

Section 4

Regional Historic Groundwater Use in Georgia

4.1 Introduction

Water use is typically affected by population and climate patterns. According to the U.S. Census Bureau, the population in Georgia has doubled between 1960 and 2000 (Georgia EPD, 2009). Also, almost 75 percent of Georgia's population is concentrated in metropolitan areas. Most of the State's fastest growing counties are in or adjacent to metro Atlanta and along the coast. The population trend in Georgia from 1900 through 2015 is shown on **Figure 4-1**. More than nine million people currently reside in the state of Georgia. As the population increases, so does water demand leading to increased withdrawals of groundwater.

As discussed in section 2 of this report, annual rainfall totals throughout Georgia range from 45 inches in central Georgia to 80 inches in northeast Georgia. There are two periods of high rainfall, which occur February through March and July through August. **Figure 4-2** summarizes the representative average monthly rainfall hydrograph for Georgia based on 505 rainfall stations for the period of record 1891 through 2008. The mean annual rainfall for the State during this period is 50.79 inches. Some agricultural water demand can be met by rainfall; however, when rainfall is insufficient to meet demand during the growing season, pumping for irrigation purposes increases.

Groundwater use in Georgia has been tabulated state-wide, and for the Coastal Plain area, for a recent lower than average rainfall year (2000) and higher than average rainfall year (2005) to illustrate how water use demands vary geographically over time and with rainfall. For the purposes of this study, groundwater use in Georgia was grouped into five major water use categories as defined below:

- Public supply: Water supplied by a publicly or privately-owned water system (at least 25 people served or a minimum of 15 service connections) for public distribution;
- Commercial/industrial supply: Water used to support business operations such as commercial facilities, eateries, manufacturing processes, etc.;
- Agriculture supply: Water used for agricultural activities;
- Domestic self supply: Water supplied for domestic purposes by small utilities; and
- Other: Water used for mining and thermoelectric power generation.

4.2 Historic Groundwater Use State-wide

As summarized in **Table 4-1** and on **Figure 4-3**, groundwater use in Georgia was higher during 2000 [1,450 million gallons per day (mgd)] than during 2005 (1,180 mgd). Agricultural water use was the largest category of water use – 51 percent and 42 percent of the State’s total water demands in 2000 and 2005, respectively. The reduction in water use can be partially attributed to reduced demands for irrigation as a result of higher rainfall in 2005. Public supply and commercial/industrial water uses were higher in 2000 than in 2005 and increased slightly, from 19 percent to 22 percent and from 18 percent to 22 percent, respectively, from 2000 to 2005 as a percentage of total water use. Estimated domestic water use increased slightly as an increase in percentage of total withdrawal from 8 percent to 10 percent from 2000 to 2005. These increases in water withdrawals correlate with the population growth previously referenced in Section 4.1. Water use for mining remained fairly constant, averaging around 4 percent of total use in 2000 and 2005. Groundwater use for thermoelectric purposes was very minor, consisting of 0.3 percent of total use in 2000 and 2005.

Table 4-1 Groundwater Use (mgd) in Georgia for 2000 and 2005

Year	Water Use Category						Total
	Public Supply	Domestic ³	Commercial/Industrial ^{4,6}	Agriculture ^{5,7}	Mining	Thermo-electric	
2000 ¹	277.7	110.8	265.4	742.0	50.3	3.7	1449.9
% of Total	19.2%	7.6%	18.3%	51.2%	3.5%	0.3%	100%
2005 ²	254.2	119.7	260.0	493.5	48.9	3.8	1180.1
% of Total	21.5%	10.1%	22.0%	41.8%	4.1%	0.3%	100%

¹As referenced in USGS Information Circular 106, "Water Use in Georgia by County for 2000 and Water-Use Trends, 1980-2000."

²As referenced in USGS Scientific Investigations Report 2009-5002, "Water Use in Georgia by County for 2005 and Water-Use Trends, 1980-2005."

2000 Water Uses:

³Based on domestic percentage contribution from 2005 domestic/commercial water use withdrawals.

⁴Consists of commercial (18.4 mgd) and industrial (247.1 mgd) water uses, which were calculated from percentage contributions of 2005 domestic/commercial and industrial/mining water use withdrawals

⁵Consists of irrigation (732.7 mgd) and livestock (9.3 mgd) water uses.

2005 Water Uses:

⁶Consists of commercial (19.8 mgd) and industrial (240.2 mgd) water uses.

⁷Consists of irrigation (486.4 mgd), aquaculture (4.98 mgd), and livestock (2.1 mgd) water uses.

4.3 Historic Groundwater Use in the Coastal Plain of Georgia

Groundwater use in the Coastal Plain of Georgia was 1,310 mgd in 2000 and 1,010 mgd in 2005, as summarized in **Table 4-2** and on **Figure 4-4**. Agricultural water use accounted for the largest category of withdrawals – 55 percent and 48 percent of the province’s total water uses in 2000 and 2005, respectively. This difference in water use can be partially attributed to lesser demands for irrigation as a result of higher

rainfall in 2005. Public supply and commercial/industrial water uses also decreased slightly but the percentage of total withdrawal increased slightly, from 18 percent to 21 percent and from 19 percent to 22 percent, respectively, in 2000 and 2005 as a percentage of total withdrawal. Estimated domestic water use had a slight increase from 4 percent to 6 percent of total withdrawals from 2000 to 2005. Water use for mining remained fairly constant, averaging around 4 percent of total use in 2000 and 2005. Water use for thermoelectric purposes was very minor, consisting of 0.3 percent to 0.4 percent of total use in 2000 and 2005, respectively.

Table 4-2 Groundwater Use (mgd) in the Coastal Plain of Georgia for 2000 and 2005

Year	Water Use Category						Total
	Public Supply	Domestic ³	Commercial/Industrial ^{4,6}	Agriculture ^{5,7}	Mining	Thermo-electric	
2000 ¹	232.5	56.1	244.3	727.1	47.9	3.7	1,311.60
% of Total	17.7%	4.3%	18.6%	55.4%	3.7%	0.3%	100%
2005 ²	209.2	56.8	218.0	482.0	42.5	3.7	1,012.20
% of Total	20.7%	5.6%	21.5%	47.6%	4.2%	0.4%	100%

¹As referenced in USGS Information Circular 106, "Water Use in Georgia by County for 2000 and Water Use Trends, 1980-2000."

²As referenced in USGS Scientific Investigations Report 2009-5002, "Water Use in Georgia by County for 2005 and Water-Use Trends, 1980-2005."

2000 Water Uses:

³Based on domestic percentage contribution from 2005 domestic/commercial water use withdrawals.

⁴Consists of commercial (9.3 mgd) and industrial (235 mgd) water uses, which were calculated from percentage contributions of 2005 domestic/commercial and industrial/mining water use withdrawals.

⁵Consists of irrigation (724.6 mgd) and livestock (2.4 mgd) water uses.

2005 Water Uses:

⁶Consists of commercial (9.4 mgd) and industrial (208.6 mgd) water uses.

⁷Consists of irrigation (475.8 mgd) and livestock (6.2 mgd) water uses.

4.4 Summary

Based on the USGS report (Fanning and Trent, 2009) on water use during 2005, 5,470 mgd was withdrawn state-wide from both surface and groundwater sources. Groundwater accounted for 1,180 mgd (22 percent) of the withdrawals, while surface water accounted for 4,290 mgd (78 percent). This percentage breakdown remained constant in 2000, with groundwater withdrawals accounting for 1,450 mgd (22 percent) and surface water withdrawals accounting for 5,040 mgd (78 percent).

As shown in **Table 4-3** and on **Figure 4-5**, the majority of groundwater withdrawals during 2000 (1,311 mgd or 90 percent) and 2005 (1,022 mgd or 87 percent) were generally in the southern portion of the State in the Coastal Plain province, which has several well defined and highly transmissive aquifers. Of the four principal aquifers located in the Coastal Plain, the majority of groundwater in 2005 (56 percent) was withdrawn from the Floridan Aquifer, followed by withdrawals in the Cretaceous Aquifer (17 percent) and the Claiborne and Clayton Aquifers (a combined 14 percent).

Groundwater withdrawals in 2000 exhibited a similar trend, with the Floridan Aquifer comprising the majority of flows.

Table 4-3 Groundwater Withdrawals (mgd) in Georgia by Principal Aquifer for 2000 and 2005

Province	Aquifer	Total	% of Total	Total	% of Total
		2000 ¹		2005 ²	
Coastal Plain	Floridan Aquifer	819.3	57	657.7	56
	Claiborne Aquifer	152.1	10	88.9	8
	Clayton Aquifer	113.2	8	70.0	6
	Cretaceous Aquifer	226.7	16	205.1	17
Coastal Plain Total		1,311.2	91	1,021.7	87
Piedmont, Blue Ridge	Crystalline-rock Aquifers	91.7	6	108.2	9
Valley, Ridge, Appalachian Plateau	Paleozoic-rock Aquifers	47.0	3	50.2	4
State-Wide Total		1,449.9	100	1,180.0	100

¹As referenced in USGS Information Circular 106, "Water Use in Georgia by County for 2000 and Water-Use Trends, 1980-2000."

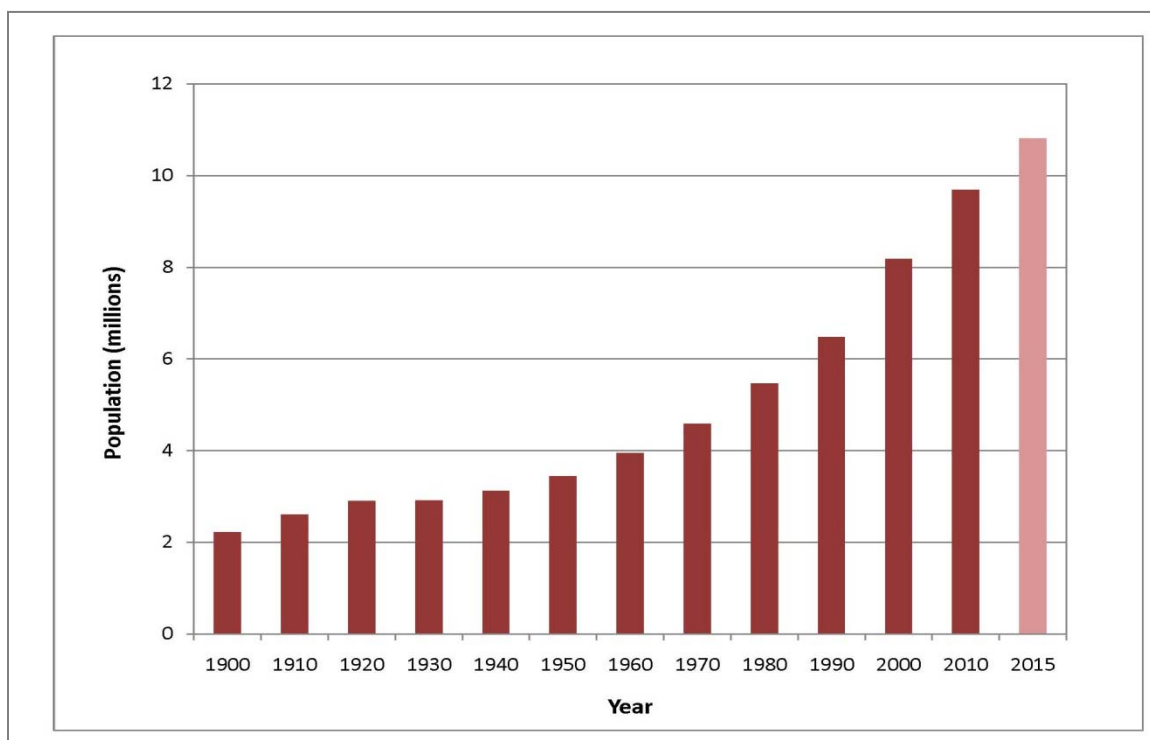
²As referenced in USGS Scientific Investigations Report 2009-5002, "Water Use in Georgia by County for 2005 and Water-Use Trends, 1980-2005."

Agriculture is one of the dominant land uses in the Coastal Plain (**Table 4-4** and **Figure 4-6**), accounting for 26 percent of the total acreage in 2005. **Figure 4-7** shows the areal distribution of land use in Georgia. Because of the highly productive aquifers in the Coastal Plain, groundwater is often used as a source of irrigation water, with the majority of agricultural users located in the southwestern portion of the province.

Table 4-4 Land Use Summary in the Coastal Plain of Georgia for 2005 ¹

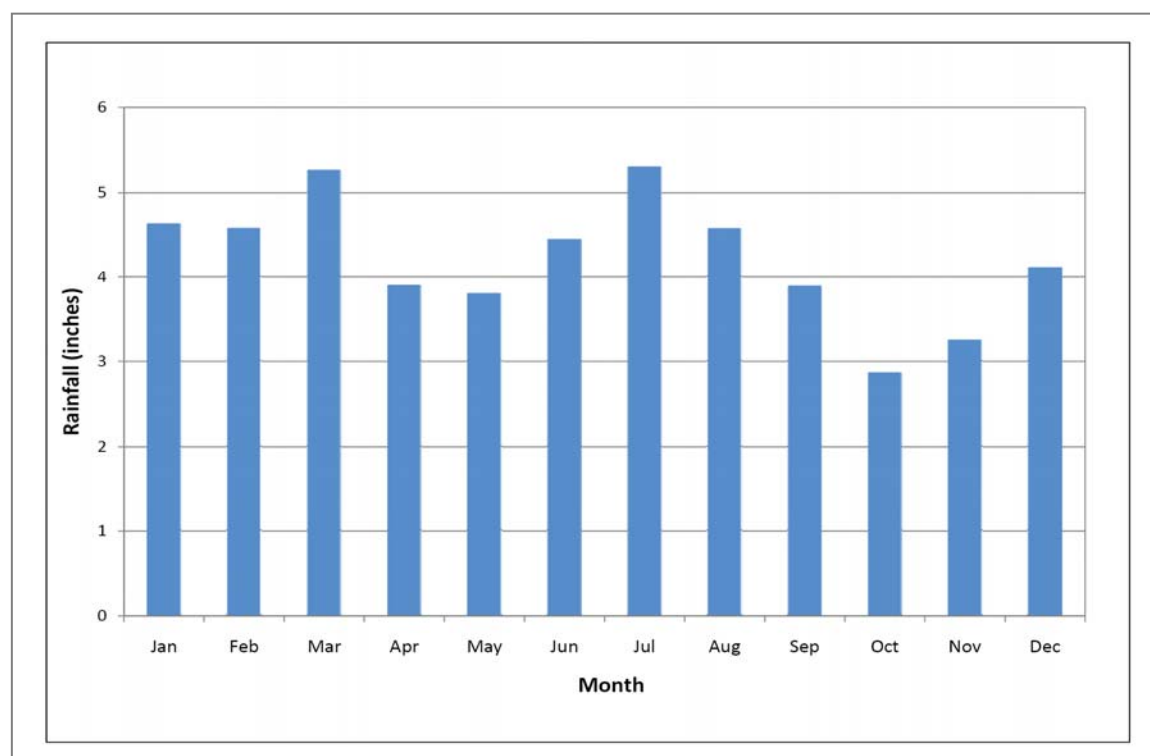
Land Use Classification	Area (ac)	% of Total
Evergreen Forest	6,435,420	27.5
Row Crops/Pasture	5,986,970	25.6
Forested Wetland	3,794,297	16.2
Clearcut/Sparse	2,058,414	8.8
Deciduous Forest	1,636,504	7.0
Low Intensity Urban	1,281,642	5.5
Mixed Forest	772,103	3.3
Open Water	753,911	3.2
Non-forested Wetland/Salt	344,007	1.5
High Intensity Urban	147,994	0.6
Non-forested Wetland/Fresh	119,518	0.5
Quarries/Strip Mines/Rocks	22,509	0.1
Beaches/Dunes/Mud	15,704	0.1
Total	23,368,993	100

¹As referenced in University of Georgia Natural Resources Spatial Analysis Lab (NARSAL)-Georgia Land Use Trends <http://narsal.uga.edu/glut/ecoregion.php>



Source: Georgia EPD, 2009; Projections for 2015 obtained from the Georgia Office of Planning and Budget.

Figure 4-1
Georgia's Population (1900 –2015)



Source: NOAA.

Figure 4-2
Average Monthly Rainfall for Georgia (1891-2008)

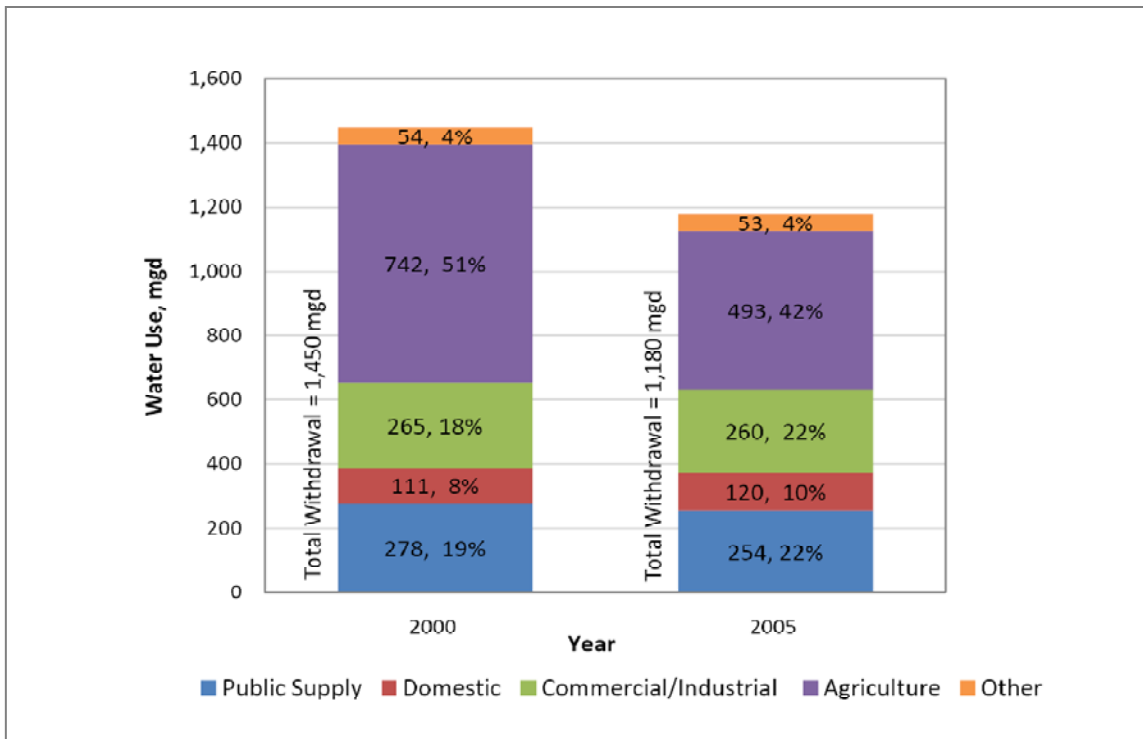


Figure 4-3
Groundwater Use (mgd) in Georgia for 2000 and 2005

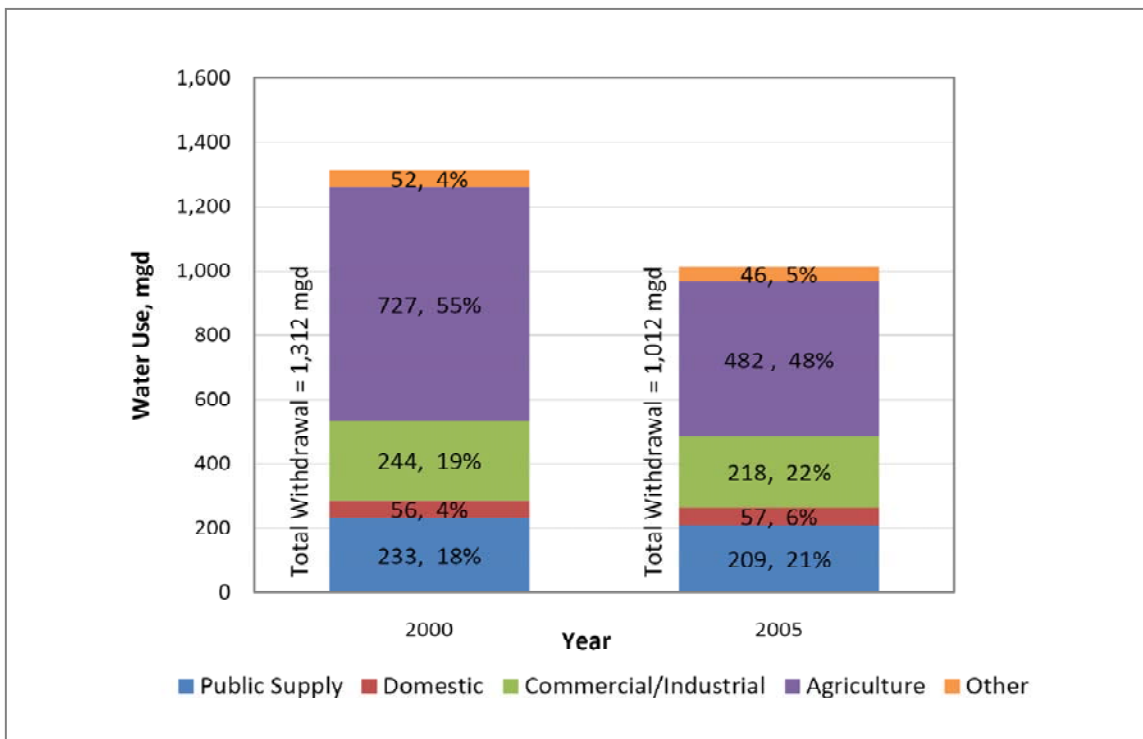


Figure 4-4
Groundwater Use (mgd) in the Coastal Plain of Georgia for 2000 and 2005

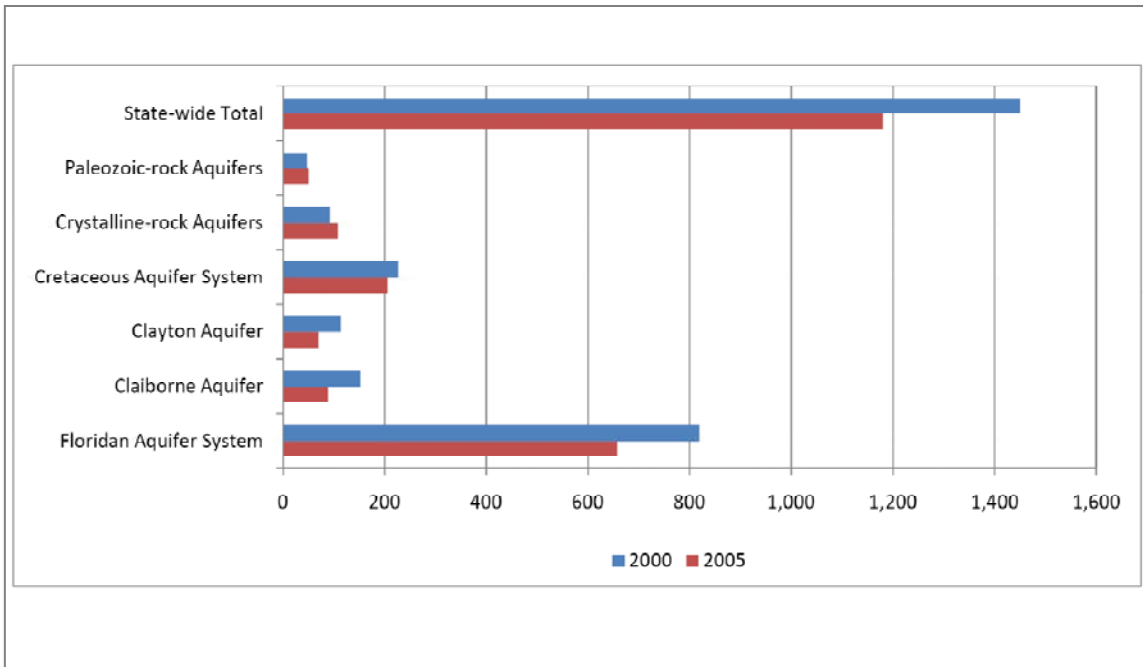
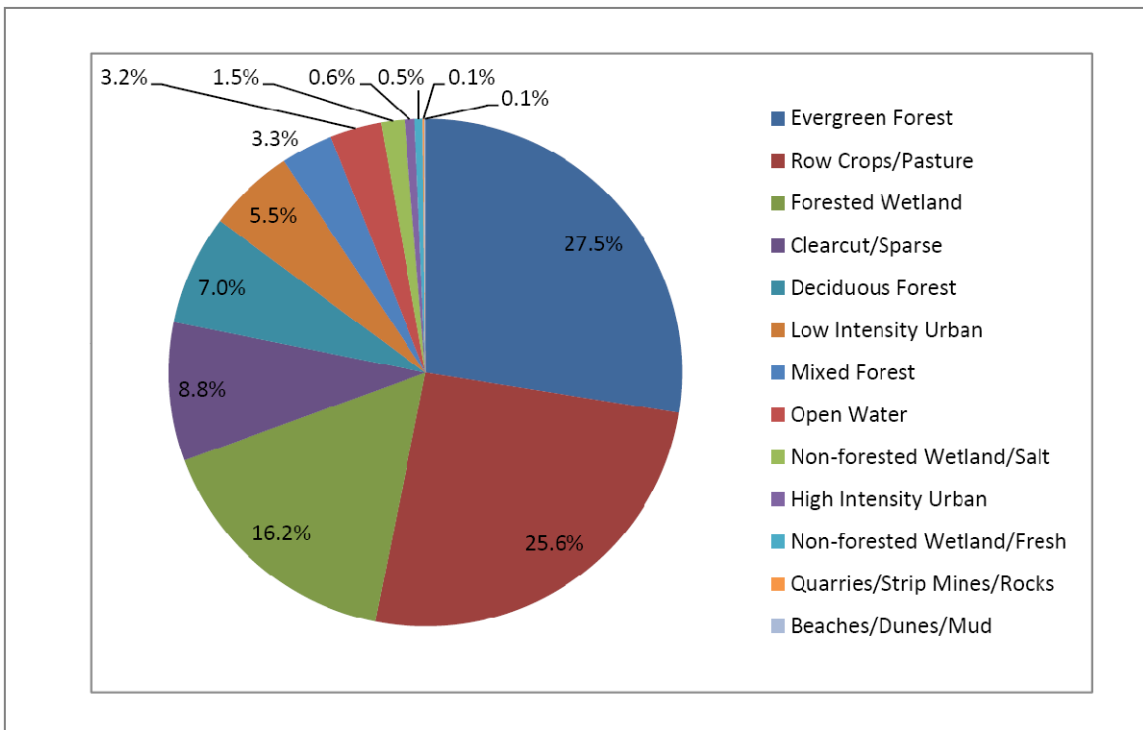
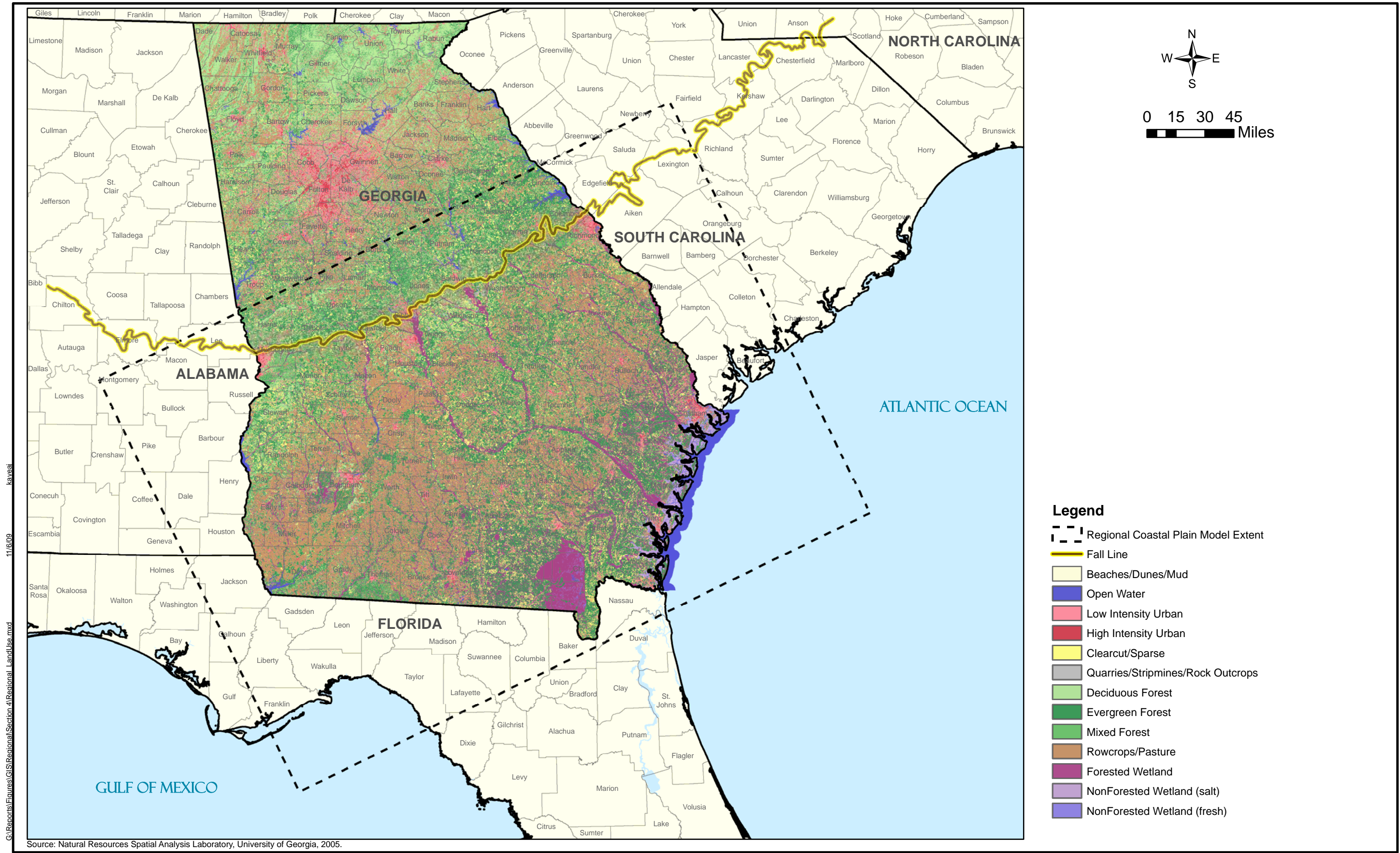


Figure 4-5
Groundwater Withdrawals (mgd) in Georgia by Principal Aquifer for 2000 and 2005



Source: University of Georgia Natural Resources Spatial Analysis Lab (NARSAL)-Georgia Land Use Trends.

Figure 4-6
Land Use Summary in the Coastal Plain of Georgia for 2005



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Land Use Summary in Georgia for 2005