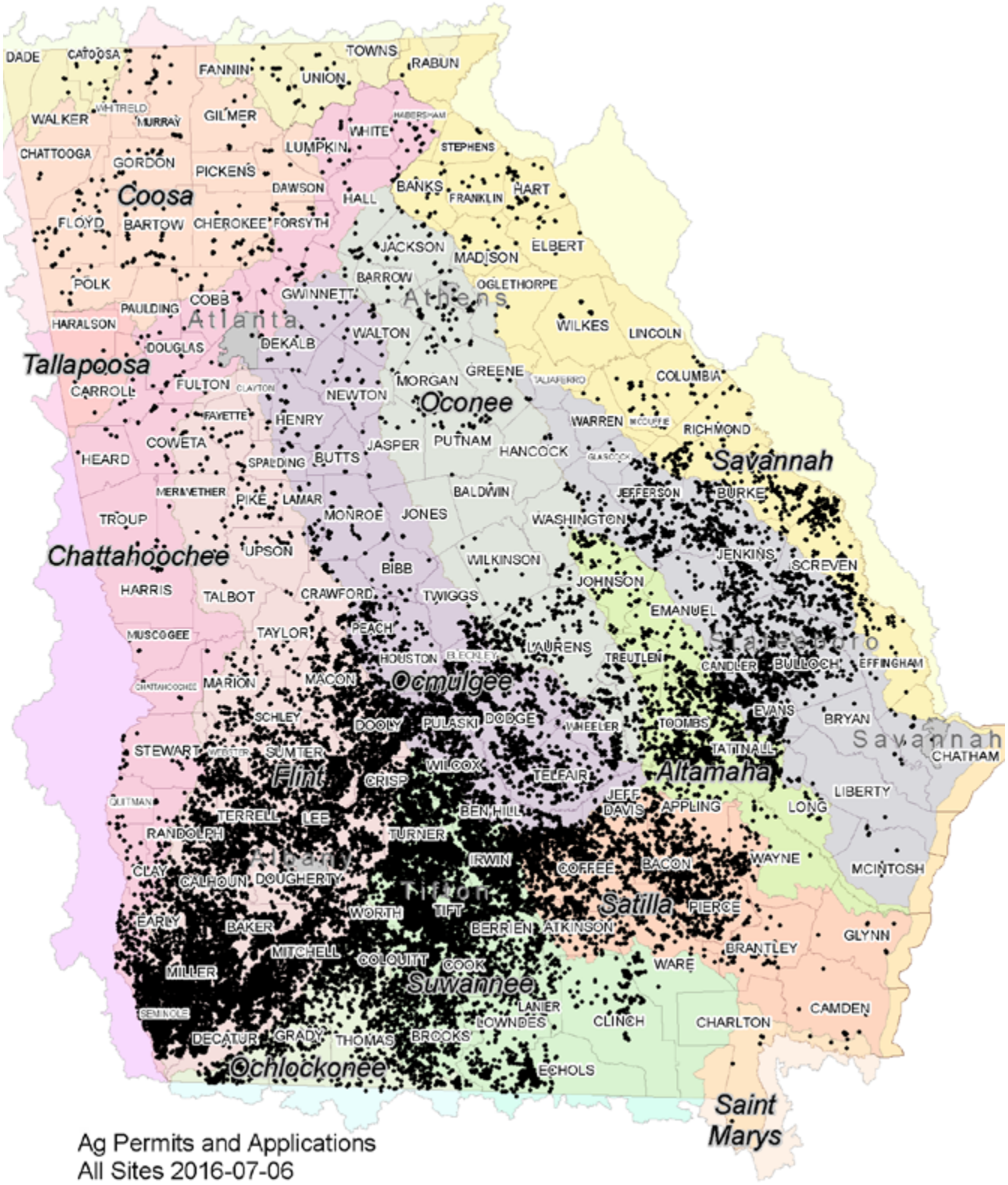
Locations for Water Withdrawal Permits and Pending Applications (EPD)



The Georgia Environmental Protection Division (EPD) is the state agency responsible for managing all water withdrawal permitting and compliance. According to EPD's "List of Farm (Agricultural) Water Withdrawal Permits within the State of Georgia," the agency has issued 24,170 agricultural water withdrawal permits.[34] [*See* Figure 7]

Figure 7. Agricultural Water Withdrawal Permits Issued by Basin and Type

River Basin	Farm GW Permits	Farm SW Permits	Farm Well-to-Pond Permits	Total Farm Permits
Altamaha	317	837	75	1,229
Chattahoochee	246	290	53	589
Coosa	23	174	5	202
Flint	5,197	1,530	337	7,064
Ochlockonee	514	693	119	1,326
Ocmulgee	1,280	1,094	165	2,539
Oconee	192	364	33	589
Ogeechee	790	916	101	1,807
Saint Marys	5	3	2	10
Satilla	880	1,412	76	2,368
Savannah	252	254	18	524
Suwanee	2,161	3,259	432	5,852
Talapoosa	-	14	-	14
Tennessee	2	55	-	57
Totals	**11,859**	**10,895**	**1,416**	**24,170**

Water withdrawal permits are issued for a wide scope of uses. Permittees—including individuals, corporations, and state agencies—water row crops, operate timber plantations, manage golf courses and county clubs, and use water in livestock and aquaculture operations (i.e., fish hatcheries). It is very important to understand that an agricultural permit does not automatically imply that an agricultural withdrawal is actually occurring or a field is being watered.

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As noted in Figure 7 and as may be expected, EPD has issued more agricultural water withdrawal permits in the Flint River basin than any other basin in the state. The vast majority are for groundwater withdrawals. As may not be expected, the Suwanee River basin ranks second, with more than 5,800 permits issued, and the majority are surface water withdrawal permits (3,259 permits). In this region, permit holders rely on farm ponds and often move irrigation system pumps and equipment from one pond to another. The reason is generally linked to the costs of establishing groundwater or surface water sources. Where abundant groundwater is closer to the surface, well-drilling makes more economic sense. Where it is not, the cost associated with a new impoundment—like a farm pond—makes more sense. In recent years, weighed against these basic cost factors are the increased risks and uncertainties of the increase in variability of surface flows, caused in part by changes in rainfall patterns influenced by climate change, by agricultural and other consumptive uses of surface waters, and by changes in land use from agricultural to suburban sprawl. Indeed, the proliferation of ponds, including 'stacking' of farm ponds along ephemeral, intermittent, and perennial streams has changed surface flow patterns in ways that have yet to be fully understood.

Water Wars

Beginning in the 1990s, the use of groundwater and surface water by the agricultural sector came under the spotlight during the Alabama, Florida, and Georgia "water wars" over the shared waters of the Apalachicola-Chattahoochee-Flint (ACF) River Basin and after a significant drought (1998-2002).

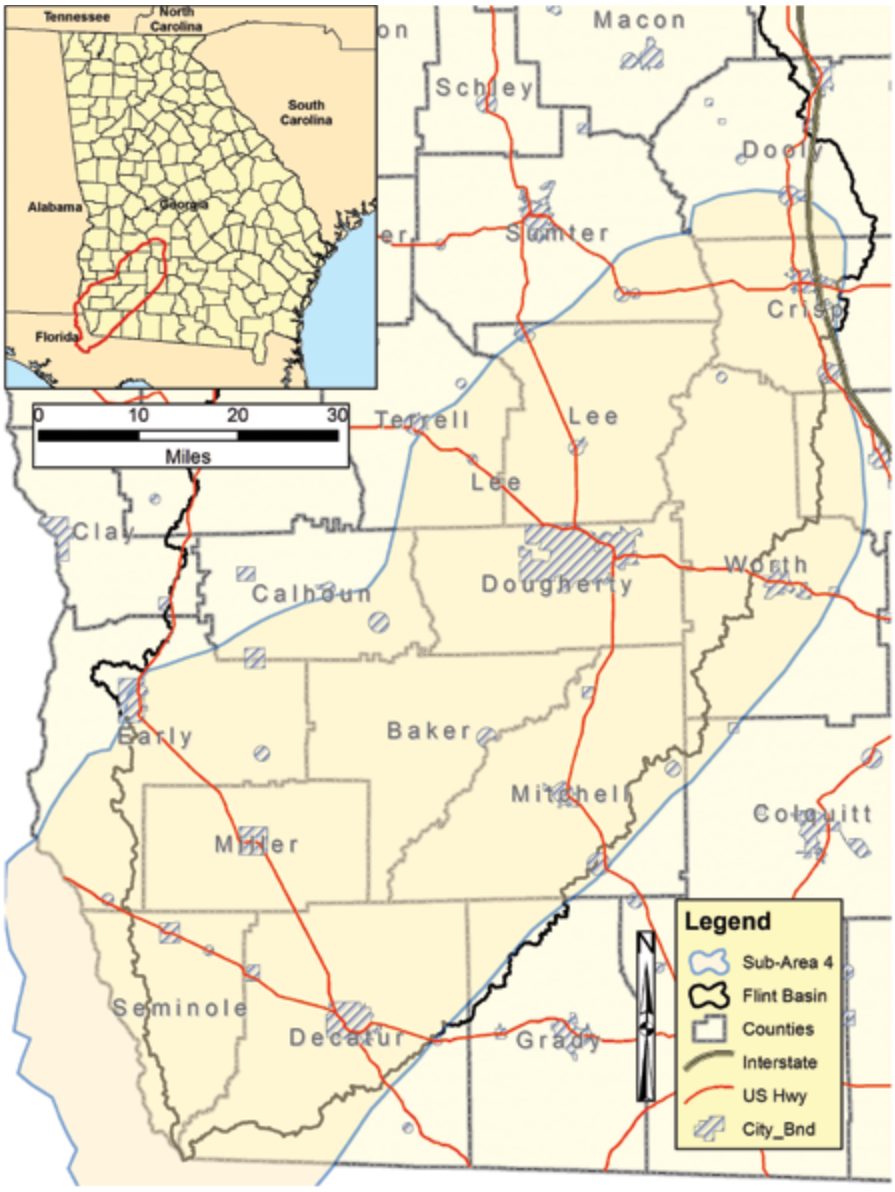
Between 1999 and 2006, spurred by worsening drought conditions, EPD increased its attention to the effect of agricultural irrigation. The agency instituted the first moratorium on the issuance of both new groundwater permits in Floridan Aquifer beneath the Lower Flint River Basin and surface water withdrawal permits in the Flint River basin. At the same time, the state embarked on an eight-year "Sound Science Initiative" to study agricultural water use and permitting in the Flint River basin. Additionally, EPD studied farm use impacts on water supply and the interconnectivity of groundwater and surface water flows. This initiative culminated with the *Flint River Basin Regional Water Development and Conservation Plan* (2006) and a lifting of the first moratorium. The Plan established a permitting regime for "use" areas in the lower Flint River basin. For example, EPD's policy was not to issue new permits in Capacity Use Areas—or areas where the Floridan Aquifer was at the maximum permitted capacity—essentially continuing the moratorium in a significantly smaller area where groundwater resources were stretched thin. Additionally, all new surface water permits issued in the Spring Creek and Ichawaynochaway sub-basins included "low-flow protection plans" as a standard permit condition. This permit condition required the "complete cessation of irrigation" when the stream flow at the withdrawal point falls below 25 percent of the average annual discharge.[35]

During the "Sound Science" study period, the General Assembly passed the Flint River Drought Protection Act (FRDPA) in 2000.[36] The FRDPA's goal originally was to reduce surface water withdrawals during dry periods, keep more water in the ACF basin, and mitigate tri-state water war friction. As originally designed the FRDPA provided the EPD director with the authority to declare drought in the Flint River basin and trigger an auction whereby the state could pay farmers not to irrigate. This process was triggered twice: first in 2001, when over 33,000 acres of land were removed from irrigation at a cost of $4.5 million, and again in 2002 when 41,000 acres were removed at a cost of $5.3 million. However, the auctions "failed to remove the highest water use cropland from irrigation," according to EPD.[37] As such, the process may not have resulted greater or more consistently maintained surface flows in the Flint River basin's portion of the ACF system, and therefore downstream into Florida. Despite subsequent drought events, the EPD director never declared another drought to trigger

auctions, and the General Assembly never included any money for the process in the state budget.

Instead in 2012, EPD instituted a second moratorium in response to the 2011 drought, which caused record low stream flows, and stressed groundwater supplies (and presumably the tri-state conflict). This moratorium continues to apply today to groundwater permit applications in "Subarea 4" of the lower Flint and Chattahoochee River basins [*See* Figure 8], in surface water withdrawal permits in the Flint's Kinchafoonee, Ichawaynochaway, and Spring Creeks, and in a 24-county area of the Lower Flint River. Furthermore, EPD and the General Assembly amended the FRDPA in 2014 (Senate Bill 213) to make the drought declaration process discretionary. The most promising element of the revision included a requirement that **all** irrigation systems achieve efficiencies of 80 percent by January 1, 2020.

Figure 8. Sub-Area 4 of Lower Chattahoochee and Flint River Basins



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The state's attention to irrigation efficiency, data, and technology began a decade before the FRDPA was revised. In 2003, the General Assembly passed House Bill (HB) 579 to amend the Groundwater Use Act (1972) and required all permitted farm water withdrawals to have water flow meters on their pumps. The legislation established the Agricultural Water Use Measurement Program, and placed the Georgia Soil and Water Conservation Commission in charge of installing, maintaining, inspecting, and collecting meter-related data. By 2010 the Commission had installed more than 13,000 water meters to measure the volume of surface water, groundwater, and groundwater-to-pond water use.[38]

In the latest round of the "water wars," Florida accused Georgia's farmers, producers, and growers of illegally irrigating tens of thousands of acres of farmland. In October 2016 and only days before the U.S. Supreme Court-appointed Special Master Ralph Lancaster presided over the *Florida v. Georgia* case in Portland, Maine, Florida's legal team submitted a pre-trial brief alleging that Georgia's farmers were illegally watering 90,000 acres in the Flint River basin.[39]

In response and with no public notice, EPD immediately began issuing notices of violation (NOV) to permit holders in the lower Flint River basin *alleged* to be withdrawing water without a permit or irrigating more acreage than specified in their permits. According to EPD, as of February 2017, the agency issued 390 NOVs "for 6,004 wetted acres that appears not to be authorized under water use permits in the Flint River Basin." The total anticipated "unpermitted acreage in the Flint River basin is less than three percent of the total irrigated acreage," which another state document pegged at about 25,000 acres and is less than Florida alleged.[40]

It is important to understand that a notice of violation is not a fine; it is a notice that something appears to be wrong and enables a permittee to address possible non-compliance or violation of law before any fines might be levied. Among the many questions surrounding these early-stage enforcement actions, one centers on whether or not the acreages reported in the water withdrawal permitting process actually constitute a condition of a permit. EPD envisions resolution of NOV's to be case by case, and could likely be resolved in one of the following ways. An unpermitted irrigator can stop irrigating or can obtain a permit. If the unpermitted withdrawal has tapped the Floridan aquifer where a moratorium is in place, then the hole must be plugged.

If the permittee is irrigating more acreage than identified in the permit but has multiple permits on contiguous land, they may be able to shift acres around so there is no net-increase or new water being applied. Finally, a landowner alleged to be operating without a permit can produce a permit to prove EPD simply lacks a copy in its official files.

On October 28, 2016, days after EPD began issuing NOVs, Georgia's Governor created an Agricultural Permitting Compliance Task Force to help pave a regulatory and compliance path forward. The Task Force—which included state agency staff, technical experts, and agricultural stakeholders—met at least five times between November 2016 and March 2017. The Task Force's charge was to determine the level of non-compliance with state law, how it happened, and make recommendations to ensure better compliance in the future.[41] The Task Force reportedly submitted recommendations to the Governor's office in April 2017.

The "Recommendations of the Governor's Agricultural Permitting Compliance Task Force" as drafted and submitted by EPD to the Task Force chair include findings and recommendations in four areas: permitting, metering, compliance, and budget. A high level finding acknowledges inconsistencies with how the state and permittees interpret enforceable "authorized activities" and "permit conditions." To address this, the Task Force drafted a long list of recommended and explicitly enforceable permit conditions, which include establishing "the maximum irrigated acreage, pump capacity, water source, an operable water measuring device, low-flow requirements, irrigation

efficiency requirements referenced in Senate Bill 213 (2014), reading and reporting of water use, and location specified in the permit. Additional permit conditions may be contained in the permit including, but not limited to, meter reading requirements, the aquifer, and the depth and installation location to which a well is limited."[42]

Another major finding addresses a failure of the state's agricultural water withdrawal metering program. As noted above, permittees are required to install meters that measure water withdrawals to comply with HB 579 (2003). The Georgia Soil and Water Conservation Commission managed this program for 13 years from inception in 2003 until December 1, 2016, when EPD assumed responsibility for the program because the Commission failed to implement the metering program in "a proven, efficient," and "effective manner" as required by law.

According to an internal review of state records, the EPD determined that statewide there may be 710 undocumented withdrawal permits—groundwater (310) and surface water (400). This includes 24 undocumented withdrawals in the Chattahoochee River basin and 343 in the Flint River basin. Furthermore, more than 12,000 permits—or 52 percent statewide—lack a meter that is supposed to be provided and paid for by the state of Georgia.[43] While possession of an agricultural permit does not automatically imply that an agricultural withdrawal is actually occurring or a field is being watered, every permitted withdrawal should be metered whether currently active or inactive.

The Task Force also recommended changing the party responsible for installing and maintaining a meter. To maintain consistency with the timelines set forth by HB 579 (2003), the state intends to purchase and install a meter for any permittee who applied for a permit before December 31, 2002. For any permit that was applied for after that date, the permittee would remain responsible for purchase and installation, which costs approximately $800. In both cases, the permittee would be responsible for maintaining an operable meter, meter repair and replacement, and reporting water use to EPD. The long term goal for all permittees statewide would be to ensure that each point of original withdrawal has a functioning meter.

To date, the first public action taken in response to the Task Force's draft recommendations occurred on June 23, 2017. The Governor's office announced a plan to invest $10.5 million from the One Georgia Authority into EPD's oversight of the state agricultural metering program, which will include the appointment of a new Agricultural Water Project Manager. EPD is now focusing on ensuring meters are installed for permitted withdrawals in the heavily used Flint and Suwannee river basins "as recommended by [the] Governor's Agricultural Permitting Compliance Task Force."[44]

Georgia will invest $10.5 million from the One Georgia Authority into EPD's oversight of the state agricultural metering program.

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What Can We Learn from Our Neighbors

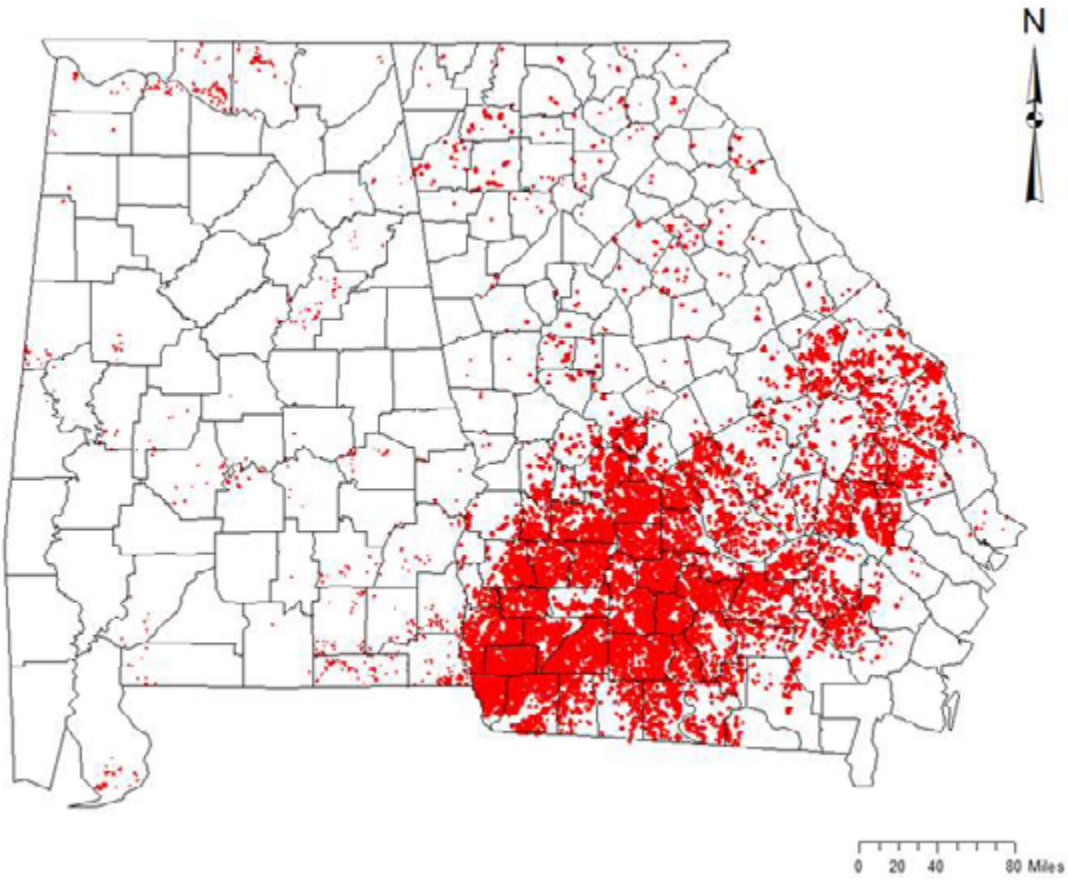
The challenges states face in balancing water resources are certainly unique to their regions. The hurdles are high but not insurmountable. The details of nearly every water problem will be localized but the solutions will not be inherently different. There is only so much water available to go around. Devising equitable mechanisms to access these limited resources in a world already impacted by climate change is imperative not optional.

Alabama: A Poorly Regulated Neighbor?

Close to home and as noted above, the "water wars" have painted a target on Flint River basin permit holders. However, Florida's and Georgia's most recent skirmishes in the nearly 30-year-old water wars did not address another actor: the state of Alabama. While the documented number of irrigated acres in Alabama—169,240—is dwarfed by Georgia, there is a growing interest in irrigated agriculture in the state. The Alabama Water Use Reporting Program requires irrigators "with the capacity to withdrawal 100,000 gallons of water per day or greater to obtain a Certificate of Use." Users are required to annually report their average daily and peak use for each month; however, data collection and submission is not robust.[45] According to the available data, Alabama farmers and irrigators use more surface water than groundwater for agricultural purposes, which is likely a reflection of the investment costs in developing the water source. Statewide, nursery products and turfgrass represent Alabama's most lucrative commodities.

But in the shared Apalachicola-Chattahoochee-Flint (ACF) River basin, Alabama's primary agricultural commodities are cotton, peanuts, and vegetables. Houston County, on the Alabama-Georgia-Florida line and along the Chattahoochee River, holds the number two slot in Alabama for the greatest number of irrigated acres (14,000) and greatest total irrigation-related withdrawals (11.57 MGD).[46] Alabama also has far fewer center pivots when compared with Georgia [*See* Figure 9]. Nonetheless, Georgians taking part in Georgia's regional water planning process recognize the deficiencies in Alabama's regulatory processes compared to their own state, and the inherent consequence that brings to water planning in the shared ACF basin. The Middle Chattahoochee Regional Water Plan recommends the creation of a Task Force to investigate water use, demands, and forecasts for Alabama for use in future regional planning.[47]

Figure 9. **Center Pivots in Alabama (2013) and Georgia (2010)[48]**



South Carolina: Mega Farms and Big Straws

Americans' love of potato chips has threatened one of the Palmetto State's rivers. In 2013, a Michigan-based agribusiness with thousands of acres of potato operations in six states including Georgia secured approval from the South Carolina Department of Health and Environmental Control to irrigate a massive potato farm.[49] Walther Farms originally planned to withdraw up to 9.6 billion gallons (i.e., 800,000,000 gallons per month, or 27 MGD) of water annually from the Edisto River in Aiken County to irrigate 3,700 acres of the largest mega-farm in the state. Walther's potatoes are destined for Frito-Lay, which is owned by soda-maker PepsiCo.

The proposal illustrated a deficiency in the state's water withdrawal permitting process: exceptions for agricultural withdrawals. The South Carolina Surface Withdrawal Act (2010)—the state's first legislative attempt to regulate surface water use—requires municipal and industrial surface withdrawals in excess of 3,000,000 gallons per month (100,000 gallons per day) to undergo review to obtain a permit. Agricultural water withdrawals are largely exempt from the law, do not trigger public notice, and only require "registration" with the state. Walther's industrial-scale withdrawal could disproportionally affect downstream stakeholders and reduce the Edisto River's flow by 35 percent in dry years, according to conservationists.[50]

The Friends of the Edisto River—a group of downstream business owners, landowners, anglers, and small farmers along the river—challenged the state's approval of Walther's water withdrawal in court. But in 2014, the Friends of the Edisto River agreed to drop the lawsuit. In exchange, Walther agreed to reduce its withdrawal to 3 billion gallons

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(8 MGD) annually from the river, drill groundwater wells to secure up to 3 billion gallons of additional water, and implement the best irrigation water conservation technologies available.[51]

Multiple legislative efforts to close the agricultural exemption in the Surface Withdrawal Act have failed to advance despite support from legislators, property owners, conservationists, and farmers. While Walther and agricultural lobbyists were fighting changes to South Carolina water withdrawal permitting laws, Walther was actively encouraging agribusiness producers in Colorado, New Mexico, and Texas to consider establishing operations in South Carolina. As a result, the Woody agribusiness group acquired 3,600 acres and another company purchased 800 acres in South Carolina.[52]

Water use by Walther, Woody, and other new mega-farms has reportedly reduced stream flows in the Edisto River. And in a few extreme cases, residents adjacent to a Woody corn field with a half-dozen groundwater wells watched their personal wells go dry in the summer of 2016. South Carolina has a groundwater regulatory program and requires well registrations, notices of intent and permits based on the location of the well. The highest level of regulatory compliance—obtaining a permit—is only required on the coastal plain in fourteen of the state's forty-six counties. But like Georgia, a permit does not limit a withdrawal's volume.[53]

In January 2014, over 400 people attended a public meeting hosted by South Carolina's environmental agency. (Edisto.TV)

8

A Way Forward

The example of Walther Farms—an out-of-state agribusiness and corporate entity moving into the region—is not uncommon. In Georgia, the Bill Gates Foundation has invested in Vidalia onions and agricultural property all over the state.[54] Simple business decisions, investment strategies, and global commodity values drive these choices as much as water availability, environmental conditions, and regulatory frameworks do.

Given long-term droughts and disappearing aquifers in California, Texas, and other states, water-stressed producers are looking to other areas of the country to set-up new agricultural operations in the southeast despite the region's own history of water-stress.[55]

This report makes no specific recommendations on crop diversification or crop mix in regards to water use, or recommendations about how the agricultural sector should respond to climate change. The cultural and natural variables in agriculture make long-term recommendations difficult. But Georgians should pay as much attention to the warmer winters in middle Georgia as they do to sea level rise on the Georgia coast. For example, three out of the last five winters were not cold enough for the state's signature peach crops and resulted in significantly reduced yields.[56]

There is little doubt that climate change will continue to affect surface water and groundwater supplies and quality in Georgia. Numerous studies and reports demonstrate climate change in Georgia is real and already affecting the state. One needs to look no further than the Third National Climate Assessment's findings for the southeastern United States. Sea level rise, increasing temperature, and decreased water availability are the critical areas of concern for the region. And while the frequency of intense rainfall will increase it remains unclear if overall precipitation rates will remain steady, increase, or decline. Even if long-term averages remain steady, the already-established trend in rainfall to shorter and more intense events is leading to higher surface-flow variability, including more intense floods and lower low-flow conditions. These realities will have implications for Georgia's freshwater drinking supply, wastewater and storm water management, agricultural supply, and the sustainability of recreational industries and activities.[57]

There are two primary paths forward that can help combat future freshwater challenges and secure more water for Georgia's multiple water sectors. Technological tools can enhance irrigation water conservation and efficiency. But tools alone will not resolve water conflict or produce additional water supplies. Policy changes must also be implemented, and the Governor's Agricultural Permitting Compliance Task Force has developed a useful road map with implementable recommendations. If the state ignores these findings and recommendations, Georgia leaves itself open to future water allocation challenges by neighboring states.

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Georgia's failed peach crop: Climate change or just a too-warm winter?

85 percent of state's peaches lost this year

By Meera Subramanian - InsideClimate News

Technology and Irrigation Efficiency

The Lower Flint-Ochlockonee Water Planning Region provides a snap-shot of the growth in the use of efficient irrigation equipment. Between 2010 and 2015, the number of inefficient irrigation traveler systems declined by 37 percent, and the use of center pivot and more efficient drip systems increased by 30 and 29 percent, respectively. To be accurate, not all center pivot systems use water efficiently. The best indicator of efficiency is the type of nozzle used. The older top-mounted "high pressure sprinkler" systems (*See* Figure 10) are less efficient than "low pressure drop" systems (Figure 11). The new hanging low pressure nozzles lose less water to evaporation and wind drift than the older sprinklers. In the Lower Flint River basin, 90 percent of center pivots now employ low pressure systems, according to the Georgia Water Planning and Policy Center.[58] Over time the older inefficient sprinkler systems will be retrofitted or replaced with new and more efficient sprinkler systems. A retrofit of an existing center pivot watering 160 acres could cost $8,000, and a new system could range in cost between $100,000 and $150,000.[59]

Figure 10. **Example of a high pressure sprinkler and center pivot system (USGS)**

Figure 11. **Example of a low pressure drop nozzle and center pivot system in the Flint River Basin**

Other irrigation technologies can also improve agricultural water efficiencies. For example, Variable Rate Irrigation (VRI) systems rely on sophisticated geospatial measurement and mapping systems to tell center pivot sprinklers where to apply specific amounts of water in particular sections of a field. According to the C. M. Stripling Irrigation Research Park, VRI systems, which can cost $8,000 for a large center pivot system—can conserve up to 15 percent of water.[60] Advanced Irrigation Scheduling is another technology that relies on sophisticated mapping and other metrics including soil moisture and temperature. The two systems can work in tandem: VRI determines where water should go and the scheduling system determines when.[61] When combined with smartphone applications, producers can micromanage irrigation scheduling to minimize water and energy use, and maximize yields. All of this technology has great potential, but also comes with significant costs. A single soil sensor can cost $2,000 and fields require multiple sensors.[62]

While appropriate sprinklers and other technologies illustrate the compatibility between water efficiency and production, a farmer or producer must weigh many different factors before investing in any water conservation and efficiency irrigation equipment. Cost of the system is among the most obvious, but users must also consider soil types, climate, commodity values, labor requirements, and energy costs.

Policy

Data matters in the policy world. Farmers, producers, conservationists, and decision makers can only abide by, advocate for, and act upon water policies if they have high-quality information and data. Before anyone can formulate water policy, one needs reliable and accurate water withdrawal, consumption, and return data. Additionally, better information that correlates the amount of water actually applied to crops with the final yield achieved will help inform how many inches of water are necessary for economically viable commodity production.

One step in this direction aligns with a Georgia Water Coalition recommendation to lower the regulatory threshold that triggers the requirement to obtain surface water and groundwater permits. Lowering the permitting threshold from 100,000 gallons per day to a lower metric could incentivize technologies that use less water and provide more accurate information on how a resource is being used. Most important, lowering the threshold and collecting reliable water meter flow data will provide the state with a better sense of the total number of withdrawals and volume for planning purposes.[63] In a state where water has been over-allocated in every river basin in the state and groundwater data remains inadequate, gathering and maintaining accurate water use data and more robust permitting are crucial for future planning. Furthermore, understanding the relationships between consumptive surface water or groundwater use and surface water flows is critical. In the Flint River basin, where these relationships are fairly well understood, policy advocates are only just now positioned to work toward restorative actions. In other river basins which are either data- or analysis-poor, advocacy and policy-making must first be preceded by a clear understanding of the water withdrawal and stream flow relationship. We should learn from the experience of water management in the Flint River basin, and not repeat the same mistakes in the other basins, particularly those in areas that are only now experiencing explosive growth in the installation of irrigation equipment.

Georgia's drought mitigation and response largely rests on municipal utilities and their residential customers. Georgia's Drought Response Rule, as written and implemented, is really a rule that addresses residential outdoor water use. The rule could be improved and include transparent, science-based triggers that are freed from political calculations to more effectively manage water resources during times of drought. Additionally,

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We should learn from the experience of water management in the Flint River basin, and not repeat the same mistakes in the other basins, particularly those in areas that are only now experiencing explosive growth in the installation of irrigation equipment.

Radium Springs diminished by groundwater withdrawals, pictured in August 2016 (C. Manganiello)

Georgia must update the state's drought response to account for the effects of climate change, and develop a predictive drought mechanism to create a more proactive system for drought response.[64]

Source switching should be studied and implemented where reasonable. Current data indicate a high rate of agricultural permittees shifting from surface water to groundwater withdrawals. While this shift may help improve surface water flows, groundwater withdrawals can result in reduced surface water flows in certain river basins. In some cases, deep groundwater wells that tap aquifers with limited hydrologic connections to surface water could be better options. The fact remains that the connectivity between shallower aquifers and surface waters is poorly understood, as are the sustainable yields of these deeper aquifers. More study is necessary to better understand the relationship between surface water and groundwater resources. Additionally, existing farm ponds—including the estimated 24,000 ponds in just the Apalachicola-Chattahoochee-Flint River Basin alone—could serve as primary sources or as alternative sources in areas where critical surface water flows must be maintained.[65]

Progress in land-conservation tools—including creative use of conservation easements and fee-simple transactions, targeting key aquifer-recharge areas, and key areas where surface flows are most affected by both surface and groundwater withdrawals—is a promising area of work.

Conservation easements that focus on natural-vegetation restoration, such as restorations of longleaf pine forest, are being revealed to be highly effective at protecting and enhancing surface and groundwater supplies. More creative tools, such as easements targeting decreased use of water during critical flow conditions should be explored. Easements designed to take maximum advantage of certain crop choices, rotations, and tillage practices should also be in play. The combination of such approaches will likely yield significant results. These tools are not new; they have been used with great success in the western United States. But, they are relatively new to Georgia, and the state stands to benefit by expanding their sophistication and usage.

Finally, EPD has the authority to condition water withdrawal permits. In a regulated riparian state, EPD could require permittees to reduce surface water withdrawals during drought and low flow conditions, to allow more water to "flow-by," and/or to maintain secondary sources of water supply. However, these tools could only reasonably be implemented if the state developed new basin or region-specific drought prediction, mitigation, and response plans based on specific science-based triggers, and adopted a more protective permanent instream flow policy. The "heavy hand" of regulation can be minimized if we are successful at implementing three, primarily non-regulatory areas of conservation: technologies, sourcing, and land-use practices.

9

Conclusion

A recent severe drought in California, Texas, and Georgia illustrates the challenges the nation faces in providing water supply for the energy, agricultural, and municipal and industrial sectors. From one transboundary perspective, Georgia's agricultural water withdrawal permitting process appears more advanced than the state's immediate regional neighbors because permits are required of all users regardless of withdrawal type and location

From another transboundary perspective, and arguably the most important, the Special Master in the *Florida v. Georgia* trial observed: "It also appears that Georgia's upstream agricultural water use has been—and continues to be—largely unrestrained" and "subject to no limitations."[66]

While the Supreme Court may accept Ralph Lancaster's ultimate recommendation that Florida's suit against Georgia has no merit, the Special Master's observation unequivocally identifies one of Georgia's liabilities. In other words, if Georgia were to do nothing about agricultural permitting, another court in a future case might judge differently. The Special Master's recommendation could only be a "win" for Georgia if the state can meaningfully address this obvious liability.

That is why the Governor's Agricultural Permitting Compliance Task Force's draft findings and recommendations present such a meaningful opportunity to bring clarity and certainty to a pillar of Georgia's economy. Securing healthy flows to meet the challenge of providing enough freshwater for all stakeholders is the responsibility of all water users. It's up to all of us to use water wisely.

The Special Master's recommendation could only be a "win" for Georgia if the state can meaningfully address this obvious liability.

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Author Contact:

Dr. Chris Manganiello
Water Policy Director
Chattahoochee Riverkeeper

cmanganiello@chattahoochee.org

3 Puritan Mill
916 Joseph Lowery Blvd., NW
Atlanta, Georgia 30318

Founded in 2002, the **Georgia Water Coalition's** (GWC) mission is to protect and care for Georgia's surface water and groundwater resources, which are essential for sustaining economic prosperity, providing clean and abundant drinking water, preserving diverse aquatic habitats for wildlife and recreation, strengthening property values, and protecting the quality of life for current and future generations. The GWC is a group of more than 240 organizations representing well over a quarter of a million Georgians including farmers, homeowner and lake associations, business owners, sportsmen's clubs, conservation organizations, professional associations and religious groups who work collaboratively and transparently with each other to achieve specific conservation goals.