UNIVERSITY OF FLORIDA
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SL 241

Characterizing Agriculture in Florida's Lower Suwannee River Basin Area [1]

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Introduction

The Suwannee River is a major aquatic resource that begins in Georgia and flows through north Florida until it empties into the eastern Gulf of Mexico. About two-thirds of the river basin is in Georgia, while the other one-third, known as the "Lower Suwannee Basin," is in Florida (Figure 1). The Lower Suwannee Basin forms the central portion of the Suwannee River Water Management District (SRWMD) (http://www.srwmd.state.fl.us), which encompasses all or parts of 15 counties (Figure 2).

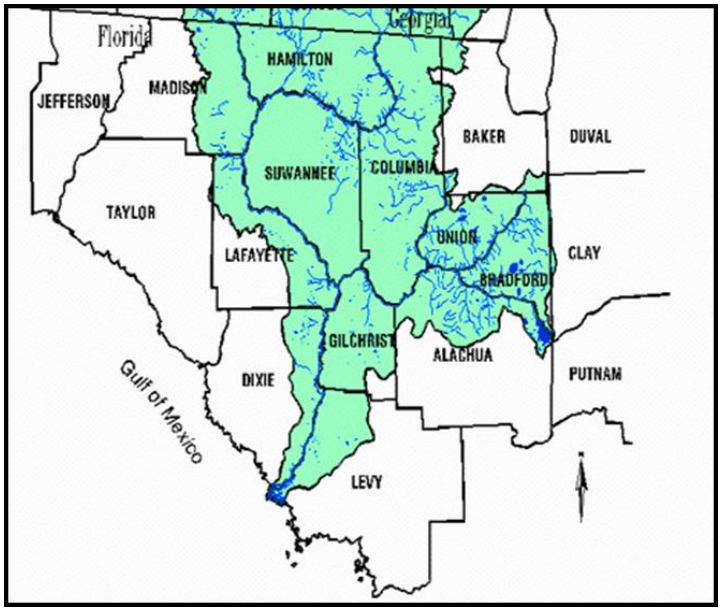

Figure 1. Florida's Lower Suwannee River Basin (in green) and surrounding area.

The Lower Suwannee Basin is designated as a "Showcase Watershed" by the U.S. Environmental Protection Agency. It contains the highest concentration of first-magnitude freshwater springs in the world. (A first magnitude spring is one that

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discharges at least 100 cubic feet of water per second, or about 64.6 million gallons per day.) During the last 20 years, the nitrate-N concentration of some of the basin's rivers and springs has increased to the point of environmental concern. In response, the states of Florida and Georgia, the Federal government, and other local organizations have identified the Suwannee River Basin as an ecosystem in need of protection because of its unique biota and important water resources.

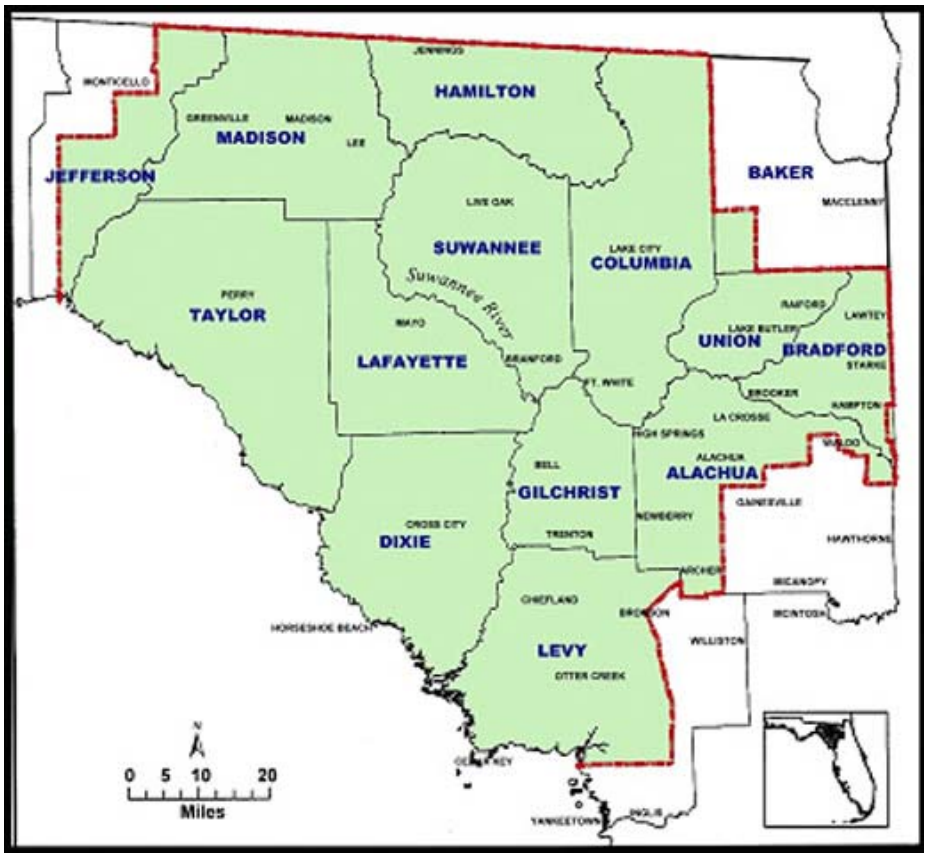

Figure 2. Boundary of the Suwannee River Water Management District.

Objective of this Publication

The Suwannee River Partnership (http://www.suwannee.org) was formed in 1999 to determine the sources of nutrient loads in the river basin, and to work with local land users to minimize future nutrient loading through voluntary, incentive-based programs. Agriculture and forestry are the dominant land uses in the watershed. While the environmental impact of forestry is usually low, intensive agricultural production has the potential to affect water quality if nutrients and water are not carefully managed.

Agriculture in the Lower Suwannee Basin is diverse--beef, dairy, poultry, field crop, forage, vegetable, and nursery production are all found there. Nutrient and water management issues important to environmental protection vary between these agricultural segments, so it is imperative to understand how they are spatially distributed throughout the 7,640 square mile area of the SRWMD. Therefore, the objective of this publication is to characterize agriculture in Florida's Lower Suwannee Basin Area so that Best Management Practice educational programs can be appropriately developed and efficiently delivered to key target audiences.

Data Sources and Collection Method

Data sources

- Agricultural production data: Florida Agricultural Statistics Service (FASS) (http://www.nass.usda.gov/Statistics_by_State/Florida/index.asp)
- Pine plantations: Florida Geographic Data Library (http://www.fgdl.org)
- Soil characteristics: USDA-NRCS county soil surveys
- Population: U.S. Census Bureau (http://quickfacts.census.gov/qfd/states/12000.html)
- Fertilizer consumption: Florida Dept. of Agriculture and Consumer Services (FDACS), Fertilizer Section (http://www.doacs.state.fl.us/onestop/aes/fertilizer.html)
- Irrigation: U.S. Geological Survey

Data collection

Data were obtained on a county-by-county basis. The SRWMD includes all of Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Suwannee, Taylor, and Union counties, and parts of Alachua, Baker, Bradford, Jefferson, Levy, and Putnam counties. Since the District includes only portions of six counties, this report covers an area slightly larger than the entire Lower Suwannee River basin. The portions of Baker and Putnam counties within the District boundary are small and were deemed insignificant for the purpose of this report, so they were not included in the summaries. *However, the reader is cautioned that the reported data for Alachua, Bradford, Jefferson, and Levy counties represent the entire county, not all of which falls within the SRWMD or the Lower Suwannee River Basin watershed*.

In some cases, agricultural production data were not available from FASS for particular counties where the number of farms for a given operation type were small, possibly compromising anonymity of the farms. In these cases, data could not be included in the overall summary, so several of the analyses are incomplete.

Characterizing the Basin

Population

The population of the 13 counties representing Florida's Lower Suwannee Basin area was 507,155 in 2004, but 44% of the total (223,090) was in Alachua county. The remaining counties had considerably lower population density (Figure 3) and remained rural in nature, although counties immediately north and west of Alachua were roughly twice as densely-populated as the rest due to influence of population centers like Live Oak, Lake City, Gainesville, and Jacksonville.

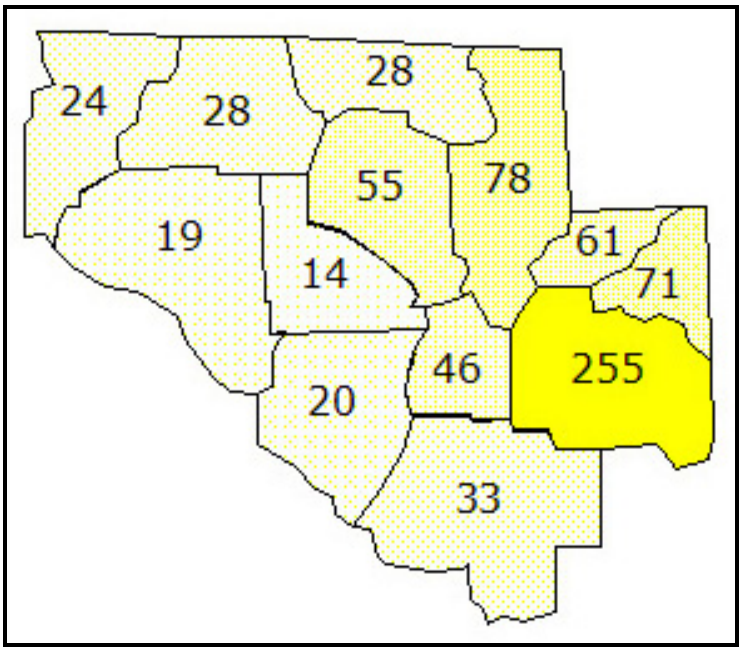

Figure 3. Population density (persons per square mile) in 2004.

Landscape and soil characteristics

The basin is generally flat with occasional rolling topography. Elevation ranges from sea level at the Gulf coast to around 180 ft in parts of Jefferson, Madison, Hamilton, Suwannee, Columbia, and Alachua counties (Figure 4). Soil erosion can be a localized problem in some sloping agricultural fields, but in general it is not a major issue across the basin. Most rain and irrigation water infiltrates the soil unless soil crusting has occurred, which can increase runoff to ditches and streams.

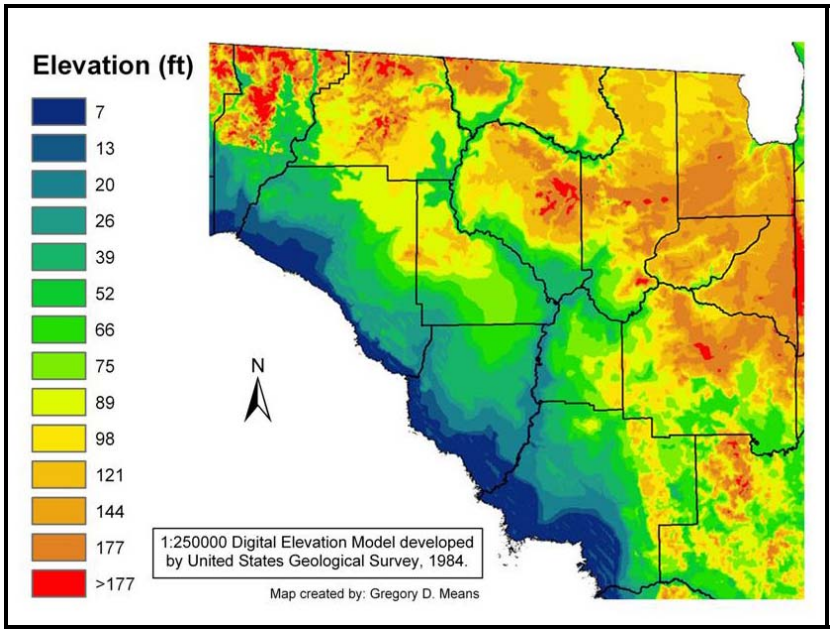

Figure 4. Land elevation in Florida's Lower Suwannee Basin area.

Most of the soils used for agricultural production are classified as Entisols, Ultisols, or Spodosols. These soil **orders** cannot be differentiated from one another by observing only the surface soil (plow layer) because they are similar. One must look deeper in the profile to find differences.

- Entisols (Figure 5, top) have little or no evidence of soil formation, and the entire profile is sandy throughout. The reason for this is that not enough time has elapsed for soil-forming processes to act following deposition of the sandy material by the ocean.
- Ultisols (Figure 5, middle) have a sub-surface layer of loamy material (Bt horizon) due to the downward movement and accumulation of clay. This clay is acidic and low in plant nutrient content.
- Spodosols (Figure 5, bottom) have a black, brown, or reddish-brown subsoil layer called a spodic (Bh) horizon. This layer is often overlain by a light-gray to whitish layer (E horizon). The spodic horizon is an accumulation of organic matter, aluminum, and iron compounds that leached from a surface litter layer. Sometimes a Bt horizon is found below the Bh horizon, but a Bh never occurs below a Bt.

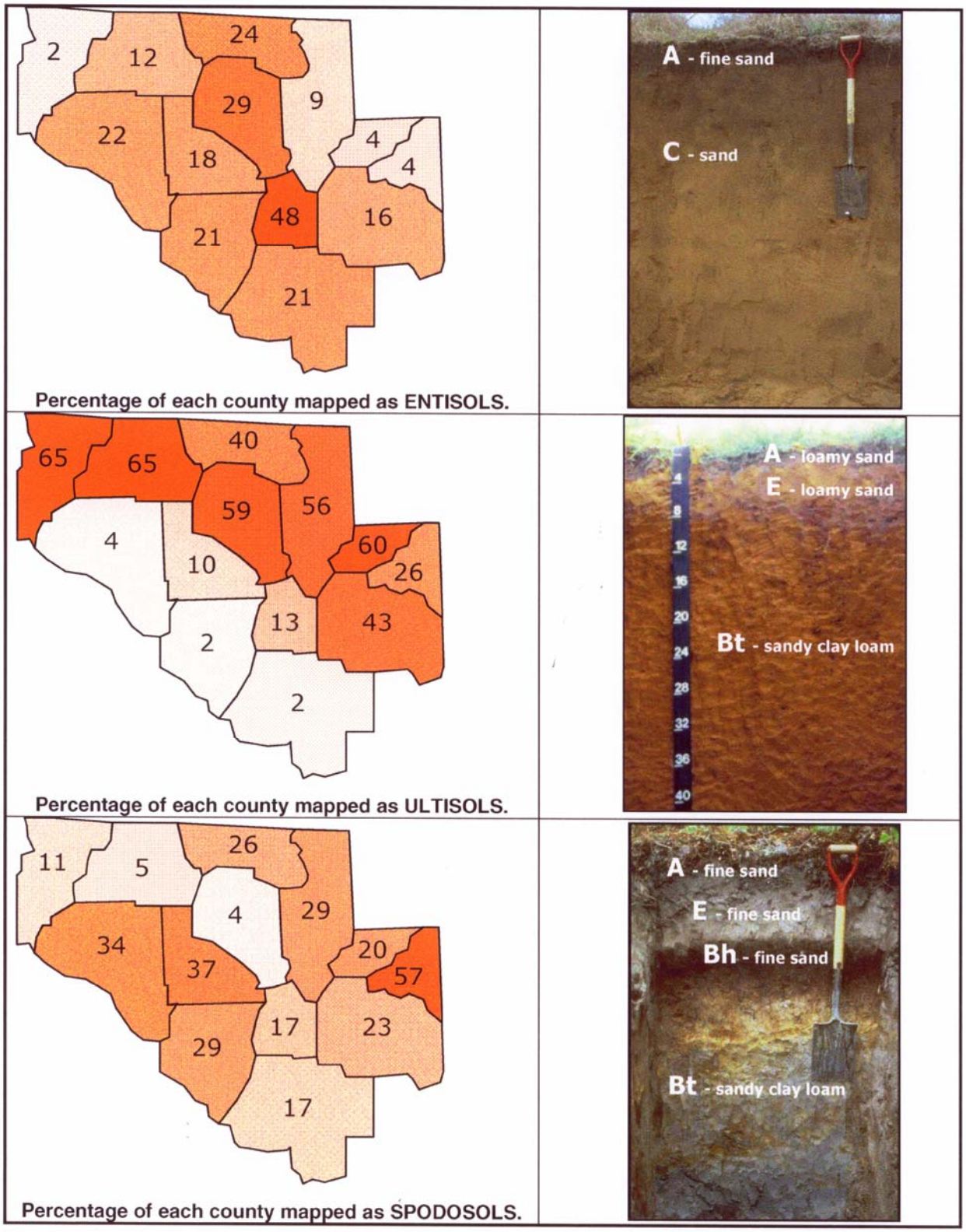

Figure 5. Distribution of three major soil orders used for agricultural production in north Florida, and examples of their profiles.

Regardless of soil order, the root zone (A horizon) texture in the basin is usually sand or fine sand. Some Ultisols can have a slightly more loamy texture (e.g. loamy sand) at the surface. Compared with agricultural soils in other parts of the USA, the water-holding capacity of north Florida soils is low (Table 1). Water-holding capacity of a typical Midwestern corn belt soil is two to three times higher than a sandy Florida soil.

Table 1. Soil texture effect on water-holding capacity.

Texture	Water-holding capacity, inches/foot		
	Low	High	Average
Sand, Fine sand	0.24	1.20	0.75
Loamy sand, Loamy fine sand	0.36	1.44	1.00
Sandy loam, Fine sandy loam	0.90	1.80	1.40

Soil nutrient-holding capacity as measured by soil cation exchange capacity (CEC) and organic matter content is also low (Table 2). Although Ultisols and Spodosols have higher CEC in the Bt and Bh horizons, these layers do not support root growth due to high acidity, compaction, or low oxygen content. The organic matter accumulated in a Bh horizon does not contribute to soil fertility because of high acidity and aluminum toxicity associated with it.

Table 2. Nutrient-holding capacity factors for three north Florida soil orders.

Property	Depth	Soil order		
		Entisol	Ultisol	Spodosol
Cation exchange capacity (meq/100 g)	Plow layer (A horizon)	3	5	4
	Sub-surface	1 (C horizon)	15 (Bt horizon)	19 (Bh horizon)
Organic matter (%)	Plow layer (A horizon)	0.8	1.0	1.2
	Sub-surface	0.2 (C horizon)	0.1 (Bt horizon)	4.5 (Bh horizon)

Of the three soil orders, Entisols are most vulnerable to leaching of nutrients and agrichemicals because they are sandy throughout, contain little organic matter, are highly conductive to water flow, and have no sub-surface layer that can slow water drainage through the profile. Six of the thirteen counties in the Lower Suwannee Basin area have more than 20% of their area mapped as Entisols (Figure 5). The highest concentration runs along a straight line through Hamilton, Suwannee, and Gilchrist counties, increasing from north to south.

Extent of farmland and planted pineland

Most counties in the Lower Suwannee Basin area had between one-quarter and one-third of their land area devoted to pine plantations (Figure 6). Taylor county contained the largest acreage of commercial pine forest by a wide margin, followed by Columbia and Levy counties (Table 3).

Counties with the largest percentage of total land area devoted to farms were Alachua, Suwannee, Union, Gilchrist, Jefferson, and Madison (Figure 6). Alachua had the most farm

acres, followed by Levy, Suwannee, Madison, and Jefferson (Table 3). Taylor had the largest average farm size, followed by Lafayette, Jefferson, and Madison.

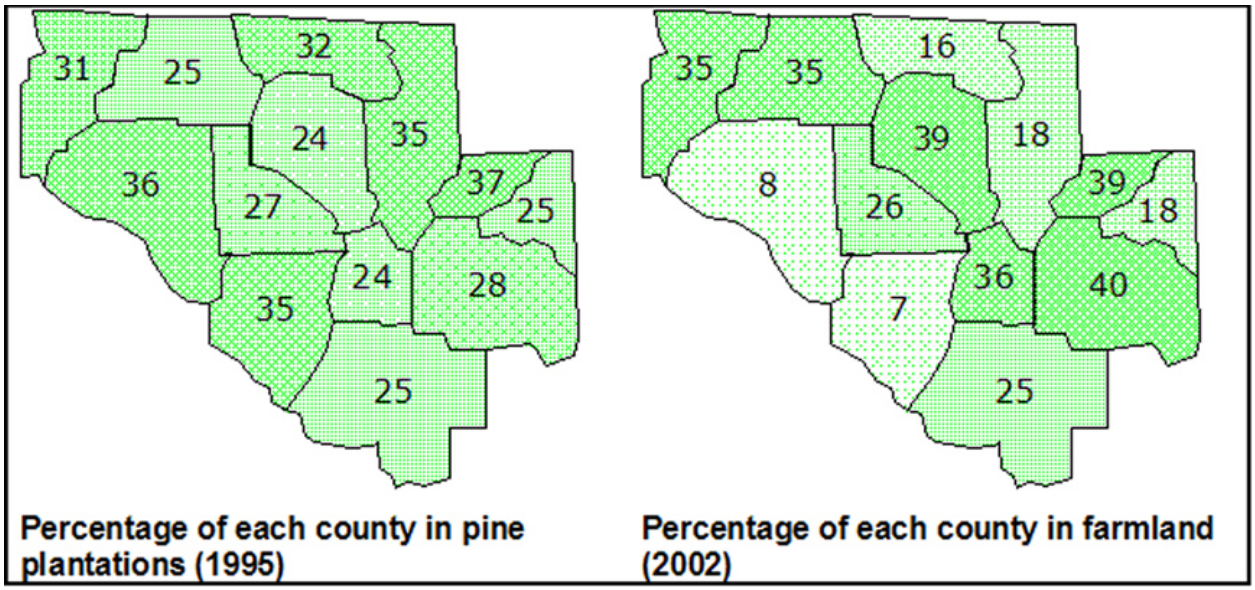

Figure 6. Relative amount of land occupied by farms and pine plantations.

Table 3. Land area devoted to farming and pine plantations by county.

County	Pine plantation acreage (1995)	Farm acreage (2002)	Number of farms	Average farm size (ac)
Alachua	156,759	222,728	1,493	149
Bradford	60,725	44,819	378	119
Columbia	179,210	90,227	688	131
Dixie	155,593	31,249	215	145
Gilchrist	54,435	81,489	408	200
Hamilton	103,873	52,027	239	218
Jefferson	119,297	132,727	418	318
Lafayette	94,695	91,988	195	472
Levy	179,993	180,314	897	201
Madison	111,455	156,995	529	297
Suwannee	105,400	170,149	1,054	161
Taylor	237,435	53,720	101	532
Union	56,944	59,635	275	217

Market value of farm production

Suwannee County had the highest market value of farm production by a wide margin compared with other counties (Figure 7). Following Suwannee were Levy, Alachua, Lafayette, Columbia, and Gilchrist.

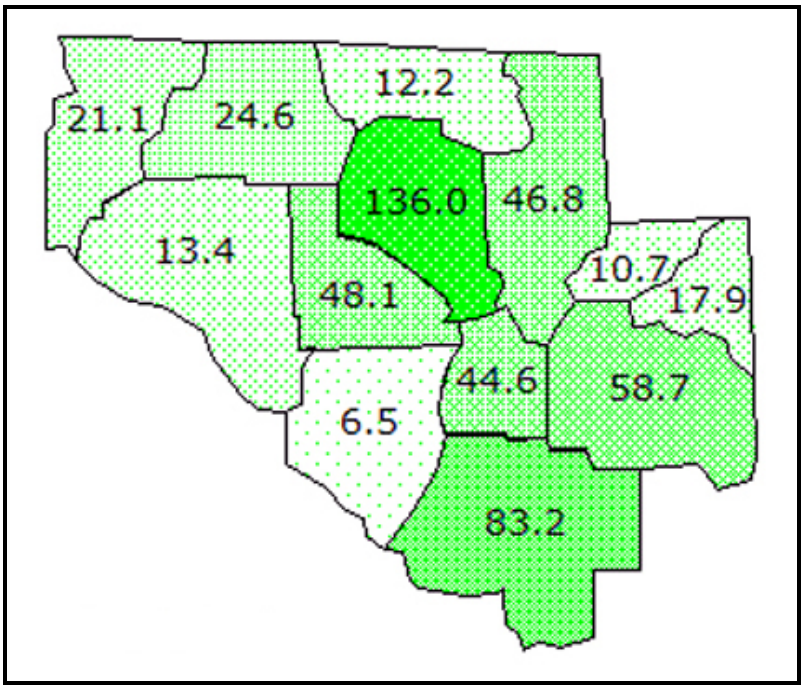

Figure 7. Market value of total farm production in millions of dollars (2002).

Field crops

Florida's Lower Suwannee Basin is a major field crop production area. Field crop distribution was determined for all crops combined, and for three crop sub-categories (Table 4).

Table 4. Sub-division of field crops and specific crops within each category.

Grains, Grain Silage and other Field Crops	Hay, Forage, & Seeds	Vegetables & Melons
Corn	Field & grass seeds	Beans (snap)
Oats	Alfalfa hay	Broccoli
Rye	Small grain hay	Cabbage (Chinese and head)
Sorghum	Other tame hay	Cantaloupes
Wheat	Wild hay	Collards
Cowpeas	Haylage, all	Cucumbers
Peanuts		Eggplant
Potatoes		Lettuce
Soybeans		Mustard greens
Tobacco		Okra
		Peas
		Peppers
		Radishes
		Squash
		Sweet corn
		Tomatoes
		Watermelons

Field crop production was greatest in Alachua, Levy, and Suwannee counties (Fig. 8). Levy had the most acreage devoted to major (non-vegetable) row crops, Alachua had the greatest hay and forage acreage, and Suwannee had the most acreage of vegetables and melons. In 2002, of Florida's 67 counties:

- Alachua ranked no. 1 in land area devoted to forage and hay production, and no. 2 in silage corn.
- Gilchrist ranked no. 4 in silage corn and no. 1 in silage sorghum.
- Hamilton ranked no. 4 in grain corn and no. 3 in cowpeas.
- Jefferson ranked no. 2 in grain corn and no. 4 in cowpeas.
- Levy ranked no. 2 in peanuts and no. 1 in silage corn.
- Madison ranked no.1 in grain corn, grain rye, cowpeas, and soybeans.
- Suwannee ranked no. 4 in forage and hay, no. 5 in peanuts, no. 3 in silage corn, no. 3 in sweet corn, and no. 7 in all vegetables harvested.

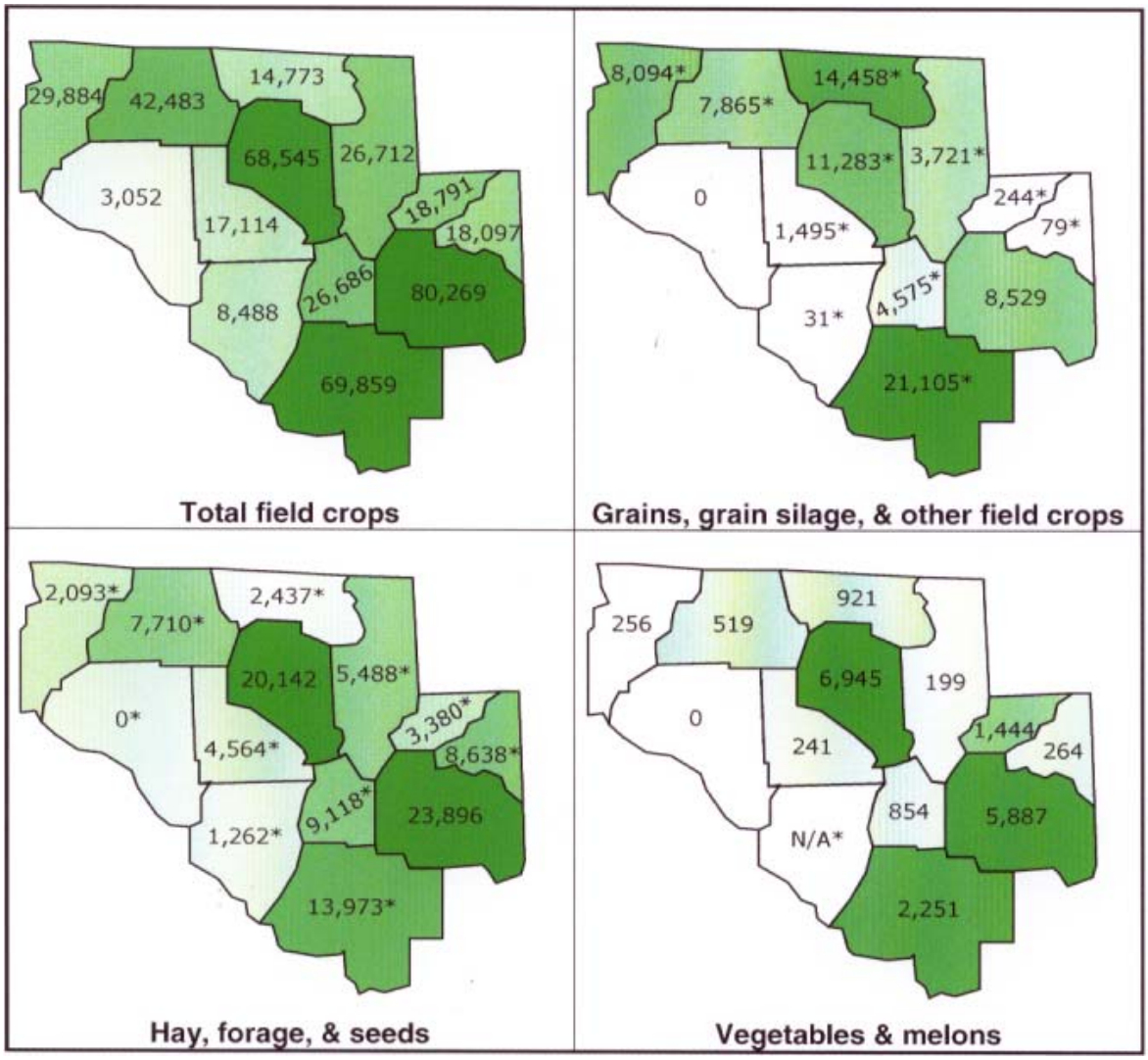

Figure 8. Cropland acreage in Florida's Lower Suwannee River Basin area (2002).

*Some crop data in these counties was excluded from the ag census to avoid disclosing individual farms.

Animal agriculture

Florida's Lower Suwannee Basin area contains significant animal agriculture (Fig. 9). For example, in 2002, of Florida's 67 counties:

- Suwannee ranked no. 1 in sales value of poultry and eggs.
- Columbia ranked no. 1 in laying hen inventory (although the actual number of birds was protected by FASS). Suwannee ranked no. 7.
- Suwannee and Lafayette ranked no. 1 and no. 4, respectively, in broiler inventory.
- Levy, Gilchrist, Lafayette, and Suwannee ranked 2nd, 3rd, 4th, and 6th, respectively, in dairy production sales value.

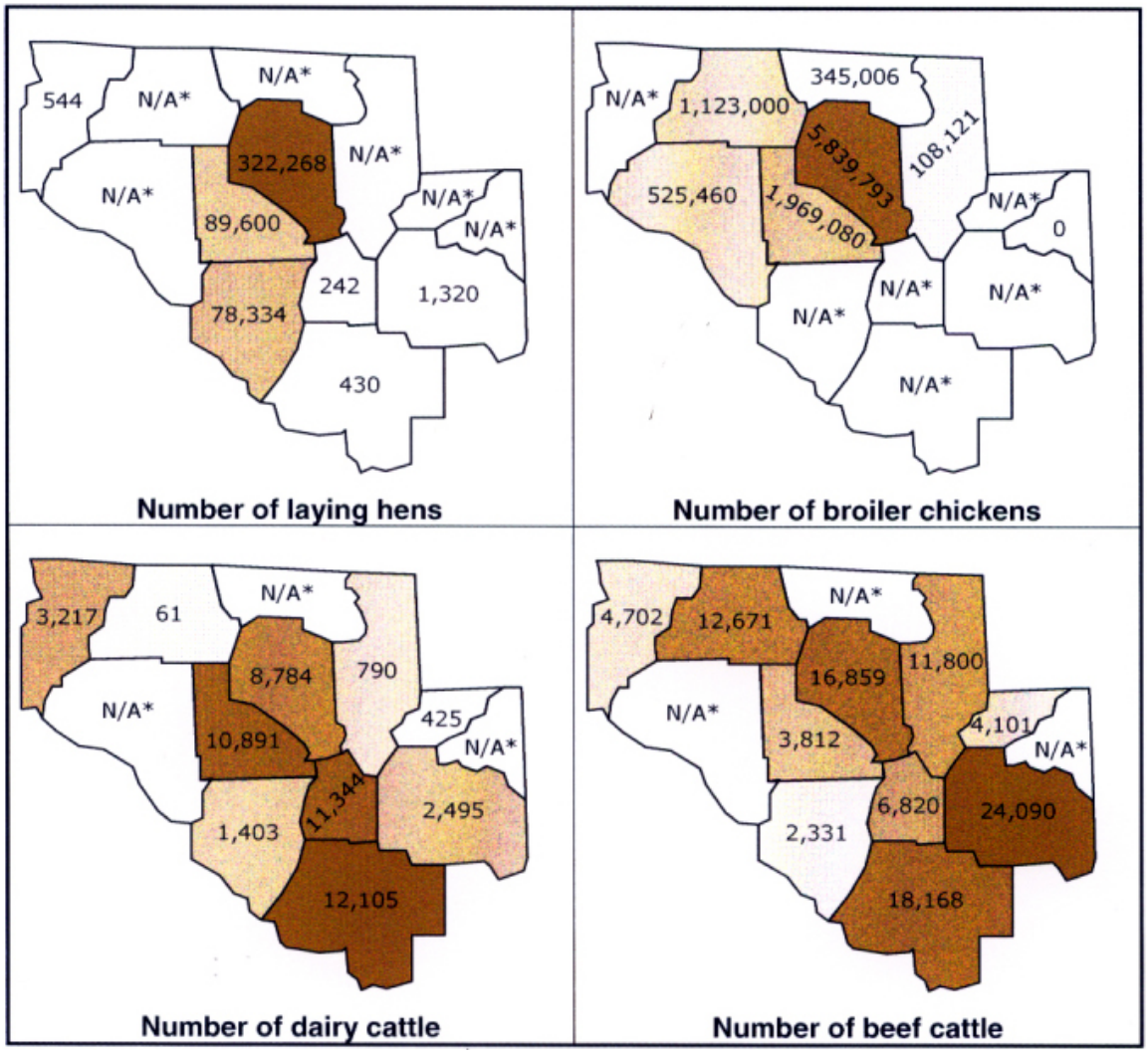

Figure 9. Animal agriculture in Florida's Lower Suwannee River Basin area (2002).

*Animal numbers for these counties were excluded from the ag census to avoid disclosing data for individual farms.

Pastureland

Pastureland is widespread throughout Florida's Lower Suwannee Basin area, and is the most common agricultural land use in each county (Fig. 10). Statewide, in 2002, Alachua ranked no. 12 for land area devoted to pasture.

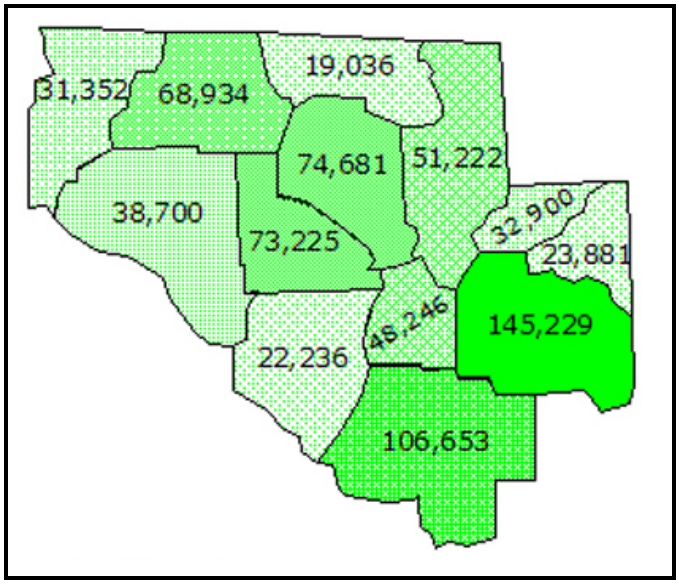

Figure 10. Pastureland acreage in Florida's Lower Suwannee River basin area (2002).

Outdoor nurseries

Levy County dominated in land area devoted to outdoor nursery production in 2002, with about half of the Lower Suwannee Basin area total (Fig. 11). Alachua had 17% of the total, and the rest was distributed among 9 other counties for which data were available. No data were reported for Lafayette and Union.

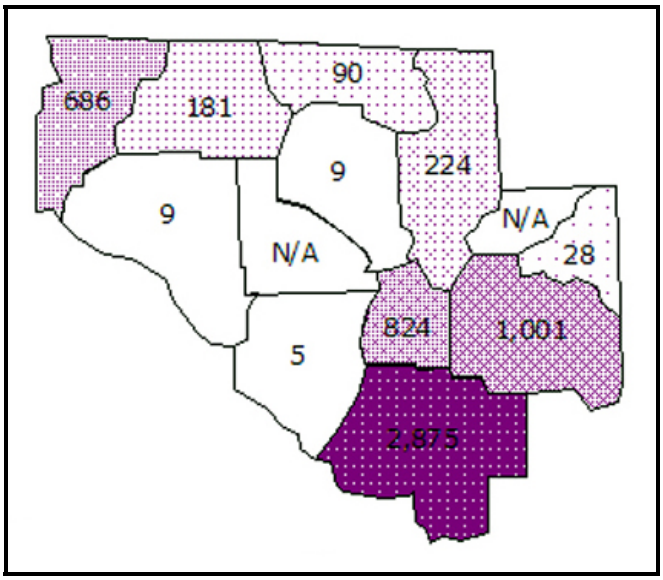

Figure 11. Outdoor nursery acreage in Florida's Lower Suwannee River Basin area (2002).

Irrigation

Although the Lower Suwannee Basin averages 50 inches of rainfall per year, uneven distribution can lead to drought periods in the spring and fall. Spring crops are particularly susceptible to water stress, so all vegetable crops and many other row crops are irrigated. Both overhead and low-volume (drip) irrigation systems are used, and the primary water source is groundwater.

The top three counties in irrigated acreage are Levy, Suwannee, and Alachua (Fig. 12), which is no surprise because these are also the top three counties in field crop production. These counties plus Gilchrist are the top four agricultural water users in terms of freshwater withdrawals (Fig. 12). When comparing the two maps in Fig. 12, the reader is cautioned that while irrigated acreage is for the entire county, water use data represent only the land area within the Suwannee River Water Management District boundary. Therefore, the two maps are not directly comparable for Alachua, Bradford, Jefferson, and Levy counties. Also, the water use data is 2 years older than the irrigated acreage data.

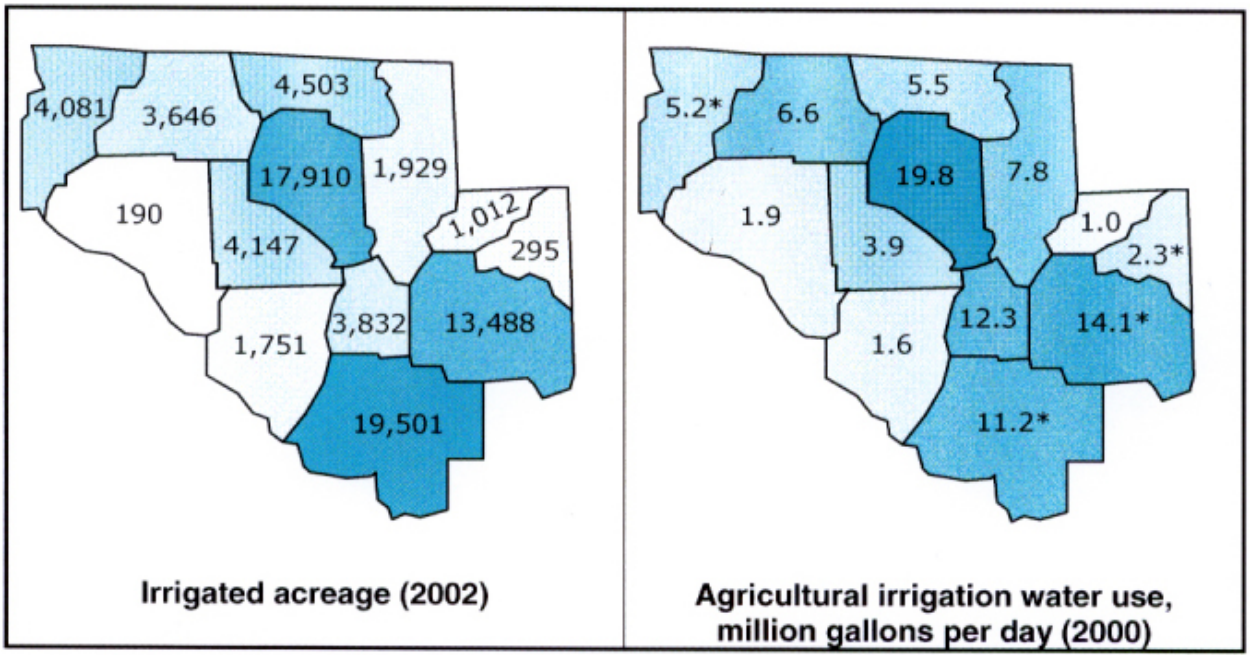

Figure 12. Agricultural irrigation water use in Florida's Lower Suwannee River Basin area.

*Values shown for Alachua, Bradford, Jefferson, and Levy counties represent only the portion of the county within the SRWMD boundary.

Fertilizer consumption

Fertilizer application is necessary to achieve maximum economic crop yields in the Lower Suwannee Basin. Nitrogen and phosphorus are two macronutrients commonly applied in fertilizers. These nutrients provide a positive crop response, but can also degrade water quality if, over the long term, they are transported by leaching or runoff from the application site to surface or groundwater.

Nitrogen fertilizer consumption by county fell into four groups (Fig. 13):

- Suwannee and Levy consumed more than 3,700 tons of N per year.
- Gilchrist, Alachua, Union, and Jefferson used between 2,000 and 2,500 tons per year.
- Madison, Columbia, and Lafayette used between 1,000 and 1,500 tons per year.
- Hamilton, Bradford, Dixie, and Taylor used less than 1,000 tons per year.

Phosphate fertilizer consumption fell into three groups (Fig. 13):

- Levy and Union consumed 1,000 or more tons of P_2O_5 per year.
- Jefferson, Suwannee, Gilchrist, and Alachua used between 600 and 900 tons per year.
- Columbia, Madison, Hamilton, Lafayette, Bradford, Dixie, and Taylor used less than 400 tons per year.

The amount of fertilizer used within a county is influenced by the amount and type of crops grown, and by the availability of animal manures that may be applied as an alternative source of N and P. It is no surprise that Levy, Suwannee, and Alachua counties are among the largest N and P fertilizer users since they are the counties with the greatest field crop acreage. Although Union county is small in land area, it is the fourth largest in terms of vegetable production within the Lower Suwannee Basin area. Fertilizer use there is relatively high because vegetable crops are intensively fertilized.

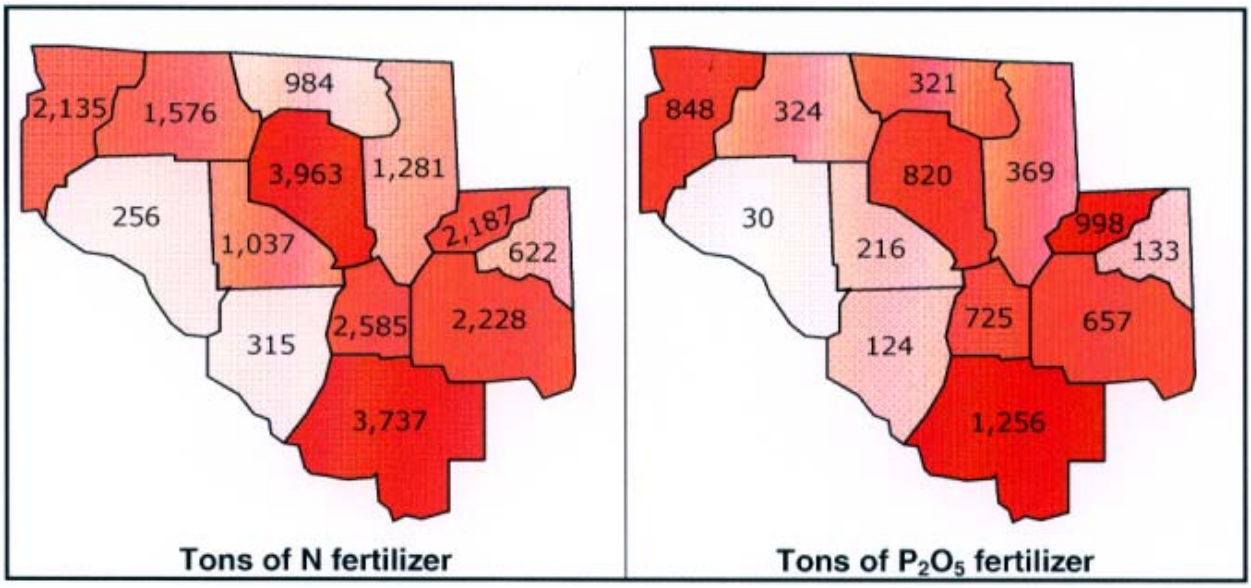

Figure 13. Nitrogen and phosphorus fertilizer consumption (July 2002 through June 2003) in Florida's Lower Suwannee River Basin area.

Summary

Florida's Lower Suwannee Basin area contains:

- A population just above one-half million that is skewed towards Alachua county.
- Topography ranging from flat to gently rolling.
- Sandy soils vulnerable to nutrient and agrichemical leaching, especially under conditions of excessive rainfall or irrigation.
- Mostly rural land that supports pine plantations, numerous small to medium-sized farms, and a few large farms.
- Forest, field crop, forage, animal, and nursery production that is economically important both locally and statewide.
- More than 75,000 acres of irrigated agriculture.
- Soils low in natural fertility that require high fertilizer rates to achieve maximum economic yield.
- Groundwater, surface water, and an ecosystem in need of environmental protection.

Therefore, educating the region's agricultural producers and other citizens about the best ways to manage water and nutrients will be essential to maintain water availability and improve its quality in the years to come.